Package ‘keras3’

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Type Package

Title R Interface to 'Keras'

Version 1.4.0

Description Interface to 'Keras' <https://keras.io>, a high-level neural networks API. 'Keras' was developed with a focus on enabling fast experimentation, supports both convolution based networks and recurrent networks (as well as combinations of the two), and runs seamlessly on both CPU and GPU devices.

Encoding UTF-8

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URL https://keras3.posit.co/, https://github.com/rstudio/keras3

BugReports https://github.com/rstudio/keras3/issues

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Contents

`activation_celu` *Continuously Differentiable Exponential Linear Unit.*

Description

The CeLU activation function is defined as:
`celu(x) = alpha * (exp(x / alpha) - 1) for x < 0`,`celu(x) = x for x >= 0`.

where `alpha` is a scaling parameter that controls the activation's shape.

Usage

```
activation_celu(x, alpha = 1)
```

Arguments

x	Input tensor.
alpha	The value for the CeLU formulation. Defaults to `1.0`.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- Barron, J. T., 2017

See Also

Other activations:
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_silu()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`
`activation_sparse_plus()`
`activation_sparsemax()`
`activation_squareplus()`
`activation_tanh()`
`activation_tanh_shrink()`
`activation_threshold()`

activation_elu *Exponential Linear Unit.*

Description

The exponential linear unit (ELU) with `alpha > 0` is defined as:

- `x` if `x > 0`
- `alpha * exp(x) - 1` if `x < 0`

ELUs have negative values which pushes the mean of the activations closer to zero.

Mean activations that are closer to zero enable faster learning as they bring the gradient closer to the natural gradient. ELUs saturate to a negative value when the argument gets smaller. Saturation means a small derivative which decreases the variation and the information that is propagated to the next layer.

Usage

```
activation_elu(x, alpha = 1)
```

Arguments

`x`	Input tensor.
`alpha`	Numeric. See description for details.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- Clevert et al., 2016

See Also

- `https://keras.io/api/layers/activations#elu-function`

Other activations:
`activation_celu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`

activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_exponential

Exponential activation function.

Description

Exponential activation function.

Usage

```
activation_exponential(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

- https://keras.io/api/layers/activations#exponential-function

Other activations:
activation_celu()
activation_elu()
activation_gelu()
activation_glu()

activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

`activation_gelu` *Gaussian error linear unit (GELU) activation function.*

Description

The Gaussian error linear unit (GELU) is defined as:

`gelu(x) = x * P(X <= x)` where `P(X) ~ N(0, 1)`, i.e. `gelu(x) = 0.5 * x * (1 + erf(x / sqrt(2)))`.

GELU weights inputs by their value, rather than gating inputs by their sign as in ReLU.

Usage

```
activation_gelu(x, approximate = FALSE)
```

Arguments

`x`	Input tensor.
`approximate`	A `bool`, whether to enable approximation.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- Hendrycks et al., 2016

See Also

- https://keras.io/api/layers/activations#gelu-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_glu   *Gated Linear Unit (GLU) activation function.*

Description

The GLU activation function is defined as:

`glu(x) = a * sigmoid(b)`,

where `x` is split into two equal parts `a` and `b` along the given axis.

Usage

```
activation_glu(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	The axis along which to split the input tensor. Defaults to -1.

Value

A tensor, the result from applying the activation to the input tensor x.

Reference

- Dauphin et al., 2017

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

activation_hard_shrink

Hard Shrink activation function.

Description

It is defined as:

`hard_shrink(x) = x` if `|x| > threshold`, `hard_shrink(x) = 0` otherwise.

Usage

```
activation_hard_shrink(x, threshold = 0.5)
```

Arguments

`x`	Input tensor.
`threshold`	Threshold value. Defaults to `0.5`.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_silu()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`
`activation_sparse_plus()`

activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_hard_sigmoid
Hard sigmoid activation function.

Description

The hard sigmoid activation is defined as:

- `0` if `if x <= -3`
- `1` if `x >= 3`
- `(x/6) + 0.5` if `-3 < x < 3`

It's a faster, piecewise linear approximation of the sigmoid activation.

Usage

```
activation_hard_sigmoid(x)
```

Arguments

`x`	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- Wikipedia "Hard sigmoid"

See Also

- https://keras.io/api/layers/activations#hardsigmoid-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_tanh()

activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

`activation_hard_silu` *Hard SiLU activation function, also known as Hard Swish.*

Description

It is defined as:

- `0` if `if x < -3`
- `x` if `x > 3`
- `x * (x + 3) / 6` if `-3 <= x <= 3`

It's a faster, piecewise linear approximation of the silu activation.

Usage

```
activation_hard_silu(x)

activation_hard_swish(x)
```

Arguments

`x`	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- A Howard, 2019

activation_hard_tanh *HardTanh activation function.*

Description

It is defined as: `hard_tanh(x) = -1 for x < -1`, `hard_tanh(x) = x for -1 <= x <= 1`, `hard_tanh(x) = 1 for x > 1`.

Usage

```
activation_hard_tanh(x)
```

Arguments

`x`	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_silu()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`

activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_leaky_relu *Leaky relu activation function.*

Description

Leaky relu activation function.

Usage

```
activation_leaky_relu(x, negative_slope = 0.2)
```

Arguments

x	Input tensor.
negative_slope	A float that controls the slope for values lower than the threshold.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

- https://keras.io/api/layers/activations#leakyrelu-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()

activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_linear *Linear activation function (pass-through).*

Description

A "linear" activation is an identity function: it returns the input, unmodified.

Usage

```
activation_linear(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

- https://keras.io/api/layers/activations#linear-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_log_sigmoid()

activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_log_sigmoid
Logarithm of the sigmoid activation function.

Description

It is defined as `f(x) = log(1 / (1 + exp(-x)))`.

Usage

```
activation_log_sigmoid(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()

activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_log_softmax *Log-Softmax activation function.*

Description

Each input vector is handled independently. The `axis` argument sets which axis of the input the function is applied along.

Usage

```
activation_log_softmax(x, axis = -1L)
```

Arguments

`x`	Input tensor.
`axis`	Integer, axis along which the softmax is applied.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

- https://keras.io/api/layers/activations#logsoftmax-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_mish *Mish activation function.*

Description

It is defined as:

`mish(x) = x * tanh(softplus(x))`

where `softplus` is defined as:

`softplus(x) = log(exp(x) + 1)`

Usage

```
activation_mish(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor x.

Reference

- Misra, 2019

See Also

- https://keras.io/api/layers/activations#mish-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

activation_relu *Applies the rectified linear unit activation function.*

Description

With default values, this returns the standard ReLU activation: `max(x, 0)`, the element-wise maximum of 0 and the input tensor.

Modifying default parameters allows you to use non-zero thresholds, change the max value of the activation, and to use a non-zero multiple of the input for values below the threshold.

Usage

```
activation_relu(x, negative_slope = 0, max_value = NULL, threshold = 0)
```

Arguments

`x`	Input tensor.
`negative_slope`	A `numeric` that controls the slope for values lower than the threshold.
`max_value`	A `numeric` that sets the saturation threshold (the largest value the function will return).
`threshold`	A `numeric` giving the threshold value of the activation function below which values will be damped or set to zero.

Value

A tensor with the same shape and dtype as input `x`.

Examples

```
x <- c(-10, -5, 0, 5, 10)
activation_relu(x)

## tf.Tensor([ 0.  0.  0.  5. 10.], shape=(5), dtype=float32)


activation_relu(x, negative_slope = 0.5)

## tf.Tensor([-5.  -2.5  0.   5.  10. ], shape=(5), dtype=float32)


activation_relu(x, max_value = 5)

## tf.Tensor([0. 0. 0. 5. 5.], shape=(5), dtype=float32)


activation_relu(x, threshold = 5)

## tf.Tensor([-0. -0.  0.  0. 10.], shape=(5), dtype=float32)
```

See Also

- https://keras.io/api/layers/activations#relu-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_relu6 — *Relu6 activation function.*

Description

It's the ReLU function, but truncated to a maximum value of 6.

Usage

```
activation_relu6(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

- https://keras.io/api/layers/activations#relu6-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_selu *Scaled Exponential Linear Unit (SELU).*

Description

The Scaled Exponential Linear Unit (SELU) activation function is defined as:

- scale * x if x > 0
- scale * alpha * (exp(x) - 1) if x < 0

where `alpha` and `scale` are pre-defined constants (`alpha = 1.67326324` and `scale = 1.05070098`).

Basically, the SELU activation function multiplies `scale` (> 1) with the output of the `activation_elu` function to ensure a slope larger than one for positive inputs.

The values of `alpha` and `scale` are chosen so that the mean and variance of the inputs are preserved between two consecutive layers as long as the weights are initialized correctly (see `initializer_lecun_normal()`) and the number of input units is "large enough" (see reference paper for more information).

Usage

```
activation_selu(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Notes

- To be used together with `initializer_lecun_normal()`.
- To be used together with the dropout variant `layer_alpha_dropout()` (legacy, depracated).

Reference

- Klambauer et al., 2017

See Also

- `https://keras.io/api/layers/activations#selu-function`

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_sigmoid()`
`activation_silu()`

activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_sigmoid *Sigmoid activation function.*

Description

It is defined as: `sigmoid(x) = 1 / (1 + exp(-x))`.

For small values (<-5), `sigmoid` returns a value close to zero, and for large values (>5) the result of the function gets close to 1.

Sigmoid is equivalent to a 2-element softmax, where the second element is assumed to be zero. The sigmoid function always returns a value between 0 and 1.

Usage

```
activation_sigmoid(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

- https://keras.io/api/layers/activations#sigmoid-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()

activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_silu *Swish (or Silu) activation function.*

Description

It is defined as: `swish(x) = x * sigmoid(x)`.

The Swish (or Silu) activation function is a smooth, non-monotonic function that is unbounded above and bounded below.

Usage

```
activation_silu(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

Reference

- Ramachandran et al., 2017

See Also

- https://keras.io/api/layers/activations#silu-function

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`
`activation_sparse_plus()`
`activation_sparsemax()`
`activation_squareplus()`
`activation_tanh()`
`activation_tanh_shrink()`
`activation_threshold()`

`activation_softmax` *Softmax converts a vector of values to a probability distribution.*

Description

The elements of the output vector are in range `[0, 1]` and sum to 1.

Each input vector is handled independently. The `axis` argument sets which axis of the input the function is applied along.

Softmax is often used as the activation for the last layer of a classification network because the result could be interpreted as a probability distribution.

The softmax of each vector x is computed as `exp(x) / sum(exp(x))`.

The input values in are the log-odds of the resulting probability.

Usage

```
activation_softmax(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	Integer, axis along which the softmax is applied.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

- https://keras.io/api/layers/activations#softmax-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

activation_softplus *Softplus activation function.*

Description

It is defined as: `softplus(x) = log(exp(x) + 1)`.

Usage

```
activation_softplus(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

- https://keras.io/api/layers/activations#softplus-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()

activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_softsign *Softsign activation function.*

Description

Softsign is defined as: `softsign(x) = x / (abs(x) + 1)`.

Usage

```
activation_softsign(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

- https://keras.io/api/layers/activations#softsign-function

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()

activation_softmax()
activation_softplus()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_soft_shrink *Soft Shrink activation function.*

Description

It is defined as:

`soft_shrink(x) = x - threshold` if `x > threshold`, `soft_shrink(x) = x + threshold` if `x < -threshold`, `soft_shrink(x) = 0` otherwise.

Usage

```
activation_soft_shrink(x, threshold = 0.5)
```

Arguments

x	Input tensor.
threshold	Threshold value. Defaults to 0.5.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()

activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_sparsemax   *Sparsemax activation function.*

Description

For each batch `i`, and class `j`, sparsemax activation function is defined as:
`sparsemax(x)[i, j] = max(x[i, j] - (x[i, :]), 0).`

Usage

```
activation_sparsemax(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	`int`, axis along which the sparsemax operation is applied. (1-based)

Value

A tensor, output of sparsemax transformation. Has the same type and shape as `x`.

Reference

- Martins et.al., 2016

See Also

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_silu()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`
`activation_sparse_plus()`
`activation_squareplus()`
`activation_tanh()`
`activation_tanh_shrink()`
`activation_threshold()`

`activation_sparse_plus` *SparsePlus activation function.*

Description

SparsePlus is defined as:

`sparse_plus(x) = 0` for `x <= -1`. `sparse_plus(x) = (1/4) * (x + 1)^2` for `-1 < x < 1`. `sparse_plus(x) = x` for `x >= 1`.

Usage

```
activation_sparse_plus(x)
```

Arguments

x	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor x.

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

---

activation_squareplus *Squareplus activation function.*

Description

The Squareplus activation function is defined as:

`f(x) = (x + sqrt(x^2 + b)) / 2`

Where b is a smoothness parameter.

Usage

```
activation_squareplus(x, b = 4L)
```

Arguments

x	Input tensor.
b	Smoothness parameter. Defaults to 4.

Value

A tensor, the result from applying the activation to the input tensor x.

Reference

- Ramachandran et al., 2021

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_tanh()
activation_tanh_shrink()
activation_threshold()

`activation_tanh` *Hyperbolic tangent activation function.*

Description

It is defined as: `tanh(x) = sinh(x) / cosh(x)`, i.e. `tanh(x) = ((exp(x) - exp(-x)) / (exp(x) + exp(-x)))`.

Usage

```
activation_tanh(x)
```

Arguments

`x`	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

- https://keras.io/api/layers/activations#tanh-function

Other activations:
`activation_celu()`
`activation_elu()`
`activation_exponential()`
`activation_gelu()`
`activation_glu()`
`activation_hard_shrink()`
`activation_hard_sigmoid()`
`activation_hard_tanh()`
`activation_leaky_relu()`
`activation_linear()`
`activation_log_sigmoid()`
`activation_log_softmax()`
`activation_mish()`
`activation_relu()`
`activation_relu6()`
`activation_selu()`
`activation_sigmoid()`
`activation_silu()`
`activation_soft_shrink()`
`activation_softmax()`
`activation_softplus()`
`activation_softsign()`
`activation_sparse_plus()`

activation_sparsemax()
activation_squareplus()
activation_tanh_shrink()
activation_threshold()

---

activation_tanh_shrink

Tanh shrink activation function.

Description

It is defined as:

`f(x) = x - tanh(x)`.

Usage

```
activation_tanh_shrink(x)
```

Arguments

`x`	Input tensor.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()
activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()

activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_threshold()

---

activation_threshold *Threshold activation function.*

Description

It is defined as:

`threshold(x) = x` if `x > threshold`, `threshold(x) = default_value` otherwise.

Usage

```
activation_threshold(x, threshold, default_value)
```

Arguments

`x`	Input tensor.
`threshold`	The value that decides when to retain or replace x.
`default_value`	Value to assign when `x <= threshold`.

Value

A tensor, the result from applying the activation to the input tensor `x`.

See Also

Other activations:
activation_celu()
activation_elu()
activation_exponential()
activation_gelu()
activation_glu()
activation_hard_shrink()
activation_hard_sigmoid()
activation_hard_tanh()
activation_leaky_relu()
activation_linear()

activation_log_sigmoid()
activation_log_softmax()
activation_mish()
activation_relu()
activation_relu6()
activation_selu()
activation_sigmoid()
activation_silu()
activation_soft_shrink()
activation_softmax()
activation_softplus()
activation_softsign()
activation_sparse_plus()
activation_sparsemax()
activation_squareplus()
activation_tanh()
activation_tanh_shrink()

---

active_property *Create an active property class method*

Description

Create an active property class method

Usage

```
active_property(fn)
```

Arguments

fn	An R function

Value

`fn`, with an additional R attribute that will cause `fn` to be converted to an active property when being converted to a method of a custom subclass.

Example

```
layer_foo <- Model("Foo", ...,
  metrics = active_property(function() {
    list(self$d_loss_metric,
         self$g_loss_metric)
  }))
```

`adapt` *Fits the state of the preprocessing layer to the data being passed*

Description

Fits the state of the preprocessing layer to the data being passed

Usage

```
adapt(object, data, ..., batch_size = NULL, steps = NULL)
```

Arguments

`object`	Preprocessing layer object
`data`	The data to train on. It can be passed either as a `tf.data.Dataset` or as an R array.
`...`	Used for forwards and backwards compatibility. Passed on to the underlying method.
`batch_size`	Integer or `NULL`. Number of asamples per state update. If unspecified, `batch_size` will default to `32`. Do not specify the batch_size if your data is in the form of a TF Dataset or a generator (since they generate batches).
`steps`	Integer or `NULL`. Total number of steps (batches of samples) When training with input tensors such as TensorFlow data tensors, the default `NULL` is equal to the number of samples in your dataset divided by the batch size, or `1` if that cannot be determined. If x is a `tf.data.Dataset`, and `steps` is `NULL`, the epoch will run until the input dataset is exhausted. When passing an infinitely repeating dataset, you must specify the steps argument. This argument is not supported with array inputs.

Details

After calling `adapt` on a layer, a preprocessing layer's state will not update during training. In order to make preprocessing layers efficient in any distribution context, they are kept constant with respect to any compiled `tf.Graph`s that call the layer. This does not affect the layer use when adapting each layer only once, but if you adapt a layer multiple times you will need to take care to re-compile any compiled functions as follows:

- If you are adding a preprocessing layer to a keras model, you need to call `compile(model)` after each subsequent call to `adapt()`.
- If you are calling a preprocessing layer inside `tfdatasets::dataset_map()`, you should call `dataset_map()` again on the input `Dataset` after each `adapt()`.
- If you are using a `tensorflow::tf_function()` directly which calls a preprocessing layer, you need to call `tf_function()` again on your callable after each subsequent call to `adapt()`.

`keras_model()` example with multiple adapts:

```
layer <- layer_normalization(axis = NULL)
adapt(layer, c(0, 2))
model <- keras_model_sequential() |> layer()
predict(model, c(0, 1, 2), verbose = FALSE) # [1] -1  0  1

## [1] -1  0  1


adapt(layer, c(-1, 1))
compile(model)  # This is needed to re-compile model.predict!
predict(model, c(0, 1, 2), verbose = FALSE) # [1] 0 1 2

## [1] 0 1 2
```

`tfdatasets` example with multiple adapts:

```
layer <- layer_normalization(axis = NULL)
adapt(layer, c(0, 2))
input_ds <- tfdatasets::range_dataset(0, 3)
normalized_ds <- input_ds |>
  tfdatasets::dataset_map(layer)
str(tfdatasets::iterate(normalized_ds))

## List of 3
##  $ :<tf.Tensor: shape=(1), dtype=float32, numpy=array([-1.], dtype=float32)>
##  $ :<tf.Tensor: shape=(1), dtype=float32, numpy=array([0.], dtype=float32)>
##  $ :<tf.Tensor: shape=(1), dtype=float32, numpy=array([1.], dtype=float32)>


adapt(layer, c(-1, 1))
normalized_ds <- input_ds |>
  tfdatasets::dataset_map(layer) # Re-map over the input dataset.

normalized_ds |>
  tfdatasets::as_array_iterator() |>
  tfdatasets::iterate(simplify = FALSE) |>
  str()

## List of 3
##  $ : num [1(1d)] 0
##  $ : num [1(1d)] 1
##  $ : num [1(1d)] 2
```

Value

Returns `object`, invisibly.

application_convnext_base
Instantiates the ConvNeXtBase architecture.

Description

Instantiates the ConvNeXtBase architecture.

Usage

```
application_convnext_base(
  include_top = TRUE,
  include_preprocessing = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "convnext_base"
)
```

Arguments

`include_top`	Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`include_preprocessing`	Boolean, whether to include the preprocessing layer at the bottom of the network.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet-1k), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer. • `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation
: A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to "softmax". When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name
: The name of the model (string).

Value

A model instance.

References

- A ConvNet for the 2020s (CVPR 2022)

For image classification use cases, see this page for detailed examples. For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The base, large, and xlarge models were first pre-trained on the ImageNet-21k dataset and then fine-tuned on the ImageNet-1k dataset. The pre-trained parameters of the models were assembled from the official repository. To get a sense of how these parameters were converted to Keras compatible parameters, please refer to this repository.

Note

Each Keras Application expects a specific kind of input preprocessing. For ConvNeXt, preprocessing is included in the model using a Normalization layer. ConvNeXt models expect their inputs to be float or uint8 tensors of pixels with values in the [0-255] range.

When calling the summary() method after instantiating a ConvNeXt model, prefer setting the expand_nested argument summary() to TRUE to better investigate the instantiated model.

See Also

- https://keras.io/api/applications/convnext#convnextbase-function

---

application_convnext_large

Instantiates the ConvNeXtLarge architecture.

Description

Instantiates the ConvNeXtLarge architecture.

Usage

```
application_convnext_large(
  include_top = TRUE,
  include_preprocessing = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "convnext_large"
)
```

Arguments

`include_top` Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

`include_preprocessing` Boolean, whether to include the preprocessing layer at the bottom of the network.

`weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet-1k), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

`classifier_activation` A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name` The name of the model (string).

Value

A model instance.

References

- A ConvNet for the 2020s (CVPR 2022)

For image classification use cases, see this page for detailed examples. For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The `base`, `large`, and `xlarge` models were first pre-trained on the ImageNet-21k dataset and then fine-tuned on the ImageNet-1k dataset. The pre-trained parameters of the models were assembled from the official repository. To get a sense of how these parameters were converted to Keras compatible parameters, please refer to this repository.

Note

Each Keras Application expects a specific kind of input preprocessing. For ConvNeXt, preprocessing is included in the model using a `Normalization` layer. ConvNeXt models expect their inputs to be float or uint8 tensors of pixels with values in the `[0-255]` range.

When calling the `summary()` method after instantiating a ConvNeXt model, prefer setting the `expand_nested` argument `summary()` to `TRUE` to better investigate the instantiated model.

See Also

- https://keras.io/api/applications/convnext#convnextlarge-function

---

`application_convnext_small` *Instantiates the ConvNeXtSmall architecture.*

Description

Instantiates the ConvNeXtSmall architecture.

Usage

```
application_convnext_small(
  include_top = TRUE,
  include_preprocessing = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "convnext_small"
)
```

Arguments

- `include_top`: Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
- `include_preprocessing`: Boolean, whether to include the preprocessing layer at the bottom of the network.
- `weights`: One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet-1k), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
- `input_tensor`: Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
- `input_shape`: Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
- `pooling`: Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.
- `classes`: Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).
- `classifier_activation`: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.
- `name`: The name of the model (string).

Value

A model instance.

References

- A ConvNet for the 2020s (CVPR 2022)

For image classification use cases, see this page for detailed examples. For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The `base`, `large`, and `xlarge` models were first pre-trained on the ImageNet-21k dataset and then fine-tuned on the ImageNet-1k dataset. The pre-trained parameters of the models were assembled from the official repository. To get a sense of how these parameters were converted to Keras compatible parameters, please refer to this repository.

Note

Each Keras Application expects a specific kind of input preprocessing. For ConvNeXt, preprocessing is included in the model using a `Normalization` layer. ConvNeXt models expect their inputs to be float or uint8 tensors of pixels with values in the `[0-255]` range.

When calling the `summary()` method after instantiating a ConvNeXt model, prefer setting the `expand_nested` argument `summary()` to `TRUE` to better investigate the instantiated model.

See Also

- https://keras.io/api/applications/convnext#convnextsmall-function

---

`application_convnext_tiny` *Instantiates the ConvNeXtTiny architecture.*

Description

Instantiates the ConvNeXtTiny architecture.

Usage

```
application_convnext_tiny(
  include_top = TRUE,
  include_preprocessing = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "convnext_tiny"
)
```

Arguments

`include_top`	Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`include_preprocessing`	Boolean, whether to include the preprocessing layer at the bottom of the network.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet-1k), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

pooling
: Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name
: The name of the model (string).

Value

A model instance.

References

- A ConvNet for the 2020s (CVPR 2022)

For image classification use cases, see this page for detailed examples. For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The `base`, `large`, and `xlarge` models were first pre-trained on the ImageNet-21k dataset and then fine-tuned on the ImageNet-1k dataset. The pre-trained parameters of the models were assembled from the official repository. To get a sense of how these parameters were converted to Keras compatible parameters, please refer to this repository.

Note

Each Keras Application expects a specific kind of input preprocessing. For ConvNeXt, preprocessing is included in the model using a `Normalization` layer. ConvNeXt models expect their inputs to be float or uint8 tensors of pixels with values in the `[0-255]` range.

When calling the `summary()` method after instantiating a ConvNeXt model, prefer setting the `expand_nested` argument `summary()` to `TRUE` to better investigate the instantiated model.

See Also

- `https://keras.io/api/applications/convnext#convnexttiny-function`

application_convnext_xlarge
Instantiates the ConvNeXtXLarge architecture.

Description

Instantiates the ConvNeXtXLarge architecture.

Usage

```
application_convnext_xlarge(
  include_top = TRUE,
  include_preprocessing = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "convnext_xlarge"
)
```

Arguments

- `include_top` Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
- `include_preprocessing` Boolean, whether to include the preprocessing layer at the bottom of the network.
- `weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet-1k), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
- `input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
- `input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
- `pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.

classes — Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation — A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to "softmax". When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name — The name of the model (string).

Value

A model instance.

References

- A ConvNet for the 2020s (CVPR 2022)

For image classification use cases, see this page for detailed examples. For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The base, large, and xlarge models were first pre-trained on the ImageNet-21k dataset and then fine-tuned on the ImageNet-1k dataset. The pre-trained parameters of the models were assembled from the official repository. To get a sense of how these parameters were converted to Keras compatible parameters, please refer to this repository.

Note

Each Keras Application expects a specific kind of input preprocessing. For ConvNeXt, preprocessing is included in the model using a Normalization layer. ConvNeXt models expect their inputs to be float or uint8 tensors of pixels with values in the [0-255] range.

When calling the summary() method after instantiating a ConvNeXt model, prefer setting the expand_nested argument summary() to TRUE to better investigate the instantiated model.

See Also

- https://keras.io/api/applications/convnext#convnextxlarge-function

---

application_densenet121

Instantiates the Densenet121 architecture.

Description

Instantiates the Densenet121 architecture.

Usage

```
application_densenet121(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "densenet121"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `'channels_last'` data format) or `(3, 224, 224)` (with `'channels_first'` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.
`name`	The name of the model (string).

Value

A Keras model instance.

Reference

- Densely Connected Convolutional Networks (CVPR 2017)

Optionally loads weights pre-trained on ImageNet. Note that the data format convention used by the model is the one specified in your Keras config at `~/.keras/keras.json`.

Note

Each Keras Application expects a specific kind of input preprocessing. For DenseNet, call `application_preprocess_input` on your inputs before passing them to the model.

See Also

- https://keras.io/api/applications/densenet#densenet121-function

---

application_densenet169

Instantiates the Densenet169 architecture.

Description

Instantiates the Densenet169 architecture.

Usage

```
application_densenet169(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "densenet169"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `'channels_last'` data format) or `(3, 224, 224)` (with `'channels_first'` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.

pooling
: Optional pooling mode for feature extraction when `include_top` is `FALSE`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block.
  - `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.

classes
: optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000.

classifier_activation
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name
: The name of the model (string).

Value

A Keras model instance.

Reference

- Densely Connected Convolutional Networks (CVPR 2017)

Optionally loads weights pre-trained on ImageNet. Note that the data format convention used by the model is the one specified in your Keras config at `~/.keras/keras.json`.

Note

Each Keras Application expects a specific kind of input preprocessing. For DenseNet, call `application_preprocess_input` on your inputs before passing them to the model.

See Also

- `https://keras.io/api/applications/densenet#densenet169-function`

`application_densenet201`
Instantiates the Densenet201 architecture.

Description

Instantiates the Densenet201 architecture.

Usage

```
application_densenet201(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "densenet201"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `'channels_last'` data format) or `(3, 224, 224)` (with `'channels_first'` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.
`name`	The name of the model (string).

Value

A Keras model instance.

Reference

- Densely Connected Convolutional Networks (CVPR 2017)

Optionally loads weights pre-trained on ImageNet. Note that the data format convention used by the model is the one specified in your Keras config at `~/.keras/keras.json`.

Note

Each Keras Application expects a specific kind of input preprocessing. For DenseNet, call `application_preprocess_input` on your inputs before passing them to the model.

See Also

- https://keras.io/api/applications/densenet#densenet201-function

---

application_efficientnet_b0

Instantiates the EfficientNetB0 architecture.

Description

Instantiates the EfficientNetB0 architecture.

Usage

```
application_efficientnet_b0(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb0",
  ...
)
```

Arguments

`include_top`	Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is TRUE, and if no `weights` argument is specified. 1000 is how many ImageNet classes there are. Defaults to `1000`.

`classifier_activation`
A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `'softmax'`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name` The name of the model (string).

`...` For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the `[0-255]` range.

See Also

- `https://keras.io/api/applications/efficientnet#efficientnetb0-function`

application_efficientnet_b1
Instantiates the EfficientNetB1 architecture.

Description

Instantiates the EfficientNetB1 architecture.

Usage

```
application_efficientnet_b1(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb1",
  ...
)
```

Arguments

include_top	Whether to include the fully-connected layer at the top of the network. Defaults to TRUE.
weights	One of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to "imagenet".
input_tensor	Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	Optional shape tuple, only to be specified if include_top is FALSE. It should have exactly 3 inputs channels.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. Defaults to NULL. • NULL means that the output of the model will be the 4D tensor output of the last convolutional layer. • avg means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. 1000 is how many ImageNet classes there are. Defaults to 1000.

classifier_activation
: A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to 'softmax'. When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name
: The name of the model (string).

...
: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a Rescaling layer), and thus application_preprocess_inputs() is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the [0-255] range.

See Also

- https://keras.io/api/applications/efficientnet#efficientnetb1-function

---

application_efficientnet_b2

Instantiates the EfficientNetB2 architecture.

Description

Instantiates the EfficientNetB2 architecture.

Usage

```
application_efficientnet_b2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
```

```
    pooling = NULL,
    classes = 1000L,
    classifier_activation = "softmax",
    name = "efficientnetb2",
    ...
)
```

Arguments

include_top	Whether to include the fully-connected layer at the top of the network. Defaults to TRUE.
weights	One of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to "imagenet".
input_tensor	Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	Optional shape tuple, only to be specified if include_top is FALSE. It should have exactly 3 inputs channels.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. Defaults to NULL. • NULL means that the output of the model will be the 4D tensor output of the last convolutional layer. • avg means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. 1000 is how many ImageNet classes there are. Defaults to 1000.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to 'softmax'. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
name	The name of the model (string).
...	For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the `[0-255]` range.

See Also

- https://keras.io/api/applications/efficientnet#efficientnetb2-function

---

`application_efficientnet_b3`

Instantiates the EfficientNetB3 architecture.

Description

Instantiates the EfficientNetB3 architecture.

Usage

```
application_efficientnet_b3(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb3",
  ...
)
```

Arguments

`include_top`	Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.

- avg means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- max means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. 1000 is how many ImageNet classes there are. Defaults to 1000.

classifier_activation
: A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to 'softmax'. When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name
: The name of the model (string).

...
: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a Rescaling layer), and thus application_preprocess_inputs() is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the [0-255] range.

See Also

- https://keras.io/api/applications/efficientnet#efficientnetb3-function

application_efficientnet_b4
Instantiates the EfficientNetB4 architecture.

Description

Instantiates the EfficientNetB4 architecture.

Usage

```
application_efficientnet_b4(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb4",
  ...
)
```

Arguments

`include_top` Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

`weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is TRUE, and if no `weights` argument is specified. 1000 is how many ImageNet classes there are. Defaults to `1000`.

`classifier_activation`
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `'softmax'`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name`
: The name of the model (string).

`...`
: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the `[0-255]` range.

See Also

- `https://keras.io/api/applications/efficientnet#efficientnetb4-function`

`application_efficientnet_b5`
Instantiates the EfficientNetB5 architecture.

Description

Instantiates the EfficientNetB5 architecture.

Usage

```
application_efficientnet_b5(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
```

```
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb5",
  ...
)
```

Arguments

- `include_top`: Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
- `weights`: One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
- `input_tensor`: Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
- `input_shape`: Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
- `pooling`: Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.
- `classes`: Optional number of classes to classify images into, only to be specified if `include_top` is TRUE, and if no `weights` argument is specified. 1000 is how many ImageNet classes there are. Defaults to `1000`.
- `classifier_activation`: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `'softmax'`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.
- `name`: The name of the model (string).
- `...`: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the `[0-255]` range.

See Also

- `https://keras.io/api/applications/efficientnet#efficientnetb5-function`

`application_efficientnet_b6`

Instantiates the EfficientNetB6 architecture.

Description

Instantiates the EfficientNetB6 architecture.

Usage

```
application_efficientnet_b6(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb6",
  ...
)
```

Arguments

`include_top`	Whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.

- avg means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- max means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. 1000 is how many ImageNet classes there are. Defaults to 1000.

classifier_activation
: A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to 'softmax'. When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name
: The name of the model (string).

...
: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a Rescaling layer), and thus application_preprocess_inputs() is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the [0-255] range.

See Also

- https://keras.io/api/applications/efficientnet#efficientnetb6-function

application_efficientnet_b7
Instantiates the EfficientNetB7 architecture.

Description

Instantiates the EfficientNetB7 architecture.

Usage

```
application_efficientnet_b7(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "efficientnetb7",
  ...
)
```

Arguments

include_top	Whether to include the fully-connected layer at the top of the network. Defaults to TRUE.
weights	One of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to "imagenet".
input_tensor	Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	Optional shape tuple, only to be specified if include_top is FALSE. It should have exactly 3 inputs channels.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. Defaults to NULL. • NULL means that the output of the model will be the 4D tensor output of the last convolutional layer. • avg means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. 1000 is how many ImageNet classes there are. Defaults to 1000.

`classifier_activation`
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `'softmax'`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name`
: The name of the model (string).

`...`
: For forward/backward compatability.

Value

A model instance.

Reference

- EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks (ICML 2019)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNet, input preprocessing is included as part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. EfficientNet models expect their inputs to be float tensors of pixels with values in the `[0-255]` range.

See Also

- https://keras.io/api/applications/efficientnet#efficientnetb7-function

---

`application_efficientnet_v2b0`

Instantiates the EfficientNetV2B0 architecture.

Description

Instantiates the EfficientNetV2B0 architecture.

Usage

```
application_efficientnet_v2b0(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
```

```
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-b0"
)
```

Arguments

`include_top` Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

`weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to NULL.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `"avg"` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `"max"` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

`classifier_activation` A string or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`include_preprocessing` Boolean, whether to include the preprocessing layer at the bottom of the network.

`name` The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- https://keras.io/api/applications/efficientnet_v2#efficientnetv2b0-function

---

`application_efficientnet_v2b1`

Instantiates the EfficientNetV2B1 architecture.

Description

Instantiates the EfficientNetV2B1 architecture.

Usage

```
application_efficientnet_v2b1(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-b1"
)
```

Arguments

include_top — Boolean, whether to include the fully-connected layer at the top of the network. Defaults to TRUE.

weights — One of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to "imagenet".

input_tensor — Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.

input_shape — Optional shape tuple, only to be specified if include_top is FALSE. It should have exactly 3 inputs channels.

pooling — Optional pooling mode for feature extraction when include_top is FALSE. Defaults to NULL.

- NULL means that the output of the model will be the 4D tensor output of the last convolutional layer.
- "avg" means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- "max" means that global max pooling will be applied.

classes — Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation — A string or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to "softmax". When loading pretrained weights, classifier_activation can only be NULL or "softmax".

include_preprocessing — Boolean, whether to include the preprocessing layer at the bottom of the network.

name — The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- https://keras.io/api/applications/efficientnet_v2#efficientnetv2b1-function

---

`application_efficientnet_v2b2`
Instantiates the EfficientNetV2B2 architecture.

Description

Instantiates the EfficientNetV2B2 architecture.

Usage

```
application_efficientnet_v2b2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-b2"
)
```

Arguments

`include_top`	Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

pooling
Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to NULL.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `"avg"` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `"max"` means that global max pooling will be applied.

classes
Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation
A string or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

include_preprocessing
Boolean, whether to include the preprocessing layer at the bottom of the network.

name
The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- https://keras.io/api/applications/efficientnet_v2#efficientnetv2b2-function `application_efficientnet_v2b3` *Instantiates the EfficientNetV2B3 architecture.*

Description

Instantiates the EfficientNetV2B3 architecture.

Usage

```
application_efficientnet_v2b3(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-b3"
)
```

Arguments

`include_top`	Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer. • `"avg"` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • `"max"` means that global max pooling will be applied.
`classes`	Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

`classifier_activation`
: A string or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`include_preprocessing`
: Boolean, whether to include the preprocessing layer at the bottom of the network.

`name`
: The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- `https://keras.io/api/applications/efficientnet_v2#efficientnetv2b3-function`

`application_efficientnet_v2l`

Instantiates the EfficientNetV2L architecture.

Description

Instantiates the EfficientNetV2L architecture.

Usage

```
application_efficientnet_v2l(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-l"
)
```

Arguments

`include_top` Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

`weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `"avg"` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `"max"` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

`classifier_activation` A string or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`include_preprocessing` Boolean, whether to include the preprocessing layer at the bottom of the network.

`name` The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- `https://keras.io/api/applications/efficientnet_v2#efficientnetv2l-function`

`application_efficientnet_v2m`

Instantiates the EfficientNetV2M architecture.

Description

Instantiates the EfficientNetV2M architecture.

Usage

```
application_efficientnet_v2m(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-m"
)
```

Arguments

include_top
: Boolean, whether to include the fully-connected layer at the top of the network. Defaults to TRUE.

weights
: One of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to "imagenet".

input_tensor
: Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.

input_shape
: Optional shape tuple, only to be specified if include_top is FALSE. It should have exactly 3 inputs channels.

pooling
: Optional pooling mode for feature extraction when include_top is FALSE. Defaults to NULL.
  - NULL means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - "avg" means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - "max" means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation
: A string or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. Defaults to "softmax". When loading pretrained weights, classifier_activation can only be NULL or "softmax".

include_preprocessing
: Boolean, whether to include the preprocessing layer at the bottom of the network.

name
: The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- https://keras.io/api/applications/efficientnet_v2#efficientnetv2m-function

---

`application_efficientnet_v2s` *Instantiates the EfficientNetV2S architecture.*

Description

Instantiates the EfficientNetV2S architecture.

Usage

```
application_efficientnet_v2s(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "efficientnetv2-s"
)
```

Arguments

`include_top`	Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.
`weights`	One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE`. It should have exactly 3 inputs channels.

pooling
: Optional pooling mode for feature extraction when `include_top` is `FALSE`. Defaults to `NULL`.

  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
  - `"avg"` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
  - `"max"` means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000 (number of ImageNet classes).

classifier_activation
: A string or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. Defaults to `"softmax"`. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

include_preprocessing
: Boolean, whether to include the preprocessing layer at the bottom of the network.

name
: The name of the model (string).

Value

A model instance.

Reference

- EfficientNetV2: Smaller Models and Faster Training (ICML 2021)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For EfficientNetV2, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[0, 255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled EfficientNetV2 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

See Also

- `https://keras.io/api/applications/efficientnet_v2#efficientnetv2s-function`

application_inception_resnet_v2
Instantiates the Inception-ResNet v2 architecture.

Description

Instantiates the Inception-ResNet v2 architecture.

Usage

```
application_inception_resnet_v2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "inception_resnet_v2"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(299, 299, 3)` (with `'channels_last'` data format) or `(3, 299, 299)` (with `'channels_first'` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 75. E.g. `(150, 150, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `'avg'` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `'max'` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.

`classifier_activation`
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name`
: The name of the model (string).

Value

A model instance.

Reference

- Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning (AAAI 2017)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For `InceptionResNetV2`, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inp` will scale input pixels between -1 and 1.

See Also

- `https://keras.io/api/applications/inceptionresnetv2#inceptionresnetv2-function`

`application_inception_v3`

Instantiates the Inception v3 architecture.

Description

Instantiates the Inception v3 architecture.

Usage

```
application_inception_v3(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
```

```
  classifier_activation = "softmax",
  name = "inception_v3"
)
```

Arguments

`include_top` Boolean, whether to include the fully-connected layer at the top, as the last layer of the network. Defaults to `TRUE`.

`weights` One of `NULL` (random initialization), `imagenet` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model. `input_tensor` is useful for sharing inputs between multiple different networks. Defaults to `NULL`.

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(299, 299, 3)` (with `channels_last` data format) or `(3, 299, 299)` (with `channels_first` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 75. E.g. `(150, 150, 3)` would be one valid value. `input_shape` will be ignored if the `input_tensor` is provided.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`.

- `NULL` (default) means that the output of the model will be the 4D tensor output of the last convolutional block.
- `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

`classes` optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to 1000.

`classifier_activation`
A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name` The name of the model (string).

Value

A model instance.

Reference

- Rethinking the Inception Architecture for Computer Vision (CVPR 2016)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For `InceptionV3`, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs` will scale input pixels between `-1` and `1`.

See Also

- https://keras.io/api/applications/inceptionv3#inceptionv3-function

---

`application_mobilenet` *Instantiates the MobileNet architecture.*

Description

Instantiates the MobileNet architecture.

Usage

```
application_mobilenet(
  input_shape = NULL,
  alpha = 1,
  depth_multiplier = 1L,
  dropout = 0.001,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = NULL
)
```

Arguments

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `"channels_last"` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value. Defaults to `NULL`. `input_shape` will be ignored if the `input_tensor` is provided.

`alpha` Controls the width of the network. This is known as the width multiplier in the MobileNet paper.

- If `alpha` < `1.0`, proportionally decreases the number of filters in each layer.
- If `alpha` > `1.0`, proportionally increases the number of filters in each layer.
- If `alpha` == `1`, default number of filters from the paper are used at each layer. Defaults to `1.0`.

depth_multiplier
: Depth multiplier for depthwise convolution. This is called the resolution multiplier in the MobileNet paper. Defaults to `1.0`.

dropout
: Dropout rate. Defaults to `0.001`.

include_top
: Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

weights
: One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

input_tensor
: Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model. `input_tensor` is useful for sharing inputs between multiple different networks. Defaults to `NULL`.

pooling
: Optional pooling mode for feature extraction when `include_top` is `FALSE`.

- `NULL` (default) means that the output of the model will be the 4D tensor output of the last convolutional block.
- `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to `1000`.

classifier_activation
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name
: The name of the model (string).

Value

A model instance.

Reference

- MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For MobileNet, call `application_preprocess_inpu` on your inputs before passing them to the model. `application_preprocess_inputs()` will scale input pixels between `-1` and `1`.

See Also

- https://keras.io/api/applications/mobilenet#mobilenet-function

---

application_mobilenet_v2
Instantiates the MobileNetV2 architecture.

Description

MobileNetV2 is very similar to the original MobileNet, except that it uses inverted residual blocks with bottlenecking features. It has a drastically lower parameter count than the original MobileNet. MobileNets support any input size greater than 32 x 32, with larger image sizes offering better performance.

Usage

```
application_mobilenet_v2(
  input_shape = NULL,
  alpha = 1,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = NULL
)
```

Arguments

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `"channels_last"` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value. Defaults to `NULL`. `input_shape` will be ignored if the `input_tensor` is provided.

`alpha` Controls the width of the network. This is known as the width multiplier in the MobileNet paper.

- If `alpha` < `1.0`, proportionally decreases the number of filters in each layer.
- If `alpha` > `1.0`, proportionally increases the number of filters in each layer.
- If `alpha` == `1`, default number of filters from the paper are used at each layer. Defaults to `1.0`.

`include_top` Boolean, whether to include the fully-connected layer at the top of the network. Defaults to `TRUE`.

`weights` One of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded. Defaults to `"imagenet"`.

input_tensor
: Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model. `input_tensor` is useful for sharing inputs between multiple different networks. Defaults to `NULL`.

pooling
: Optional pooling mode for feature extraction when `include_top` is `FALSE`.
  - `NULL` (default) means that the output of the model will be the 4D tensor output of the last convolutional block.
  - `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.

classes
: Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to `1000`.

classifier_activation
: A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name
: The name of the model (string).

Value

A model instance.

Reference

- MobileNetV2: Inverted Residuals and Linear Bottlenecks (CVPR 2018)

This function returns a Keras image classification model, optionally loaded with weights pre-trained on ImageNet.

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For MobileNetV2, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs` will scale input pixels between `-1` and `1`.

See Also

- `https://keras.io/api/applications/mobilenet#mobilenetv2-function` `application_mobilenet_v3_large` *Instantiates the MobileNetV3Large architecture.*

Description

Instantiates the MobileNetV3Large architecture.

Usage

```
application_mobilenet_v3_large(
  input_shape = NULL,
  alpha = 1,
  minimalistic = FALSE,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  classes = 1000L,
  pooling = NULL,
  dropout_rate = 0.2,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "MobileNetV3Large"
)
```

Arguments

`input_shape` Optional shape tuple, to be specified if you would like to use a model with an input image resolution that is not `(224, 224, 3)`. It should have exactly 3 inputs channels. You can also omit this option if you would like to infer input_shape from an input_tensor. If you choose to include both input_tensor and input_shape then input_shape will be used if they match, if the shapes do not match then we will throw an error. E.g. `(160, 160, 3)` would be one valid value.

`alpha` controls the width of the network. This is known as the depth multiplier in the MobileNetV3 paper, but the name is kept for consistency with MobileNetV1 in Keras.

- If `alpha` < `1.0`, proportionally decreases the number of filters in each layer.
- If `alpha` > `1.0`, proportionally increases the number of filters in each layer.
- If `alpha` == `1`, default number of filters from the paper are used at each layer.

`minimalistic` In addition to large and small models this module also contains so-called minimalistic models, these models have the same per-layer dimensions characteristic as MobilenetV3 however, they don't utilize any of the advanced blocks (squeeze-and-excite units, hard-swish, and 5x5 convolutions). While these models are less efficient on CPU, they are much more performant on GPU/DSP.

include_top	Boolean, whether to include the fully-connected layer at the top of the network. Defaults to TRUE.
weights	String, one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
classes	Integer, optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
pooling	String, optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
dropout_rate	fraction of the input units to drop on the last layer.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
include_preprocessing	Boolean, whether to include the preprocessing layer (Rescaling) at the bottom of the network. Defaults to TRUE.
name	The name of the model (string).

Value

A model instance.

Reference

- Searching for MobileNetV3 (ICCV 2019)

The following table describes the performance of MobileNets v3::
MACs stands for Multiply Adds

Classification Checkpoint	MACs(M)	Parameters(M)	Top1 Accuracy	Pixel1 CPU(ms)
mobilenet_v3_large_1.0_224	217	5.4	75.6	51.2
mobilenet_v3_large_0.75_224	155	4.0	73.3	39.8
mobilenet_v3_large_minimalistic_1.0_224	209	3.9	72.3	44.1
mobilenet_v3_small_1.0_224	66	2.9	68.1	15.8
mobilenet_v3_small_0.75_224	44	2.4	65.4	12.8
mobilenet_v3_small_minimalistic_1.0_224	65	2.0	61.9	12.2

For image classification use cases, see this page for detailed examples.
For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For MobileNetV3, by default input preprocessing is included as a part of the model (as a Rescaling layer), and thus application_preprocess_inputs() is actually a pass-through function. In this use case, MobileNetV3 models expect their inputs to be float tensors of pixels with values in the [0-255] range. At the same time, preprocessing as a part of the model (i.e. Rescaling layer) can be disabled by setting include_preprocessing argument to FALSE. With preprocessing disabled MobileNetV3 models expect their inputs to be float tensors of pixels with values in the [-1, 1] range.

Call Arguments

- inputs: A floating point numpy.array or backend-native tensor, 4D with 3 color channels, with values in the range [0, 255] if include_preprocessing is TRUE and in the range [-1, 1] otherwise.

See Also

- https://keras.io/api/applications/mobilenet#mobilenetv3large-function

---

application_mobilenet_v3_small

Instantiates the MobileNetV3Small architecture.

Description

Instantiates the MobileNetV3Small architecture.

Usage

```
application_mobilenet_v3_small(
  input_shape = NULL,
  alpha = 1,
  minimalistic = FALSE,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  classes = 1000L,
  pooling = NULL,
  dropout_rate = 0.2,
  classifier_activation = "softmax",
  include_preprocessing = TRUE,
  name = "MobileNetV3Small"
)
```

Arguments

input_shape	Optional shape tuple, to be specified if you would like to use a model with an input image resolution that is not (224, 224, 3). It should have exactly 3 inputs channels. You can also omit this option if you would like to infer input_shape from an input_tensor. If you choose to include both input_tensor and input_shape then input_shape will be used if they match, if the shapes do not match then we will throw an error. E.g. (160, 160, 3) would be one valid value.
alpha	controls the width of the network. This is known as the depth multiplier in the MobileNetV3 paper, but the name is kept for consistency with MobileNetV1 in Keras. • If alpha < 1.0, proportionally decreases the number of filters in each layer. • If alpha > 1.0, proportionally increases the number of filters in each layer. • If alpha == 1, default number of filters from the paper are used at each layer.
minimalistic	In addition to large and small models this module also contains so-called minimalistic models, these models have the same per-layer dimensions characteristic as MobilenetV3 however, they don't utilize any of the advanced blocks (squeeze-and-excite units, hard-swish, and 5x5 convolutions). While these models are less efficient on CPU, they are much more performant on GPU/DSP.
include_top	Boolean, whether to include the fully-connected layer at the top of the network. Defaults to TRUE.
weights	String, one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	Optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
classes	Integer, optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
pooling	String, optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
dropout_rate	fraction of the input units to drop on the last layer.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
include_preprocessing	Boolean, whether to include the preprocessing layer (Rescaling) at the bottom of the network. Defaults to TRUE.
name	The name of the model (string).

Value

A model instance.

Reference

- Searching for MobileNetV3 (ICCV 2019)

The following table describes the performance of MobileNets v3::

MACs stands for Multiply Adds

Classification Checkpoint	MACs(M)	Parameters(M)	Top1 Accuracy	Pixel1 CPU(ms)
mobilenet_v3_large_1.0_224	217	5.4	75.6	51.2
mobilenet_v3_large_0.75_224	155	4.0	73.3	39.8
mobilenet_v3_large_minimalistic_1.0_224	209	3.9	72.3	44.1
mobilenet_v3_small_1.0_224	66	2.9	68.1	15.8
mobilenet_v3_small_0.75_224	44	2.4	65.4	12.8
mobilenet_v3_small_minimalistic_1.0_224	65	2.0	61.9	12.2

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For MobileNetV3, by default input preprocessing is included as a part of the model (as a `Rescaling` layer), and thus `application_preprocess_inputs()` is actually a pass-through function. In this use case, MobileNetV3 models expect their inputs to be float tensors of pixels with values in the `[0-255]` range. At the same time, preprocessing as a part of the model (i.e. `Rescaling` layer) can be disabled by setting `include_preprocessing` argument to `FALSE`. With preprocessing disabled MobileNetV3 models expect their inputs to be float tensors of pixels with values in the `[-1, 1]` range.

Call Arguments

- `inputs`: A floating point `numpy.array` or backend-native tensor, 4D with 3 color channels, with values in the range `[0, 255]` if `include_preprocessing` is `TRUE` and in the range `[-1, 1]` otherwise.

See Also

- https://keras.io/api/applications/mobilenet#mobilenetv3small-function

---

application_nasnet_large

Instantiates a NASNet model in ImageNet mode.

Description

Instantiates a NASNet model in ImageNet mode.

Usage

```
application_nasnet_large(
  input_shape = NULL,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "nasnet_large"
)
```

Arguments

`input_shape`	Optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(331, 331, 3)` for NASNetLarge. It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(224, 224, 3)` would be one valid value.
`include_top`	Whether to include the fully-connected layer at the top of the network.
`weights`	`NULL` (random initialization) or `imagenet` (ImageNet weights). For loading `imagenet` weights, `input_shape` should be (331, 331, 3)
`input_tensor`	Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer. • `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name The name of the model (string).

Value

A Keras model instance.

Reference

- Learning Transferable Architectures for Scalable Image Recognition (CVPR 2018)

Optionally loads weights pre-trained on ImageNet. Note that the data format convention used by the model is the one specified in your Keras config at `~/.keras/keras.json`.

Note

Each Keras Application expects a specific kind of input preprocessing. For NASNet, call `application_preprocess_inputs` on your inputs before passing them to the model.

See Also

- https://keras.io/api/applications/nasnet#nasnetlarge-function

---

application_nasnet_mobile

Instantiates a Mobile NASNet model in ImageNet mode.

Description

Instantiates a Mobile NASNet model in ImageNet mode.

Usage

```
application_nasnet_mobile(
  input_shape = NULL,
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "nasnet_mobile"
)
```

Arguments

`input_shape` Optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` for NASNetMobile It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(224, 224, 3)` would be one valid value.

`include_top` Whether to include the fully-connected layer at the top of the network.

`weights` `NULL` (random initialization) or `imagenet` (ImageNet weights). For loading `imagenet` weights, `input_shape` should be (224, 224, 3)

`input_tensor` Optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.

`pooling` Optional pooling mode for feature extraction when `include_top` is `FALSE`.

- `NULL` means that the output of the model will be the 4D tensor output of the last convolutional layer.
- `avg` means that global average pooling will be applied to the output of the last convolutional layer, and thus the output of the model will be a 2D tensor.
- `max` means that global max pooling will be applied.

`classes` Optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.

`classifier_activation`
A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name` The name of the model (string).

Value

A Keras model instance.

Reference

- Learning Transferable Architectures for Scalable Image Recognition (CVPR 2018)

Optionally loads weights pre-trained on ImageNet. Note that the data format convention used by the model is the one specified in your Keras config at `~/.keras/keras.json`.

Note

Each Keras Application expects a specific kind of input preprocessing. For NASNet, call `application_preprocess_inputs` on your inputs before passing them to the model.

See Also

- `https://keras.io/api/applications/nasnet#nasnetmobile-function`

application_resnet101 *Instantiates the ResNet101 architecture.*

Description

Instantiates the ResNet101 architecture.

Usage

```
application_resnet101(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet101"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `"channels_last"` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

`name`	The name of the model (string).

Value

A Model instance.

Reference

- Deep Residual Learning for Image Recognition (CVPR 2015)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs()` will convert the input images from RGB to BGR, then will zero-center each color channel with respect to the ImageNet dataset, without scaling.

See Also

- `https://keras.io/api/applications/resnet#resnet101-function`

`application_resnet101_v2` *Instantiates the ResNet101V2 architecture.*

Description

Instantiates the ResNet101V2 architecture.

Usage

```
application_resnet101_v2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet101v2"
)
```

Arguments

include_top	whether to include the fully-connected layer at the top of the network.
weights	one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	optional shape tuple, only to be specified if include_top is FALSE (otherwise the input shape has to be (224, 224, 3) (with "channels_last" data format) or (3, 224, 224) (with "channels_first" data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. (200, 200, 3) would be one valid value.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
name	The name of the model (string).

Value

A Model instance.

Reference

- Identity Mappings in Deep Residual Networks (CVPR 2016)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call application_preprocess_inputs() on your inputs before passing them to the model. application_preprocess_inputs() will scale input pixels between -1 and 1.

See Also

- https://keras.io/api/applications/resnet#resnet101v2-function

application_resnet152 *Instantiates the ResNet152 architecture.*

Description

Instantiates the ResNet152 architecture.

Usage

```
application_resnet152(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet152"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `"channels_last"` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name	The name of the model (string).

Value

A Model instance.

Reference

- Deep Residual Learning for Image Recognition (CVPR 2015)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs()` will convert the input images from RGB to BGR, then will zero-center each color channel with respect to the ImageNet dataset, without scaling.

See Also

- https://keras.io/api/applications/resnet#resnet152-function

---

`application_resnet152_v2`

Instantiates the ResNet152V2 architecture.

Description

Instantiates the ResNet152V2 architecture.

Usage

```
application_resnet152_v2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet152v2"
)
```

Arguments

include_top	whether to include the fully-connected layer at the top of the network.
weights	one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	optional shape tuple, only to be specified if include_top is FALSE (otherwise the input shape has to be (224, 224, 3) (with "channels_last" data format) or (3, 224, 224) (with "channels_first" data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. (200, 200, 3) would be one valid value.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
name	The name of the model (string).

Value

A Model instance.

Reference

- Identity Mappings in Deep Residual Networks (CVPR 2016)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call application_preprocess_inputs() on your inputs before passing them to the model. application_preprocess_inputs() will scale input pixels between -1 and 1.

See Also

- https://keras.io/api/applications/resnet#resnet152v2-function

application_resnet50 *Instantiates the ResNet50 architecture.*

Description

Instantiates the ResNet50 architecture.

Usage

```
application_resnet50(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet50"
)
```

Arguments

`include_top`	whether to include the fully-connected layer at the top of the network.
`weights`	one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
`input_tensor`	optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
`input_shape`	optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `"channels_last"` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
`pooling`	Optional pooling mode for feature extraction when `include_top` is `FALSE`. • `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block. • `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • `max` means that global max pooling will be applied.
`classes`	optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified. Defaults to `1000`.
`classifier_activation`	A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.

name — The name of the model (string).

Value

A Model instance.

Reference

- Deep Residual Learning for Image Recognition (CVPR 2015)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs()` will convert the input images from RGB to BGR, then will zero-center each color channel with respect to the ImageNet dataset, without scaling.

See Also

- https://keras.io/api/applications/resnet#resnet50-function

`application_resnet50_v2` *Instantiates the ResNet50V2 architecture.*

Description

Instantiates the ResNet50V2 architecture.

Usage

```
application_resnet50_v2(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "resnet50v2"
)
```

Arguments

include_top	whether to include the fully-connected layer at the top of the network.
weights	one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	optional shape tuple, only to be specified if include_top is FALSE (otherwise the input shape has to be (224, 224, 3) (with "channels_last" data format) or (3, 224, 224) (with "channels_first" data format). It should have exactly 3 inputs channels, and width and height should be no smaller than 32. E.g. (200, 200, 3) would be one valid value.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".
name	The name of the model (string).

Value

A Model instance.

Reference

- Identity Mappings in Deep Residual Networks (CVPR 2016)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

Note

Each Keras Application expects a specific kind of input preprocessing. For ResNet, call application_preprocess_inputs() on your inputs before passing them to the model. application_preprocess_inputs() will scale input pixels between -1 and 1.

See Also

- https://keras.io/api/applications/resnet#resnet50v2-function

application_vgg16 *Instantiates the VGG16 model.*

Description

Instantiates the VGG16 model.

Usage

```
application_vgg16(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "vgg16"
)
```

Arguments

include_top	whether to include the 3 fully-connected layers at the top of the network.
weights	one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	optional shape tuple, only to be specified if include_top is FALSE (otherwise the input shape has to be (224, 224, 3) (with channels_last data format) or (3, 224, 224) (with "channels_first" data format). It should have exactly 3 input channels, and width and height should be no smaller than 32. E.g. (200, 200, 3) would be one valid value.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.
classifier_activation	A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name The name of the model (string).

Value

A `Model` instance.

Reference

- Very Deep Convolutional Networks for Large-Scale Image Recognition (ICLR 2015)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The default input size for this model is 224x224.

Note

Each Keras Application expects a specific kind of input preprocessing. For VGG16, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs()` will convert the input images from RGB to BGR, then will zero-center each color channel with respect to the ImageNet dataset, without scaling.

See Also

- https://keras.io/api/applications/vgg#vgg16-function

`application_vgg19` *Instantiates the VGG19 model.*

Description

Instantiates the VGG19 model.

Usage

```
application_vgg19(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "vgg19"
)
```

Arguments

- `include_top` — whether to include the 3 fully-connected layers at the top of the network.
- `weights` — one of `NULL` (random initialization), `"imagenet"` (pre-training on ImageNet), or the path to the weights file to be loaded.
- `input_tensor` — optional Keras tensor (i.e. output of `keras_input()`) to use as image input for the model.
- `input_shape` — optional shape tuple, only to be specified if `include_top` is `FALSE` (otherwise the input shape has to be `(224, 224, 3)` (with `channels_last` data format) or `(3, 224, 224)` (with `"channels_first"` data format). It should have exactly 3 input channels, and width and height should be no smaller than 32. E.g. `(200, 200, 3)` would be one valid value.
- `pooling` — Optional pooling mode for feature extraction when `include_top` is `FALSE`.
  - `NULL` means that the output of the model will be the 4D tensor output of the last convolutional block.
  - `avg` means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor.
  - `max` means that global max pooling will be applied.
- `classes` — optional number of classes to classify images into, only to be specified if `include_top` is `TRUE`, and if no `weights` argument is specified.
- `classifier_activation` — A `str` or callable. The activation function to use on the "top" layer. Ignored unless `include_top=TRUE`. Set `classifier_activation=NULL` to return the logits of the "top" layer. When loading pretrained weights, `classifier_activation` can only be `NULL` or `"softmax"`.
- `name` — The name of the model (string).

Value

A model instance.

Reference

- Very Deep Convolutional Networks for Large-Scale Image Recognition (ICLR 2015)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The default input size for this model is 224x224.

Note

Each Keras Application expects a specific kind of input preprocessing. For VGG19, call `application_preprocess_inputs()` on your inputs before passing them to the model. `application_preprocess_inputs()` will convert the input images from RGB to BGR, then will zero-center each color channel with respect to the ImageNet dataset, without scaling.

See Also

- https://keras.io/api/applications/vgg#vgg19-function

---

application_xception *Instantiates the Xception architecture.*

Description

Instantiates the Xception architecture.

Usage

```
application_xception(
  include_top = TRUE,
  weights = "imagenet",
  input_tensor = NULL,
  input_shape = NULL,
  pooling = NULL,
  classes = 1000L,
  classifier_activation = "softmax",
  name = "xception"
)
```

Arguments

include_top	whether to include the 3 fully-connected layers at the top of the network.
weights	one of NULL (random initialization), "imagenet" (pre-training on ImageNet), or the path to the weights file to be loaded.
input_tensor	optional Keras tensor (i.e. output of keras_input()) to use as image input for the model.
input_shape	optional shape tuple, only to be specified if include_top is FALSE (otherwise the input shape has to be (299, 299, 3). It should have exactly 3 inputs channels, and width and height should be no smaller than 71. E.g. (150, 150, 3) would be one valid value.
pooling	Optional pooling mode for feature extraction when include_top is FALSE. • NULL means that the output of the model will be the 4D tensor output of the last convolutional block. • avg means that global average pooling will be applied to the output of the last convolutional block, and thus the output of the model will be a 2D tensor. • max means that global max pooling will be applied.
classes	optional number of classes to classify images into, only to be specified if include_top is TRUE, and if no weights argument is specified.

classifier_activation
: A str or callable. The activation function to use on the "top" layer. Ignored unless include_top=TRUE. Set classifier_activation=NULL to return the logits of the "top" layer. When loading pretrained weights, classifier_activation can only be NULL or "softmax".

name
: The name of the model (string).

Value

A model instance.

Reference

- Xception: Deep Learning with Depthwise Separable Convolutions (CVPR 2017)

For image classification use cases, see this page for detailed examples.

For transfer learning use cases, make sure to read the guide to transfer learning & fine-tuning.

The default input image size for this model is 299x299.

Note

Each Keras Application expects a specific kind of input preprocessing. For Xception, call application_preprocess_inputs() on your inputs before passing them to the model. application_preprocess_inputs() will scale input pixels between -1 and 1.

See Also

- https://keras.io/api/applications/xception#xception-function

---

audio_dataset_from_directory

Generates a tf.data.Dataset *from audio files in a directory.*

Description

If your directory structure is:

```
main_directory/
...class_a/
......a_audio_1.wav
......a_audio_2.wav
...class_b/
......b_audio_1.wav
......b_audio_2.wav
```

Then calling audio_dataset_from_directory(main_directory, labels = 'inferred') will return a tf.data.Dataset that yields batches of audio files from the subdirectories class_a and class_b, together with labels 0 and 1 (0 corresponding to class_a and 1 corresponding to class_b).

Only .wav files are supported at this time.

Usage

```
audio_dataset_from_directory(
  directory,
  labels = "inferred",
  label_mode = "int",
  class_names = NULL,
  batch_size = 32L,
  sampling_rate = NULL,
  output_sequence_length = NULL,
  ragged = FALSE,
  shuffle = TRUE,
  seed = NULL,
  validation_split = NULL,
  subset = NULL,
  follow_links = FALSE,
  verbose = TRUE
)
```

Arguments

`directory` Directory where the data is located. If `labels` is `"inferred"`, it should contain subdirectories, each containing audio files for a class. Otherwise, the directory structure is ignored.

`labels` Either "inferred" (labels are generated from the directory structure), `NULL` (no labels), or a list/tuple of integer labels of the same size as the number of audio files found in the directory. Labels should be sorted according to the alphanumeric order of the audio file paths (obtained via `os.walk(directory)` in Python).

`label_mode` String describing the encoding of `labels`. Options are:

- `"int"`: means that the labels are encoded as integers (e.g. for `sparse_categorical_crossentropy` loss).
- `"categorical"` means that the labels are encoded as a categorical vector (e.g. for `categorical_crossentropy` loss)
- `"binary"` means that the labels (there can be only 2) are encoded as `float32` scalars with values 0 or 1 (e.g. for `binary_crossentropy`).
- `NULL` (no labels).

`class_names` Only valid if "labels" is `"inferred"`. This is the explicit list of class names (must match names of subdirectories). Used to control the order of the classes (otherwise alphanumerical order is used).

`batch_size` Size of the batches of data. Default: 32. If `NULL`, the data will not be batched (the dataset will yield individual samples).

`sampling_rate` Audio sampling rate (in samples per second).

`output_sequence_length` Maximum length of an audio sequence. Audio files longer than this will be truncated to `output_sequence_length`. If set to `NULL`, then all sequences in the same batch will be padded to the length of the longest sequence in the batch.

`ragged`	Whether to return a Ragged dataset (where each sequence has its own length). Defaults to `FALSE`.
`shuffle`	Whether to shuffle the data. Defaults to `TRUE`. If set to `FALSE`, sorts the data in alphanumeric order.
`seed`	Optional random seed for shuffling and transformations.
`validation_split`	Optional float between 0 and 1, fraction of data to reserve for validation.
`subset`	Subset of the data to return. One of `"training"`, `"validation"` or `"both"`. Only used if `validation_split` is set.
`follow_links`	Whether to visits subdirectories pointed to by symlinks. Defaults to `FALSE`.
`verbose`	Whether to display number information on classes and number of files found. Defaults to `TRUE`.

Value

A `tf.data.Dataset` object.

- If `label_mode` is `NULL`, it yields `string` tensors of shape `(batch_size,)`, containing the contents of a batch of audio files.
- Otherwise, it yields a tuple `(audio, labels)`, where `audio` has shape `(batch_size, sequence_length, num_channe` and `labels` follows the format described below.

Rules regarding labels format:

- if `label_mode` is `int`, the labels are an `int32` tensor of shape `(batch_size,)`.
- if `label_mode` is `binary`, the labels are a `float32` tensor of 1s and 0s of shape `(batch_size, 1)`.
- if `label_mode` is `categorical`, the labels are a `float32` tensor of shape `(batch_size, num_classes)`, representing a one-hot encoding of the class index.

See Also

- https://keras.io/api/data_loading/audio#audiodatasetfromdirectory-function

Other dataset utils:
`image_dataset_from_directory()`
`split_dataset()`
`text_dataset_from_directory()`
`timeseries_dataset_from_array()`

Other utils:
`clear_session()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`get_file()`

get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Callback *Define a custom* Callback *class*

Description

Callbacks can be passed to keras methods such as `fit()`, `evaluate()`, and `predict()` in order to hook into the various stages of the model training, evaluation, and inference lifecycle.

To create a custom callback, call `Callback()` and override the method associated with the stage of interest.

Usage

```
Callback(
  classname,
  on_epoch_begin = NULL,
  on_epoch_end = NULL,
  on_train_begin = NULL,
  on_train_end = NULL,
  on_train_batch_begin = NULL,
  on_train_batch_end = NULL,
  on_test_begin = NULL,
  on_test_end = NULL,
  on_test_batch_begin = NULL,
  on_test_batch_end = NULL,
  on_predict_begin = NULL,
  on_predict_end = NULL,
  on_predict_batch_begin = NULL,
  on_predict_batch_end = NULL,
  ...,
```

```
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

`classname` String, the name of the custom class. (Conventionally, CamelCase).

`on_epoch_begin` `\(epoch, logs = NULL)`

Called at the start of an epoch.

Subclasses should override for any actions to run. This function should only be called during TRAIN mode.

Args:

- `epoch`: Integer, index of epoch.
- `logs`: Named List. Currently no data is passed to this argument for this method but that may change in the future.

`on_epoch_end` `\(epoch, logs = NULL)`

Called at the end of an epoch.

Subclasses should override for any actions to run. This function should only be called during TRAIN mode.

Args:

- `epoch`: Integer, index of epoch.
- `logs`: Named List, metric results for this training epoch, and for the validation epoch if validation is performed. Validation result keys are prefixed with `val_`. For training epoch, the values of the `Model`'s metrics are returned. Example: `list(loss = 0.2, accuracy = 0.7)`.

`on_train_begin` `\(logs = NULL)`

Called at the beginning of training.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_train_end` `\(logs = NULL)`

Called at the end of training.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently the output of the last call to `on_epoch_end()` is passed to this argument for this method but that may change in the future.

`on_train_batch_begin`

`\(batch, logs = NULL)`

Called at the beginning of a training batch in `fit()` methods.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_train_batch_end`

`\(batch, logs=NULL)`

Called at the end of a training batch in `fit()` methods.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Aggregated metric results up until this batch.

`on_test_begin` `\(logs = NULL)`

Called at the beginning of evaluation or validation.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_test_end` `\(logs = NULL)`

Called at the end of evaluation or validation.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently the output of the last call to `on_test_batch_end()` is passed to this argument for this method but that may change in the future.

`on_test_batch_begin`

`\(batch, logs = NULL)`

Called at the beginning of a batch in `evaluate()` methods.

Also called at the beginning of a validation batch in the `fit()` methods, if validation data is provided.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile()` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_test_batch_end`

`\(batch, logs = NULL)`

Called at the end of a batch in `evaluate()` methods.

Also called at the end of a validation batch in the `fit()` methods, if validation data is provided.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile()` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Aggregated metric results up until this batch.

`on_predict_begin`
`\(logs = NULL)`

Called at the beginning of prediction.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_predict_end` `\(logs = NULL)`

Called at the end of prediction.

Subclasses should override for any actions to run.

Args:

- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_predict_batch_begin`
`\(batch, logs = NULL)`

Called at the beginning of a batch in `predict()` methods.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile()` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Currently no data is passed to this argument for this method but that may change in the future.

`on_predict_batch_end`
`\(batch, logs = NULL)`

Called at the end of a batch in `predict()` methods.

Subclasses should override for any actions to run.

Note that if the `steps_per_execution` argument to `compile` in `Model` is set to `N`, this method will only be called every `N` batches.

Args:

- `batch`: Integer, index of batch within the current epoch.
- `logs`: Named list. Aggregated metric results up until this batch.

`...`, `public` Additional methods or public members of the custom class.

`private`	Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.
`inherit`	What the custom class will subclass. By default, the base keras class.
`parent_env`	The R environment that all class methods will have as a grandparent.

Value

A function that returns the custom `Callback` instances, similar to the builtin callback functions.

Examples

```
training_finished <- FALSE
callback_mark_finished <- Callback("MarkFinished",
  on_train_end = function(logs = NULL) {
    training_finished <<- TRUE
  }
)

model <- keras_model_sequential(input_shape = c(1)) |>
  layer_dense(1)
model |> compile(loss = 'mean_squared_error')
model |> fit(op_ones(c(1, 1)), op_ones(c(1, 1)),
             callbacks = callback_mark_finished())
stopifnot(isTRUE(training_finished))
```

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: the `Layer` instance.
- `super`: the `Layer` superclass.
- `private`: An R environment specific to the class instance. Any objects defined here will be invisible to the Keras framework.
- `__class__` the current class type object. This will also be available as an alias symbol, the value supplied to `Layer(classname = )`

Attributes (accessible via `self$`)

- `params`: Named list, Training parameters (e.g. verbosity, batch size, number of epochs, ...).
- `model`: Instance of `Model`. Reference of the model being trained.

The `logs` named list that callback methods take as argument will contain keys for quantities relevant to the current batch or epoch (see method-specific docstrings).

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.

- super: The custom class superclass.
- private: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- __class__ and as.symbol(classname): the custom class type object.

See Also

- https://keras.io/api/callbacks/base_callback#callback-class

Other callbacks:
callback_backup_and_restore()
callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()
callback_terminate_on_nan()

---

callback_backup_and_restore

Callback to back up and restore the training state.

Description

callback_backup_and_restore() callback is intended to recover training from an interruption that has happened in the middle of a fit execution, by backing up the training states in a temporary checkpoint file, at the end of each epoch. Each backup overwrites the previously written checkpoint file, so at any given time there is at most one such checkpoint file for backup/restoring purpose.

If training restarts before completion, the training state (which includes the model weights and epoch number) is restored to the most recently saved state at the beginning of a new fit run. At the completion of a fit run, the temporary checkpoint file is deleted.

Note that the user is responsible to bring jobs back after the interruption. This callback is important for the backup and restore mechanism for fault tolerance purpose, and the model to be restored from a previous checkpoint is expected to be the same as the one used to back up. If user changes arguments passed to compile or fit, the checkpoint saved for fault tolerance can become invalid.

Usage

```
callback_backup_and_restore(
  backup_dir,
  save_freq = "epoch",
  double_checkpoint = FALSE,
```

```
  delete_checkpoint = TRUE
)
```

Arguments

- `backup_dir` String, path of directory where to store the data needed to restore the model. The directory cannot be reused elsewhere to store other files, e.g. by the `backup_and_restore` callback of another training run, or by another callback (e.g. `callback_model_checkpoint`) of the same training run.
- `save_freq` `"epoch"`, integer, or `FALSE`. When set to `"epoch"`, the callback saves the checkpoint at the end of each epoch. When set to an integer, the callback saves the checkpoint every `save_freq` batches. Set `save_freq = FALSE` only if using preemption checkpointing (i.e. with `save_before_preemption = TRUE`).
- `double_checkpoint` Boolean. If enabled, `BackupAndRestore` callback will save 2 last training states (current and previous). After interruption if current state can't be loaded due to IO error (e.g. file corrupted) it will try to restore previous one. Such behaviour will consume twice more space on disk, but increase fault tolerance. Defaults to `FALSE`.
- `delete_checkpoint` Boolean. This `backup_and_restore` callback works by saving a checkpoint to back up the training state. If `delete_checkpoint = TRUE`, the checkpoint will be deleted after training is finished. Use `FALSE` if you'd like to keep the checkpoint for future usage. Defaults to `TRUE`.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
callback_interrupting <- new_callback_class(
  "InterruptingCallback",
  on_epoch_begin = function(epoch, logs = NULL) {
    if (epoch == 4) {
      stop('Interrupting!')
    }
  }
)

backup_dir <- tempfile()
callback <- callback_backup_and_restore(backup_dir = backup_dir)
model <- keras_model_sequential() %>%
  layer_dense(10)
model %>% compile(optimizer = optimizer_sgd(), loss = 'mse')

# ensure model is built (i.e., weights are initialized) for
# callback_backup_and_restore()
model(op_ones(c(5, 20))) |> invisible()
```

```
tryCatch({
  model %>% fit(x = op_ones(c(5, 20)),
                y = op_zeros(5),
                epochs = 10, batch_size = 1,
                callbacks = list(callback, callback_interrupting()),
                verbose = 0)
}, python.builtin.RuntimeError = function(e) message("Interrupted!"))

## Interrupted!

model$history$epoch

## [1] 0 1 2


# model$history %>% keras3:::to_keras_training_history() %>% as.data.frame() %>% print()

history <- model %>% fit(x = op_ones(c(5, 20)),
                         y = op_zeros(5),
                         epochs = 10, batch_size = 1,
                         callbacks = list(callback),
                         verbose = 0)

# Only 6 more epochs are run, since first training got interrupted at
# zero-indexed epoch 4, second training will continue from 4 to 9.
nrow(as.data.frame(history))

## [1] 10
```

See Also

- https://keras.io/api/callbacks/backup_and_restore#backupandrestore-class

Other callbacks:
Callback()
callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()
callback_terminate_on_nan()

callback_csv_logger *Callback that streams epoch results to a CSV file.*

Description

Supports all values that can be represented as a string, including 1D iterables such as atomic vectors.

Usage

```
callback_csv_logger(filename, separator = ",", append = FALSE)
```

Arguments

`filename`	Filename of the CSV file, e.g. `'run/log.csv'`.
`separator`	String used to separate elements in the CSV file.
`append`	Boolean. `TRUE`: append if file exists (useful for continuing training). `FALSE`: overwrite existing file.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
csv_logger <- callback_csv_logger('training.log')
model %>% fit(X_train, Y_train, callbacks = list(csv_logger))
```

See Also

- https://keras.io/api/callbacks/csv_logger#csvlogger-class

Other callbacks:
`Callback()`
`callback_backup_and_restore()`
`callback_early_stopping()`
`callback_lambda()`
`callback_learning_rate_scheduler()`
`callback_model_checkpoint()`
`callback_reduce_lr_on_plateau()`
`callback_remote_monitor()`
`callback_swap_ema_weights()`
`callback_tensorboard()`
`callback_terminate_on_nan()`

callback_early_stopping
Stop training when a monitored metric has stopped improving.

Description

Assuming the goal of a training is to minimize the loss. With this, the metric to be monitored would be 'loss', and mode would be 'min'. A model$fit() training loop will check at end of every epoch whether the loss is no longer decreasing, considering the min_delta and patience if applicable. Once it's found no longer decreasing, model$stop_training is marked TRUE and the training terminates.

The quantity to be monitored needs to be available in logs list. To make it so, pass the loss or metrics at model$compile().

Usage

```
callback_early_stopping(
  monitor = "val_loss",
  min_delta = 0L,
  patience = 0L,
  verbose = 0L,
  mode = "auto",
  baseline = NULL,
  restore_best_weights = FALSE,
  start_from_epoch = 0L
)
```

Arguments

monitor	Quantity to be monitored. Defaults to "val_loss".
min_delta	Minimum change in the monitored quantity to qualify as an improvement, i.e. an absolute change of less than min_delta, will count as no improvement. Defaults to 0.
patience	Number of epochs with no improvement after which training will be stopped. Defaults to 0.
verbose	Verbosity mode, 0 or 1. Mode 0 is silent, and mode 1 displays messages when the callback takes an action. Defaults to 0.
mode	One of {"auto", "min", "max"}. In min mode, training will stop when the quantity monitored has stopped decreasing; in "max" mode it will stop when the quantity monitored has stopped increasing; in "auto" mode, the direction is automatically inferred from the name of the monitored quantity. Defaults to "auto".
baseline	Baseline value for the monitored quantity. If not NULL, training will stop if the model doesn't show improvement over the baseline. Defaults to NULL.

restore_best_weights
: Whether to restore model weights from the epoch with the best value of the monitored quantity. If `FALSE`, the model weights obtained at the last step of training are used. An epoch will be restored regardless of the performance relative to the `baseline`. If no epoch improves on `baseline`, training will run for `patience` epochs and restore weights from the best epoch in that set. Defaults to `FALSE`.

start_from_epoch
: Number of epochs to wait before starting to monitor improvement. This allows for a warm-up period in which no improvement is expected and thus training will not be stopped. Defaults to `0`.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
callback <- callback_early_stopping(monitor = 'loss',
                                   patience = 3)
# This callback will stop the training when there is no improvement in
# the loss for three consecutive epochs.
model <- keras_model_sequential() %>%
  layer_dense(10)
model %>% compile(optimizer = optimizer_sgd(), loss = 'mse')
history <- model %>% fit(x = op_ones(c(5, 20)),
                         y = op_zeros(5),
                         epochs = 10, batch_size = 1,
                         callbacks = list(callback),
                         verbose = 0)
nrow(as.data.frame(history))  # Only 4 epochs are run.
```

```
## [1] 10
```

See Also

- https://keras.io/api/callbacks/early_stopping#earlystopping-class

Other callbacks:
`Callback()`
`callback_backup_and_restore()`
`callback_csv_logger()`
`callback_lambda()`
`callback_learning_rate_scheduler()`
`callback_model_checkpoint()`
`callback_reduce_lr_on_plateau()`
`callback_remote_monitor()`
`callback_swap_ema_weights()`
`callback_tensorboard()`

callback_terminate_on_nan()

---

callback_lambda *Callback for creating simple, custom callbacks on-the-fly.*

Description

This callback is constructed with anonymous functions that will be called at the appropriate time (during `Model.{fit | evaluate | predict}`). Note that the callbacks expects positional arguments, as:

- `on_epoch_begin` and `on_epoch_end` expect two positional arguments: `epoch`, `logs`
- `on_train_begin` and `on_train_end` expect one positional argument: `logs`
- `on_train_batch_begin` and `on_train_batch_end` expect two positional arguments: `batch`, `logs`
- See `Callback` class definition for the full list of functions and their expected arguments.

Usage

```
callback_lambda(
  on_epoch_begin = NULL,
  on_epoch_end = NULL,
  on_train_begin = NULL,
  on_train_end = NULL,
  on_train_batch_begin = NULL,
  on_train_batch_end = NULL,
  ...
)
```

Arguments

`on_epoch_begin`	called at the beginning of every epoch.
`on_epoch_end`	called at the end of every epoch.
`on_train_begin`	called at the beginning of model training.
`on_train_end`	called at the end of model training.
`on_train_batch_begin`	called at the beginning of every train batch.
`on_train_batch_end`	called at the end of every train batch.
`...`	Any function in `Callback()` that you want to override by passing `function_name = function`. For example, `callback_lambda(.., on_train_end = train_end_fn)`. The custom function needs to have same arguments as the ones defined in `Callback()`.

Value

A Callback instance that can be passed to fit.keras.src.models.model.Model().

Examples

```
# Print the batch number at the beginning of every batch.
batch_print_callback <- callback_lambda(
  on_train_batch_begin = function(batch, logs) {
    print(batch)
  }
)

# Stream the epoch loss to a file in new-line delimited JSON format
# (one valid JSON object per line)
json_log <- file('loss_log.json', open = 'wt')
json_logging_callback <- callback_lambda(
  on_epoch_end = function(epoch, logs) {
    jsonlite::write_json(
      list(epoch = epoch, loss = logs$loss),
      json_log,
      append = TRUE
    )
  },
  on_train_end = function(logs) {
    close(json_log)
  }
)

# Terminate some processes after having finished model training.
processes <- ...
cleanup_callback <- callback_lambda(
  on_train_end = function(logs) {
    for (p in processes) {
      if (is_alive(p)) {
        terminate(p)
      }
    }
  }
)

model %>% fit(
  ...,
  callbacks = list(
    batch_print_callback,
    json_logging_callback,
    cleanup_callback
  )
)
```

See Also

- https://keras.io/api/callbacks/lambda_callback#lambdacallback-class

Other callbacks:
Callback()
callback_backup_and_restore()
callback_csv_logger()
callback_early_stopping()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()
callback_terminate_on_nan()

---

callback_learning_rate_scheduler

Learning rate scheduler.

Description

At the beginning of every epoch, this callback gets the updated learning rate value from `schedule` function provided, with the current epoch and current learning rate, and applies the updated learning rate on the optimizer.

Usage

```
callback_learning_rate_scheduler(schedule, verbose = 0L)
```

Arguments

`schedule`	A function that takes an epoch index (integer, indexed from 0) and current learning rate (float) as inputs and returns a new learning rate as output (float).
`verbose`	Integer. 0: quiet, 1: log update messages.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
# This function keeps the initial learning rate steady for the first ten epochs
# and decreases it exponentially after that.
scheduler <- function(epoch, lr) {
  if (epoch < 10)
```

```
    return(lr)
  else
    return(lr * exp(-0.1))
}

model <- keras_model_sequential() |> layer_dense(units = 10)
model |> compile(optimizer = optimizer_sgd(), loss = 'mse')
model$optimizer$learning_rate |> as.array() |> round(5)
```

```
## [1] 0.01
```

```
callback <- callback_learning_rate_scheduler(schedule = scheduler)
history <- model |> fit(x = array(runif(100), c(5, 20)),
                        y = array(0, c(5, 1)),
                        epochs = 15, callbacks = list(callback), verbose = 0)
model$optimizer$learning_rate |> as.array() |> round(5)
```

```
## [1] 0.00607
```

See Also

- https://keras.io/api/callbacks/learning_rate_scheduler#learningratescheduler-class

Other callbacks:
`Callback()`
`callback_backup_and_restore()`
`callback_csv_logger()`
`callback_early_stopping()`
`callback_lambda()`
`callback_model_checkpoint()`
`callback_reduce_lr_on_plateau()`
`callback_remote_monitor()`
`callback_swap_ema_weights()`
`callback_tensorboard()`
`callback_terminate_on_nan()`

`callback_model_checkpoint` *Callback to save the Keras model or model weights at some frequency.*

Description

`callback_model_checkpoint()` is used in conjunction with training using `model |> fit()` to save a model or weights (in a checkpoint file) at some interval, so the model or weights can be loaded later to continue the training from the state saved.

A few options this callback provides include:

- Whether to only keep the model that has achieved the "best performance" so far, or whether to save the model at the end of every epoch regardless of performance.
- Definition of "best"; which quantity to monitor and whether it should be maximized or minimized.
- The frequency it should save at. Currently, the callback supports saving at the end of every epoch, or after a fixed number of training batches.
- Whether only weights are saved, or the whole model is saved.

Usage

```
callback_model_checkpoint(
  filepath,
  monitor = "val_loss",
  verbose = 0L,
  save_best_only = FALSE,
  save_weights_only = FALSE,
  mode = "auto",
  save_freq = "epoch",
  initial_value_threshold = NULL
)
```

Arguments

`filepath` string, path to save the model file. `filepath` can contain named formatting options, which will be filled the value of `epoch` and keys in `logs` (passed in `on_epoch_end`). The `filepath` name needs to end with `".weights.h5"` when `save_weights_only = TRUE` or should end with `".keras"` or `".h5"` when checkpoint saving the whole model (default). For example: if `filepath` is `"{epoch:02d}-{val_loss:.2f}.ke` or `"{epoch:02d}-{val_loss:.2f}.weights.h5"`, then the model checkpoints will be saved with the epoch number and the validation loss in the filename. The directory of the filepath should not be reused by any other callbacks to avoid conflicts.

`monitor` The metric name to monitor. Typically the metrics are set by the `model |> compile()` method. Note:

- Prefix the name with `"val_"` to monitor validation metrics.
- Use `"loss"` or `"val_loss"` to monitor the model's total loss.
- If you specify metrics as strings, like `"accuracy"`, pass the same string (with or without the `"val_"` prefix).
- If you pass `Metric` objects (created by one of `metric_*()`), `monitor` should be set to `metric$name`.

- If you're not sure about the metric names you can check the contents of the `history$metrics` list returned by `history <- model |> fit()`
- Multi-output models set additional prefixes on the metric names.

`verbose` Verbosity mode, 0 or 1. Mode 0 is silent, and mode 1 displays messages when the callback takes an action.

`save_best_only` if `save_best_only = TRUE`, it only saves when the model is considered the "best" and the latest best model according to the quantity monitored will not be overwritten. If `filepath` doesn't contain formatting options like `{epoch}` then `filepath` will be overwritten by each new better model.

`save_weights_only` if TRUE, then only the model's weights will be saved (`model |> save_model_weights(filepath)`), else the full model is saved (`model |> save_model(filepath)`).

`mode` one of `{"auto", "min", "max"}`. If `save_best_only = TRUE`, the decision to overwrite the current save file is made based on either the maximization or the minimization of the monitored quantity. For `val_acc`, this should be `"max"`, for `val_loss` this should be `"min"`, etc. In `"auto"` mode, the mode is set to `"max"` if the quantities monitored are `"acc"` or start with `"fmeasure"` and are set to `"min"` for the rest of the quantities.

`save_freq` `"epoch"` or integer. When using `"epoch"`, the callback saves the model after each epoch. When using integer, the callback saves the model at end of this many batches. If the `Model` is compiled with `steps_per_execution = N`, then the saving criteria will be checked every Nth batch. Note that if the saving isn't aligned to epochs, the monitored metric may potentially be less reliable (it could reflect as little as 1 batch, since the metrics get reset every epoch). Defaults to `"epoch"`.

`initial_value_threshold` Floating point initial "best" value of the metric to be monitored. Only applies if `save_best_value = TRUE`. Only overwrites the model weights already saved if the performance of current model is better than this value.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
model <- keras_model_sequential(input_shape = c(10)) |>
  layer_dense(1, activation = "sigmoid") |>
  compile(loss = "binary_crossentropy", optimizer = "adam",
          metrics = c('accuracy'))

EPOCHS <- 10
checkpoint_filepath <- tempfile('checkpoint-model-', fileext = ".keras")
model_checkpoint_callback <- callback_model_checkpoint(
  filepath = checkpoint_filepath,
  monitor = 'val_accuracy',
  mode = 'max',
```

```
  save_best_only = TRUE
)

# Model is saved at the end of every epoch, if it's the best seen so far.
model |> fit(x = random_uniform(c(2, 10)), y = op_ones(2, 1),
             epochs = EPOCHS, validation_split = .5, verbose = 0,
             callbacks = list(model_checkpoint_callback))

# The model (that are considered the best) can be loaded as -
load_model(checkpoint_filepath)

## Model: "sequential"
## +---------------------------------+------------------------+---------------+
## | Layer (type)                    | Output Shape           |       Param # |
## +=================================+========================+===============+
## | dense (Dense)                   | (None, 1)              |            11 |
## +---------------------------------+------------------------+---------------+
##  Total params: 35 (144.00 B)
##  Trainable params: 11 (44.00 B)
##  Non-trainable params: 0 (0.00 B)
##  Optimizer params: 24 (100.00 B)


# Alternatively, one could checkpoint just the model weights as -
checkpoint_filepath <- tempfile('checkpoint-', fileext = ".weights.h5")
model_checkpoint_callback <- callback_model_checkpoint(
  filepath = checkpoint_filepath,
  save_weights_only = TRUE,
  monitor = 'val_accuracy',
  mode = 'max',
  save_best_only = TRUE
)

# Model weights are saved at the end of every epoch, if it's the best seen
# so far.
# same as above
model |> fit(x = random_uniform(c(2, 10)), y = op_ones(2, 1),
             epochs = EPOCHS, validation_split = .5, verbose = 0,
             callbacks = list(model_checkpoint_callback))

# The model weights (that are considered the best) can be loaded
model |> load_model_weights(checkpoint_filepath)
```

See Also

- https://keras.io/api/callbacks/model_checkpoint#modelcheckpoint-class

Other callbacks:
`Callback()`

callback_backup_and_restore()
callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()
callback_terminate_on_nan()

---

callback_reduce_lr_on_plateau

Reduce learning rate when a metric has stopped improving.

Description

Models often benefit from reducing the learning rate by a factor of 2-10 once learning stagnates. This callback monitors a quantity and if no improvement is seen for a 'patience' number of epochs, the learning rate is reduced.

Usage

```
callback_reduce_lr_on_plateau(
  monitor = "val_loss",
  factor = 0.1,
  patience = 10L,
  verbose = 0L,
  mode = "auto",
  min_delta = 1e-04,
  cooldown = 0L,
  min_lr = 0,
  ...
)
```

Arguments

monitor	String. Quantity to be monitored.
factor	Float. Factor by which the learning rate will be reduced. `new_lr = lr * factor`.
patience	Integer. Number of epochs with no improvement after which learning rate will be reduced.
verbose	Integer. 0: quiet, 1: update messages.
mode	String. One of `{'auto', 'min', 'max'}`. In `'min'` mode, the learning rate will be reduced when the quantity monitored has stopped decreasing; in `'max'` mode it will be reduced when the quantity monitored has stopped increasing;

	in 'auto' mode, the direction is automatically inferred from the name of the monitored quantity.
min_delta	Float. Threshold for measuring the new optimum, to only focus on significant changes.
cooldown	Integer. Number of epochs to wait before resuming normal operation after the learning rate has been reduced.
min_lr	Float. Lower bound on the learning rate.
...	For forward/backward compatability.

Value

A Callback instance that can be passed to fit.keras.src.models.model.Model().

Examples

```
reduce_lr <- callback_reduce_lr_on_plateau(monitor = 'val_loss', factor = 0.2,
                                           patience = 5, min_lr = 0.001)
model %>% fit(x_train, y_train, callbacks = list(reduce_lr))
```

See Also

- https://keras.io/api/callbacks/reduce_lr_on_plateau#reducelronplateau-class

Other callbacks:
Callback()
callback_backup_and_restore()
callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()
callback_terminate_on_nan()

---

callback_remote_monitor

Callback used to stream events to a server.

Description

Requires the requests library. Events are sent to root + '/publish/epoch/end/' by default. Calls are HTTP POST, with a data argument which is a JSON-encoded named list of event data. If send_as_json = TRUE, the content type of the request will be "application/json". Otherwise the serialized JSON will be sent within a form.

Usage

```
callback_remote_monitor(
  root = "http://localhost:9000",
  path = "/publish/epoch/end/",
  field = "data",
  headers = NULL,
  send_as_json = FALSE
)
```

Arguments

`root`	String; root url of the target server.
`path`	String; path relative to `root` to which the events will be sent.
`field`	String; JSON field under which the data will be stored. The field is used only if the payload is sent within a form (i.e. when `send_as_json = FALSE`).
`headers`	Named list; optional custom HTTP headers.
`send_as_json`	Boolean; whether the request should be sent as `"application/json"`.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

See Also

- https://keras.io/api/callbacks/remote_monitor#remotemonitor-class

Other callbacks:
`Callback()`
`callback_backup_and_restore()`
`callback_csv_logger()`
`callback_early_stopping()`
`callback_lambda()`
`callback_learning_rate_scheduler()`
`callback_model_checkpoint()`
`callback_reduce_lr_on_plateau()`
`callback_swap_ema_weights()`
`callback_tensorboard()`
`callback_terminate_on_nan()`

`callback_swap_ema_weights` *Swaps model weights and EMA weights before and after evaluation.*

Description

This callbacks replaces the model's weight values with the values of the optimizer's EMA weights (the exponential moving average of the past model weights values, implementing "Polyak averaging") before model evaluation, and restores the previous weights after evaluation.

The `SwapEMAWeights` callback is to be used in conjunction with an optimizer that sets `use_ema = TRUE`.

Note that the weights are swapped in-place in order to save memory. The behavior is undefined if you modify the EMA weights or model weights in other callbacks.

Usage

```
callback_swap_ema_weights(swap_on_epoch = FALSE)
```

Arguments

`swap_on_epoch`	Whether to perform swapping at `on_epoch_begin()` and `on_epoch_end()`. This is useful if you want to use EMA weights for other callbacks such as `callback_model_checkpoint()`. Defaults to `FALSE`.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
# Remember to set `use_ema=TRUE` in the optimizer
optimizer <- optimizer_sgd(use_ema = TRUE)
model |> compile(optimizer = optimizer, loss = ..., metrics = ...)

# Metrics will be computed with EMA weights
model |> fit(X_train, Y_train,
             callbacks = c(callback_swap_ema_weights()))

# If you want to save model checkpoint with EMA weights, you can set
# `swap_on_epoch=TRUE` and place ModelCheckpoint after SwapEMAWeights.
model |> fit(
  X_train, Y_train,
  callbacks = c(
    callback_swap_ema_weights(swap_on_epoch = TRUE),
    callback_model_checkpoint(...)
  )
)
```

See Also

Other callbacks:
`Callback()`
`callback_backup_and_restore()`

callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_tensorboard()
callback_terminate_on_nan()

---

callback_tensorboard *Enable visualizations for TensorBoard.*

Description

TensorBoard is a visualization tool provided with TensorFlow. A TensorFlow installation is required to use this callback.

This callback logs events for TensorBoard, including:

- Metrics summary plots
- Training graph visualization
- Weight histograms
- Sampled profiling

When used in `model |> evaluate()` or regular validation in addition to epoch summaries, there will be a summary that records evaluation metrics vs `model$optimizer$iterations` written. The metric names will be prepended with `evaluation`, with `model$optimizer$iterations` being the step in the visualized TensorBoard.

If you have installed TensorFlow with `pip` or `reticulate::py_install()`, you should be able to launch TensorBoard from the command line:

```
tensorboard --logdir=path_to_your_logs
```

or from R with `tensorflow::tensorboard()`.

You can find more information about TensorBoard here.

Usage

```
callback_tensorboard(
  log_dir = "logs",
  histogram_freq = 0L,
  write_graph = TRUE,
  write_images = FALSE,
  write_steps_per_second = FALSE,
  update_freq = "epoch",
```

```
  profile_batch = 0L,
  embeddings_freq = 0L,
  embeddings_metadata = NULL
)
```

Arguments

`log_dir` the path of the directory where to save the log files to be parsed by TensorBoard. e.g., `log_dir = file.path(working_dir, 'logs')`. This directory should not be reused by any other callbacks.

`histogram_freq` frequency (in epochs) at which to compute weight histograms for the layers of the model. If set to 0, histograms won't be computed. Validation data (or split) must be specified for histogram visualizations.

`write_graph` (Not supported at this time) Whether to visualize the graph in TensorBoard. Note that the log file can become quite large when `write_graph` is set to `TRUE`.

`write_images` whether to write model weights to visualize as image in TensorBoard.

`write_steps_per_second`
whether to log the training steps per second into TensorBoard. This supports both epoch and batch frequency logging.

`update_freq` `"batch"` or `"epoch"` or integer. When using `"epoch"`, writes the losses and metrics to TensorBoard after every epoch. If using an integer, let's say `1000`, all metrics and losses (including custom ones added by `Model.compile`) will be logged to TensorBoard every 1000 batches. `"batch"` is a synonym for 1, meaning that they will be written every batch. Note however that writing too frequently to TensorBoard can slow down your training, especially when used with distribution strategies as it will incur additional synchronization overhead. Batch-level summary writing is also available via `train_step` override. Please see TensorBoard Scalars tutorial for more details.

`profile_batch` Profile the batch(es) to sample compute characteristics. profile_batch must be a non-negative integer or a tuple of integers. A pair of positive integers signify a range of batches to profile. By default, profiling is disabled.

`embeddings_freq`
frequency (in epochs) at which embedding layers will be visualized. If set to `0`, embeddings won't be visualized.

`embeddings_metadata`
Named list which maps embedding layer names to the filename of a file in which to save metadata for the embedding layer. In case the same metadata file is to be used for all embedding layers, a single filename can be passed.

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

Examples

```
tensorboard_callback <- callback_tensorboard(log_dir = "./logs")
model %>% fit(x_train, y_train, epochs = 2, callbacks = list(tensorboard_callback))
```

```
# Then run the tensorboard command to view the visualizations.
```

Custom batch-level summaries in a subclassed Model:

```
MyModel <- new_model_class("MyModel",
  initialize = function() {
    self$dense <- layer_dense(units = 10)
  },
  call = function(x) {
    outputs <- x |> self$dense()
    tf$summary$histogram('outputs', outputs)
    outputs
  }
)

model <- MyModel()
model |> compile(optimizer = 'sgd', loss = 'mse')

# Make sure to set `update_freq = N` to log a batch-level summary every N
# batches. In addition to any `tf$summary` contained in `model$call()`,
# metrics added in `model |>compile` will be logged every N batches.
tb_callback <- callback_tensorboard(log_dir = './logs', update_freq = 1)
model |> fit(x_train, y_train, callbacks = list(tb_callback))
```

Custom batch-level summaries in a Functional API Model:

```
my_summary <- function(x) {
  tf$summary$histogram('x', x)
  x
}

inputs <- layer_input(10)
outputs <- inputs |>
  layer_dense(10) |>
  layer_lambda(my_summary)

model <- keras_model(inputs, outputs)
model |> compile(optimizer = 'sgd', loss = 'mse')

# Make sure to set `update_freq = N` to log a batch-level summary every N
# batches. In addition to any `tf.summary` contained in `Model.call`,
# metrics added in `Model.compile` will be logged every N batches.
tb_callback <- callback_tensorboard(log_dir = './logs', update_freq = 1)
model |> fit(x_train, y_train, callbacks = list(tb_callback))
```

Profiling:

```
# Profile a single batch, e.g. the 5th batch.
tensorboard_callback <- callback_tensorboard(
```

```
  log_dir = './logs', profile_batch = 5)
model |> fit(x_train, y_train, epochs = 2,
             callbacks = list(tensorboard_callback))

# Profile a range of batches, e.g. from 10 to 20.
tensorboard_callback <- callback_tensorboard(
  log_dir = './logs', profile_batch = c(10, 20))
model |> fit(x_train, y_train, epochs = 2,
             callbacks = list(tensorboard_callback))
```

See Also

- https://keras.io/api/callbacks/tensorboard#tensorboard-class

Other callbacks:
`Callback()`
`callback_backup_and_restore()`
`callback_csv_logger()`
`callback_early_stopping()`
`callback_lambda()`
`callback_learning_rate_scheduler()`
`callback_model_checkpoint()`
`callback_reduce_lr_on_plateau()`
`callback_remote_monitor()`
`callback_swap_ema_weights()`
`callback_terminate_on_nan()`

`callback_terminate_on_nan` *Callback that terminates training when a NaN loss is encountered.*

Description

Callback that terminates training when a NaN loss is encountered.

Usage

```
callback_terminate_on_nan()
```

Value

A `Callback` instance that can be passed to `fit.keras.src.models.model.Model()`.

See Also

- https://keras.io/api/callbacks/terminate_on_nan#terminateonnan-class

Other callbacks:
Callback()
callback_backup_and_restore()
callback_csv_logger()
callback_early_stopping()
callback_lambda()
callback_learning_rate_scheduler()
callback_model_checkpoint()
callback_reduce_lr_on_plateau()
callback_remote_monitor()
callback_swap_ema_weights()
callback_tensorboard()

---

clear_session — *Resets all state generated by Keras.*

Description

Keras manages a global state, which it uses to implement the Functional model-building API and to uniquify autogenerated layer names.

If you are creating many models in a loop, this global state will consume an increasing amount of memory over time, and you may want to clear it. Calling `clear_session()` releases the global state: this helps avoid clutter from old models and layers, especially when memory is limited.

Example 1: calling `clear_session()` when creating models in a loop

```
for (i in 1:100) {
  # Without `clear_session()`, each iteration of this loop will
  # slightly increase the size of the global state managed by Keras
  model <- keras_model_sequential()
  for (j in 1:10) {
    model <- model |> layer_dense(units = 10)
  }
}

for (i in 1:100) {
  # With `clear_session()` called at the beginning,
  # Keras starts with a blank state at each iteration
  # and memory consumption is constant over time.
  clear_session()
  model <- keras_model_sequential()
  for (j in 1:10) {
    model <- model |> layer_dense(units = 10)
```

```
  }
}
```

Example 2: resetting the layer name generation counter

```
layers <- lapply(1:10, \(i) layer_dense(units = 10))

new_layer <- layer_dense(units = 10)
print(new_layer$name)

## [1] "dense_10"


clear_session()
new_layer <- layer_dense(units = 10)
print(new_layer$name)

## [1] "dense"
```

Usage

```
clear_session(free_memory = TRUE)
```

Arguments

`free_memory`	Whether to call Python garbage collection. It's usually a good practice to call it to make sure memory used by deleted objects is immediately freed. However, it may take a few seconds to execute, so when using `clear_session()` in a short loop, you may want to skip it.

Value

`NULL`, invisibly, called for side effects.

See Also

- https://keras.io/api/utils/config_utils#clearsession-function

Other backend:
`config_backend()`
`config_epsilon()`
`config_floatx()`
`config_image_data_format()`
`config_set_epsilon()`
`config_set_floatx()`
`config_set_image_data_format()`

Other utils:
`audio_dataset_from_directory()`

config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

clone_model *Clone a Functional or Sequential* `Model` *instance.*

Description

Model cloning is similar to calling a model on new inputs, except that it creates new layers (and thus new weights) instead of sharing the weights of the existing layers.

Note that `clone_model()` will not preserve the uniqueness of shared objects within the model (e.g. a single variable attached to two distinct layers will be restored as two separate variables).

Usage

```
clone_model(
  model,
  input_tensors = NULL,
  clone_function = NULL,
  call_function = NULL,
  recursive = FALSE,
  ...
)
```

Arguments

`model` Instance of `Model` (could be a Functional model or a Sequential model).

`input_tensors` Optional list of input tensors to build the model upon. If not provided, new `keras_input()` objects will be created.

`clone_function` Callable with signature `function(layer)` to be used to clone each layer in the target model (except `Input` instances). It takes as argument the layer instance to be cloned, and returns the corresponding layer instance to be used in the model copy. If unspecified, this callable defaults to the following serialization/deserialization function: ``function(layer) layer$`__class__`$from_config(layer$get_confi`` By passing a custom callable, you can customize your copy of the model, e.g. by wrapping certain layers of interest (you might want to replace all `LSTM` instances with equivalent `Bidirectional(LSTM(...))` instances, for example). Defaults to `NULL`.

`call_function` Callable with signature `function(layer, ...)` to be used to call each cloned layer and a set of inputs. It takes the layer instance, and the call arguments, and returns the call outputs. If unspecified, this callable defaults to the regular `call()` method: `function(layer, ...) do.call(layer, list(...))`. By passing a custom callable, you can insert new layers before or after a given layer.

`recursive` Note, This argument can only be used with Functional models. Boolean. Whether to recursively clone any Sequential or Functional models encountered in the original Sequential/Functional model. If `FALSE`, then inner models are cloned by calling `clone_function()`. If `TRUE`, then inner models are cloned by calling `clone_model()` with the same `clone_function`, `call_function`, and `recursive` arguments. Note that in this case, `call_function` will not be propagated to any Sequential model (since it is not applicable to Sequential models).

`...` For forward/backward compatability.

Value

An instance of `Model` reproducing the behavior of the original model, on top of new inputs tensors, using newly instantiated weights. The cloned model may behave differently from the original model if a custom `clone_function` or `call_function` modifies a layer or layer call.

Examples

```
# Create a test Sequential model.
model <- keras_model_sequential(input_shape = c(728)) |>
  layer_dense(32, activation = 'relu') |>
  layer_dense(1, activation = 'sigmoid')

# Create a copy of the test model (with freshly initialized weights).
new_model <- clone_model(model)
```

Using a `clone_function` to make a model deterministic by setting the random seed everywhere:

```
clone_function <- function(layer) {
```

```
  config <- layer$get_config()
  if ("seed" %in% names(config))
    config$seed <- 1337L
  layer$`__class__`$from_config(config)
}

new_model <- clone_model(model, clone_function = clone_function)
```

Using a call_function to add a Dropout layer after each Dense layer (without recreating new layers):

```
call_function <- function(layer, ...) {
  out <- layer(...)
  if (inherits(layer, keras$layers$Dense))
    out <- out |> layer_dropout(0.5)
  out
}

inputs <- keras_input(c(728))
outputs <- inputs |>
  layer_dense(32, activation = 'relu') |>
  layer_dense(1, activation = 'sigmoid')
model <- keras_model(inputs, outputs)

new_model <- clone_model(
  model,
  clone_function = function(x) x, # Reuse the same layers.
  call_function = call_function,
)
new_model

## Model: "functional_4"
## +-----------------------------------+--------------------------+---------------+
## | Layer (type)                      | Output Shape             |       Param # |
## +===================================+==========================+===============+
## | keras_tensor_8 (InputLayer)       | (None, 728)              |             0 |
## +-----------------------------------+--------------------------+---------------+
## | dense_2 (Dense)                   | (None, 32)               |        23,328 |
## +-----------------------------------+--------------------------+---------------+
## | dropout (Dropout)                 | (None, 32)               |             0 |
## +-----------------------------------+--------------------------+---------------+
## | dense_3 (Dense)                   | (None, 1)                |            33 |
## +-----------------------------------+--------------------------+---------------+
## | dropout_1 (Dropout)               | (None, 1)                |             0 |
## +-----------------------------------+--------------------------+---------------+
##  Total params: 23,361 (91.25 KB)
##  Trainable params: 23,361 (91.25 KB)
##  Non-trainable params: 0 (0.00 B)
```

Note that subclassed models cannot be cloned by default, since their internal layer structure is not known. To achieve equivalent functionality as `clone_model` in the case of a subclassed model, simply make sure that the model class implements `get_config()` (and optionally `from_config()`), and call:

```
new_model <- model$`__class__`$from_config(model$get_config())
```

In the case of a subclassed model, you cannot using a custom `clone_function`.

`compile.keras.src.models.model.Model`
Configure a model for training.

Description

Configure a model for training.

Usage

```
## S3 method for class 'keras.src.models.model.Model'
compile(
  object,
  optimizer = "rmsprop",
  loss = NULL,
  metrics = NULL,
  ...,
  loss_weights = NULL,
  weighted_metrics = NULL,
  run_eagerly = FALSE,
  steps_per_execution = 1L,
  jit_compile = "auto",
  auto_scale_loss = TRUE
)
```

Arguments

`object` Keras model object

`optimizer` String (name of optimizer) or optimizer instance. See `optimizer_*` family.

`loss` Loss function. May be:

- a string (name of builtin loss function),
- a custom function, or
- a `Loss` instance (returned by the `loss_*` family of functions).

A loss function is any callable with the signature `loss = fn(y_true, y_pred)`, where `y_true` are the ground truth values, and `y_pred` are the model's predictions. `y_true` should have shape `(batch_size, d1, .. dN)` (except in the case of sparse loss functions such as sparse categorical crossentropy which expects integer arrays of shape `(batch_size, d1, .. dN-1)`). `y_pred` should have shape `(batch_size, d1, .. dN)`. The loss function should return a float tensor.

`metrics` List of metrics to be evaluated by the model during training and testing. Each of these can be:

- a string (name of a built-in function),
- a function, optionally with a `"name"` attribute or
- a `Metric()` instance. See the `metric_*` family of functions.

Typically you will use `metrics = c('accuracy')`. A function is any callable with the signature `result = fn(y_true, y_pred)`. To specify different metrics for different outputs of a multi-output model, you could also pass a named list, such as `metrics = list(a = 'accuracy', b = c('accuracy', 'mse'))`. You can also pass a list to specify a metric or a list of metrics for each output, such as `metrics = list(c('accuracy'), c('accuracy', 'mse'))` or `metrics = list('accuracy', c('accuracy', 'mse'))`. When you pass the strings `'accuracy'` or `'acc'`, we convert this to one of `metric_binary_accuracy()`, `metric_categorical_accuracy()`, `metric_sparse_categorical_accuracy()` based on the shapes of the targets and of the model output. A similar conversion is done for the strings `"crossentropy"` and `"ce"` as well. The metrics passed here are evaluated without sample weighting; if you would like sample weighting to apply, you can specify your metrics via the `weighted_metrics` argument instead.

If providing an anonymous R function, you can customize the printed name during training by assigning `attr(<fn>, "name") <- "my_custom_metric_name"`, or by calling `custom_metric("my_custom_metric_name", <fn>)`

`...` Additional arguments passed on to the `compile()` model method.

`loss_weights` Optional list (named or unnamed) specifying scalar coefficients (R numerics) to weight the loss contributions of different model outputs. The loss value that will be minimized by the model will then be the *weighted sum* of all individual losses, weighted by the `loss_weights` coefficients. If an unnamed list, it is expected to have a 1:1 mapping to the model's outputs. If a named list, it is expected to map output names (strings) to scalar coefficients.

`weighted_metrics`
List of metrics to be evaluated and weighted by `sample_weight` or `class_weight` during training and testing.

`run_eagerly` Bool. If `TRUE`, this model's forward pass will never be compiled. It is recommended to leave this as `FALSE` when training (for best performance), and to set it to `TRUE` when debugging.

`steps_per_execution`
Int. The number of batches to run during each a single compiled function call. Running multiple batches inside a single compiled function call can greatly improve performance on TPUs or small models with a large R/Python overhead. At most, one full epoch will be run each execution. If a number larger than the size

of the epoch is passed, the execution will be truncated to the size of the epoch. Note that if `steps_per_execution` is set to `N`, `Callback$on_batch_begin` and `Callback$on_batch_end` methods will only be called every `N` batches (i.e. before/after each compiled function execution). Not supported with the PyTorch backend.

`jit_compile` Bool or `"auto"`. Whether to use XLA compilation when compiling a model. For `jax` and `tensorflow` backends, `jit_compile="auto"` enables XLA compilation if the model supports it, and disabled otherwise. For `torch` backend, `"auto"` will default to eager execution and `jit_compile=True` will run with `torch.compile` with the `"inductor"` backend.

`auto_scale_loss` Bool. If `TRUE` and the model dtype policy is `"mixed_float16"`, the passed optimizer will be automatically wrapped in a `LossScaleOptimizer`, which will dynamically scale the loss to prevent underflow.

Value

This is called primarily for the side effect of modifying `object` in-place. The first argument `object` is also returned, invisibly, to enable usage with the pipe.

Examples

```
model |> compile(
  optimizer = optimizer_adam(learning_rate = 1e-3),
  loss = loss_binary_crossentropy(),
  metrics = c(metric_binary_accuracy(),
              metric_false_negatives())
)
```

See Also

- https://keras.io/api/models/model_training_apis#compile-method

Other model training:
`evaluate.keras.src.models.model.Model()`
`predict.keras.src.models.model.Model()`
`predict_on_batch()`
`test_on_batch()`
`train_on_batch()`

---

config_backend *Publicly accessible method for determining the current backend.*

Description

Publicly accessible method for determining the current backend.

Usage

```
config_backend()
```

Value

String, the name of the backend Keras is currently using. One of "tensorflow", "torch", or "jax".

Examples

```
config_backend()

## [1] "tensorflow"
```

See Also

use_backend()

Other config backend:
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other backend:
clear_session()
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other config:
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()

config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_disable_flash_attention
Disable flash attention.

Description

Flash attention offers performance optimization for attention layers, making it especially useful for large language models (LLMs) that benefit from faster and more memory-efficient attention computations.

Once disabled, supported layers like MultiHeadAttention will not use flash attention for faster computations.

Usage

```
config_disable_flash_attention()
```

See Also

config_is_flash_attention_enabled() config_enable_flash_attention()

Other config:
config_backend()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

config_disable_interactive_logging

Turn off interactive logging.

Description

When interactive logging is disabled, Keras sends logs to absl.logging. This is the best option when using Keras in a non-interactive way, such as running a training or inference job on a server.

Usage

```
config_disable_interactive_logging()
```

Value

No return value, called for side effects.

See Also

Other io utils:
config_enable_interactive_logging()
config_is_interactive_logging_enabled()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()

zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_disable_traceback_filtering

Turn off traceback filtering.

Description

Raw Keras tracebacks (also known as stack traces) involve many internal frames, which can be challenging to read through, while not being actionable for end users. By default, Keras filters internal frames in most exceptions that it raises, to keep traceback short, readable, and focused on what's actionable for you (your own code).

See also `config_enable_traceback_filtering()` and `config_is_traceback_filtering_enabled()`.

If you have previously disabled traceback filtering via `config_disable_traceback_filtering()`, you can re-enable it via `config_enable_traceback_filtering()`.

Usage

```
config_disable_traceback_filtering()
```

Value

No return value, called for side effects.

See Also

Other traceback utils:
config_enable_traceback_filtering()
config_is_traceback_filtering_enabled()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()

config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_dtype_policy *Returns the current default dtype policy object.*

Description

Returns the current default dtype policy object.

Usage

```
config_dtype_policy()
```

Value

A DTypePolicy object.

See Also

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

`config_enable_flash_attention` *Enable flash attention.*

Description

Flash attention offers performance optimization for attention layers, making it especially useful for large language models (LLMs) that benefit from faster and more memory-efficient attention computations.

Once enabled, supported layers like `layer_multi_head_attention` will **attempt** to use flash attention for faster computations. By default, this feature is enabled.

Note that enabling flash attention does not guarantee it will always be used. Typically, the inputs must be in `float16` or `bfloat16` dtype, and input layout requirements may vary depending on the backend.

Usage

```
config_enable_flash_attention()
```

See Also

`config_disable_flash_attention()` `config_is_flash_attention_enabled()`

Other config:
`config_backend()`
`config_disable_flash_attention()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_dtype_policy()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_enable_unsafe_deserialization()`
`config_epsilon()`
`config_floatx()`
`config_image_data_format()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`config_set_backend()`
`config_set_dtype_policy()`
`config_set_epsilon()`
`config_set_floatx()`
`config_set_image_data_format()`

config_enable_interactive_logging
Turn on interactive logging.

Description

When interactive logging is enabled, Keras displays logs via stdout. This provides the best experience when using Keras in an interactive environment such as a shell or a notebook.

Usage

```
config_enable_interactive_logging()
```

Value

No return value, called for side effects.

See Also

Other io utils:
config_disable_interactive_logging()
config_is_interactive_logging_enabled()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()

zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_enable_traceback_filtering
Turn on traceback filtering.

Description

Raw Keras tracebacks (also known as stack traces) involve many internal frames, which can be challenging to read through, while not being actionable for end users. By default, Keras filters internal frames in most exceptions that it raises, to keep traceback short, readable, and focused on what's actionable for you (your own code).

See also config_disable_traceback_filtering() and config_is_traceback_filtering_enabled().

If you have previously disabled traceback filtering via config_disable_traceback_filtering(), you can re-enable it via config_enable_traceback_filtering().

Usage

```
config_enable_traceback_filtering()
```

Value

No return value, called for side effects.

See Also

Other traceback utils:
config_disable_traceback_filtering()
config_is_traceback_filtering_enabled()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()

config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

`config_enable_unsafe_deserialization`
Disables safe mode globally, allowing deserialization of lambdas.

Description

Disables safe mode globally, allowing deserialization of lambdas.

Usage

```
config_enable_unsafe_deserialization()
```

Value

No return value, called for side effects.

See Also

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

`config_epsilon` *Return the value of the fuzz factor used in numeric expressions.*

Description

Return the value of the fuzz factor used in numeric expressions.

Usage

```
config_epsilon()
```

Value

A float.

Examples

```
config_epsilon()

## [1] 1e-07
```

See Also

- https://keras.io/api/utils/config_utils#epsilon-function

Other config backend:
config_backend()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other backend:
clear_session()
config_backend()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()

config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_floatx *Return the default float type, as a string.*

Description

E.g. 'bfloat16' 'float16', 'float32', 'float64'.

Usage

```
config_floatx()
```

Value

String, the current default float type.

Examples

```
keras3::config_floatx()

## [1] "float32"
```

See Also

- https://keras.io/api/utils/config_utils#floatx-function

Other config backend:
config_backend()
config_epsilon()
config_image_data_format()
config_set_epsilon()

config_set_floatx()
config_set_image_data_format()

Other backend:
clear_session()
config_backend()
config_epsilon()
config_image_data_format()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_image_data_format   *Return the default image data format convention.*

Description

Return the default image data format convention.

Usage

```
config_image_data_format()
```

Value

A string, either 'channels_first' or 'channels_last'.

Examples

```
config_image_data_format()

## [1] "channels_last"
```

See Also

- https://keras.io/api/utils/config_utils#imagedataformat-function

Other config backend:
config_backend()
config_epsilon()
config_floatx()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other backend:
clear_session()
config_backend()
config_epsilon()
config_floatx()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()

config_set_floatx()
config_set_image_data_format()

---

config_is_flash_attention_enabled
Checks whether flash attention is globally enabled in Keras.

Description

Flash attention is a performance-optimized method for computing attention in large models, such as transformers, allowing for faster and more memory-efficient operations. This function checks the global Keras configuration to determine if flash attention is enabled for compatible layers (e.g., `MultiHeadAttention`).

Note that enabling flash attention does not guarantee it will always be used. Typically, the inputs must be in `float16` or `bfloat16` dtype, and input layout requirements may vary depending on the backend.

Usage

```
config_is_flash_attention_enabled()
```

Value

`FALSE` if disabled; otherwise, it indicates that it is enabled.

See Also

config_disable_flash_attention() config_enable_flash_attention()

---

config_is_interactive_logging_enabled
Check if interactive logging is enabled.

Description

To switch between writing logs to stdout and `absl.logging`, you may use `config_enable_interactive_logging()` and `config_disable_interactive_logging()`.

Usage

```
config_is_interactive_logging_enabled()
```

Value

Boolean, `TRUE` if interactive logging is enabled, and `FALSE` otherwise.

See Also

Other io utils:
config_disable_interactive_logging()
config_enable_interactive_logging()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()

config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_is_traceback_filtering_enabled

Check if traceback filtering is enabled.

Description

Raw Keras tracebacks (also known as stack traces) involve many internal frames, which can be challenging to read through, while not being actionable for end users. By default, Keras filters internal frames in most exceptions that it raises, to keep traceback short, readable, and focused on what's actionable for you (your own code).

See also `config_enable_traceback_filtering()` and `config_disable_traceback_filtering()`.

If you have previously disabled traceback filtering via `config_disable_traceback_filtering()`, you can re-enable it via `config_enable_traceback_filtering()`.

Usage

```
config_is_traceback_filtering_enabled()
```

Value

Boolean, `TRUE` if traceback filtering is enabled, and `FALSE` otherwise.

See Also

Other traceback utils:
config_disable_traceback_filtering()
config_enable_traceback_filtering()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()

image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

`config_set_backend` *Reload the backend (and the Keras package).*

Description

Reload the backend (and the Keras package).

Usage

```
config_set_backend(backend)
```

Arguments

backend	String

Value

Nothing, this function is called for its side effect.

Examples

```
config_set_backend("jax")
```

WARNING

Using this function is dangerous and should be done carefully. Changing the backend will **NOT** convert the type of any already-instantiated objects. Thus, any layers / tensors / etc. already created will no longer be usable without errors. It is strongly recommended **not** to keep around **any** Keras-originated objects instances created before calling `config_set_backend()`.

This includes any function or class instance that uses any Keras functionality. All such code needs to be re-executed after calling `config_set_backend()`.

See Also

Other config:
`config_backend()`
`config_disable_flash_attention()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_dtype_policy()`
`config_enable_flash_attention()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_enable_unsafe_deserialization()`
`config_epsilon()`
`config_floatx()`
`config_image_data_format()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`config_set_dtype_policy()`
`config_set_epsilon()`
`config_set_floatx()`
`config_set_image_data_format()`

`config_set_dtype_policy`

Sets the default dtype policy globally.

Description

Sets the default dtype policy globally.

Usage

```
config_set_dtype_policy(policy)
```

Arguments

policy	A string or DTypePolicy object.

Value

No return value, called for side effects.

Examples

```
config_set_dtype_policy("mixed_float16")
```

See Also

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_epsilon()
config_set_floatx()
config_set_image_data_format()

---

config_set_epsilon *Set the value of the fuzz factor used in numeric expressions.*

Description

Set the value of the fuzz factor used in numeric expressions.

Usage

```
config_set_epsilon(value)
```

Arguments

`value`	float. New value of epsilon.

Value

No return value, called for side effects.

Examples

```
config_epsilon()
```

```
## [1] 1e-07
```

```
config_set_epsilon(1e-5)
config_epsilon()
```

```
## [1] 1e-05
```

```
# Set it back to the default value.
config_set_epsilon(1e-7)
```

See Also

- https://keras.io/api/utils/config_utils#setepsilon-function

Other config backend:
`config_backend()`
`config_epsilon()`
`config_floatx()`
`config_image_data_format()`
`config_set_floatx()`
`config_set_image_data_format()`

Other backend:
`clear_session()`
`config_backend()`
`config_epsilon()`
`config_floatx()`
`config_image_data_format()`
`config_set_floatx()`
`config_set_image_data_format()`

Other config:
`config_backend()`
`config_disable_flash_attention()`
`config_disable_interactive_logging()`

config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_floatx()
config_set_image_data_format()

`config_set_floatx` *Set the default float dtype.*

Description

Set the default float dtype.

Usage

```
config_set_floatx(value)
```

Arguments

value	String; 'bfloat16', 'float16', 'float32', or 'float64'.

Value

No return value, called for side effects.

Note

It is not recommended to set this to "float16" for training, as this will likely cause numeric stability issues. Instead, mixed precision, which leverages a mix of `float16` and `float32`. It can be configured by calling `keras3::keras$mixed_precision$set_dtype_policy('mixed_float16')`.

Examples

```
config_floatx()

## [1] "float32"
```

```
config_set_floatx('float64')
config_floatx()

## [1] "float64"


# Set it back to float32
config_set_floatx('float32')
```

Raises

ValueError: In case of invalid value.

See Also

- https://keras.io/api/utils/config_utils#setfloatx-function

Other config backend:
config_backend()
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_image_data_format()

Other backend:
clear_session()
config_backend()
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_image_data_format()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()

config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_image_data_format()

---

config_set_image_data_format

Set the value of the image data format convention.

Description

Set the value of the image data format convention.

Usage

```
config_set_image_data_format(data_format)
```

Arguments

data_format	string. 'channels_first' or 'channels_last'.

Value

No return value, called for side effects.

Examples

```
config_image_data_format()

## [1] "channels_last"


# 'channels_last'

keras3::config_set_image_data_format('channels_first')
config_image_data_format()

## [1] "channels_first"


# Set it back to `'channels_last'`
keras3::config_set_image_data_format('channels_last')
```

See Also

- https://keras.io/api/utils/config_utils#setimagedataformat-function

Other config backend:
config_backend()
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()

Other backend:
clear_session()
config_backend()
config_epsilon()
config_floatx()
config_image_data_format()
config_set_epsilon()
config_set_floatx()

Other config:
config_backend()
config_disable_flash_attention()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_dtype_policy()
config_enable_flash_attention()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_enable_unsafe_deserialization()
config_epsilon()
config_floatx()
config_image_data_format()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
config_set_backend()
config_set_dtype_policy()
config_set_epsilon()
config_set_floatx()

Constraint — *Define a custom* Constraint *class*

Description

Base class for weight constraints.

A `Constraint()` instance works like a stateless function. Users who subclass the `Constraint` class should override the `call()` method, which takes a single weight parameter and return a projected version of that parameter (e.g. normalized or clipped). Constraints can be used with various Keras layers via the `kernel_constraint` or `bias_constraint` arguments.

Here's a simple example of a non-negative weight constraint:

```
constraint_nonnegative <- Constraint("NonNegative",
  call = function(w) {
    w * op_cast(w >= 0, dtype = w$dtype)
  }
)
weight <- op_convert_to_tensor(c(-1, 1))
constraint_nonnegative()(weight)

## tf.Tensor([-0.  1.], shape=(2), dtype=float64)
```

Usage in a layer:

```
layer_dense(units = 4, kernel_constraint = constraint_nonnegative())

## <Dense name=dense, built=False>
##  signature: (*args, **kwargs)
```

Usage

```
Constraint(
  classname,
  call = NULL,
  get_config = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

`classname` String, the name of the custom class. (Conventionally, CamelCase).

`call` `\(w)`

Applies the constraint to the input weight variable.

By default, the inputs weight variable is not modified. Users should override this method to implement their own projection function.

Args:

- `w`: Input weight variable.

Returns: Projected variable (by default, returns unmodified inputs).

`get_config` \()

Function that returns a named list of the object config.

A constraint config is a named list (JSON-serializable) that can be used to reinstantiate the same object (via `do.call(<constraint_class>, <config>)`).

`...`, `public` Additional methods or public members of the custom class.

`private` Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.

`inherit` What the custom class will subclass. By default, the base keras class.

`parent_env` The R environment that all class methods will have as a grandparent.

Value

A function that returns `Constraint` instances, similar to the builtin constraint functions like `constraint_maxnorm()`.

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

See Also

Other constraints:
`constraint_maxnorm()`
`constraint_minmaxnorm()`
`constraint_nonneg()`
`constraint_unitnorm()`

constraint_maxnorm *MaxNorm weight constraint.*

Description

Constrains the weights incident to each hidden unit to have a norm less than or equal to a desired value.

Usage

```
constraint_maxnorm(max_value = 2L, axis = 1L)
```

Arguments

`max_value`	the maximum norm value for the incoming weights.
`axis`	integer, axis along which to calculate weight norms. For instance, in a `Dense` layer the weight matrix has shape `(input_dim, output_dim)`, set `axis` to `0` to constrain each weight vector of length `(input_dim,)`. In a `Conv2D` layer with `data_format = "channels_last"`, the weight tensor has shape `(rows, cols, input_depth, output_d` set `axis` to `[0, 1, 2]` to constrain the weights of each filter tensor of size `(rows, cols, input_depth)`.

Value

A `Constraint` instance, a callable that can be passed to layer constructors or used directly by calling it with tensors.

See Also

- https://keras.io/api/layers/constraints#maxnorm-class

Other constraints:
`Constraint()`
`constraint_minmaxnorm()`
`constraint_nonneg()`
`constraint_unitnorm()`

constraint_minmaxnorm *MinMaxNorm weight constraint.*

Description

Constrains the weights incident to each hidden unit to have the norm between a lower bound and an upper bound.

Usage

```
constraint_minmaxnorm(min_value = 0, max_value = 1, rate = 1, axis = 1L)
```

Arguments

`min_value`	the minimum norm for the incoming weights.
`max_value`	the maximum norm for the incoming weights.
`rate`	rate for enforcing the constraint: weights will be rescaled to yield op_clip? `(1 - rate) * norm + rate * op_clip(norm, min_value, max_value)`. Effectively, this means that rate = 1.0 stands for strict enforcement of the constraint, while rate<1.0 means that weights will be rescaled at each step to slowly move towards a value inside the desired interval.
`axis`	integer, axis along which to calculate weight norms. For instance, in a `Dense` layer the weight matrix has shape `(input_dim, output_dim)`, set `axis` to `0` to constrain each weight vector of length `(input_dim,)`. In a `Conv2D` layer with `data_format = "channels_last"`, the weight tensor has shape `(rows, cols, input_depth, output_d` set `axis` to `[0, 1, 2]` to constrain the weights of each filter tensor of size `(rows, cols, input_depth)`.

Value

A `Constraint` instance, a callable that can be passed to layer constructors or used directly by calling it with tensors.

See Also

- https://keras.io/api/layers/constraints#minmaxnorm-class

Other constraints:
`Constraint()`
`constraint_maxnorm()`
`constraint_nonneg()`
`constraint_unitnorm()`

`constraint_nonneg` *Constrains the weights to be non-negative.*

Description

Constrains the weights to be non-negative.

Usage

```
constraint_nonneg()
```

Value

A Constraint instance, a callable that can be passed to layer constructors or used directly by calling it with tensors.

See Also

- https://keras.io/api/layers/constraints#nonneg-class

Other constraints:
Constraint()
constraint_maxnorm()
constraint_minmaxnorm()
constraint_unitnorm()

---

constraint_unitnorm *Constrains the weights incident to each hidden unit to have unit norm.*

Description

Constrains the weights incident to each hidden unit to have unit norm.

Usage

```
constraint_unitnorm(axis = 1L)
```

Arguments

axis	integer, axis along which to calculate weight norms. For instance, in a Dense layer the weight matrix has shape (input_dim, output_dim), set axis to 0 to constrain each weight vector of length (input_dim,). In a Conv2D layer with data_format = "channels_last", the weight tensor has shape (rows, cols, input_depth, output_d set axis to [0, 1, 2] to constrain the weights of each filter tensor of size (rows, cols, input_depth).

Value

A Constraint instance, a callable that can be passed to layer constructors or used directly by calling it with tensors.

See Also

- https://keras.io/api/layers/constraints#unitnorm-class

Other constraints:
Constraint()
constraint_maxnorm()
constraint_minmaxnorm()
constraint_nonneg()

count_params — *Count the total number of scalars composing the weights.*

Description

Count the total number of scalars composing the weights.

Usage

```
count_params(object)
```

Arguments

`object`	Layer or model object

Value

An integer count

See Also

Other layer methods:
`get_config()`
`get_weights()`
`quantize_weights()`
`reset_state()`

custom_metric — *Custom metric function*

Description

Custom metric function

Usage

```
custom_metric(name, metric_fn)
```

Arguments

`name`	name used to show training progress output
`metric_fn`	An R function with signature `function(y_true, y_pred)` that accepts tensors.

Details

You can provide an arbitrary R function as a custom metric. Note that the `y_true` and `y_pred` parameters are tensors, so computations on them should use `op_*` tensor functions.

Use the `custom_metric()` function to define a custom metric. Note that a name (`'mean_pred'`) is provided for the custom metric function: this name is used within training progress output.

If you want to save and load a model with custom metrics, you should also call `register_keras_serializable()`, or specify the metric in the call the `load_model()`. For example: `load_model("my_model.keras", c('mean_pred' = metric_mean_pred))`.

Alternatively, you can wrap all of your code in a call to `with_custom_object_scope()` which will allow you to refer to the metric by name just like you do with built in keras metrics.

Alternative ways of supplying custom metrics:

- `custom_metric()`: Arbitrary R function.
- `metric_mean_wrapper()`: Wrap an arbitrary R function in a `Metric` instance.
- Create a custom `Metric()` subclass.

Value

A callable function with a `__name__` attribute.

See Also

Other metrics:
`Metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`
`metric_categorical_accuracy()`
`metric_categorical_crossentropy()`
`metric_categorical_focal_crossentropy()`
`metric_categorical_hinge()`
`metric_concordance_correlation()`
`metric_cosine_similarity()`
`metric_f1_score()`
`metric_false_negatives()`
`metric_false_positives()`
`metric_fbeta_score()`
`metric_hinge()`
`metric_huber()`
`metric_iou()`
`metric_kl_divergence()`
`metric_log_cosh()`
`metric_log_cosh_error()`
`metric_mean()`
`metric_mean_absolute_error()`

metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

dataset_boston_housing *Boston housing price regression dataset*

Description

Dataset taken from the StatLib library which is maintained at Carnegie Mellon University.

Usage

```
dataset_boston_housing(
  path = "boston_housing.npz",
  test_split = 0.2,
  seed = 113L
)
```

Arguments

path	Path where to cache the dataset locally (relative to ~/.keras/datasets).
test_split	fraction of the data to reserve as test set.
seed	Random seed for shuffling the data before computing the test split.

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`.

Samples contain 13 attributes of houses at different locations around the Boston suburbs in the late 1970s. Targets are the median values of the houses at a location (in k$).

See Also

Other datasets:
`dataset_california_housing()`
`dataset_cifar10()`
`dataset_cifar100()`
`dataset_fashion_mnist()`
`dataset_imdb()`
`dataset_mnist()`
`dataset_reuters()`

---

dataset_california_housing

Loads the California Housing dataset.

Description

This dataset was obtained from the StatLib repository.

It's a continuous regression dataset with 20,640 samples with 8 features each.

The target variable is a scalar: the median house value for California districts, in dollars.

The 8 input features are the following:

- MedInc: median income in block group
- HouseAge: median house age in block group
- AveRooms: average number of rooms per household
- AveBedrms: average number of bedrooms per household
- Population: block group population
- AveOccup: average number of household members
- Latitude: block group latitude
- Longitude: block group longitude

This dataset was derived from the 1990 U.S. census, using one row per census block group. A block group is the smallest geographical unit for which the U.S. Census Bureau publishes sample data (a block group typically has a population of 600 to 3,000 people).

A household is a group of people residing within a home. Since the average number of rooms and bedrooms in this dataset are provided per household, these columns may take surprisingly large values for block groups with few households and many empty houses, such as vacation resorts.

Usage

```
dataset_california_housing(
  version = "large",
  path = "california_housing.npz",
  test_split = 0.2,
  seed = 113L
)
```

Arguments

version	"small" or "large". The small version contains 600 samples, the large version contains 20,640 samples. The purpose of the small version is to serve as an approximate replacement for the deprecated boston_housing dataset.
path	path where to cache the dataset locally (relative to Sys.getenv("KERAS_HOME")).
test_split	fraction of the data to reserve as test set.
seed	Random seed for shuffling the data before computing the test split.

Value

Nested list of arrays: (x_train, y_train), (x_test, y_test).

x_train, x_test: arrays with shape (num_samples, 8) containing either the training samples (for x_train), or test samples (for y_train).

y_train, y_test: arrays of shape (num_samples) containing the target scalars. The targets are float scalars typically between 25,000 and 500,000 that represent the home prices in dollars.

See Also

Other datasets:
dataset_boston_housing()
dataset_cifar10()
dataset_cifar100()
dataset_fashion_mnist()
dataset_imdb()
dataset_mnist()
dataset_reuters()

---

dataset_cifar10 *CIFAR10 small image classification*

Description

Dataset of 50,000 32x32 color training images, labeled over 10 categories, and 10,000 test images.

Usage

```
dataset_cifar10()
```

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`.

The `x` data is an array of RGB image data with shape (num_samples, 3, 32, 32).

The `y` data is an array of category labels (integers in range 0-9) with shape (num_samples).

See Also

Other datasets:
`dataset_boston_housing()`
`dataset_california_housing()`
`dataset_cifar100()`
`dataset_fashion_mnist()`
`dataset_imdb()`
`dataset_mnist()`
`dataset_reuters()`

`dataset_cifar100` *CIFAR100 small image classification*

Description

Dataset of 50,000 32x32 color training images, labeled over 100 categories, and 10,000 test images.

Usage

```
dataset_cifar100(label_mode = c("fine", "coarse"))
```

Arguments

`label_mode`	one of "fine", "coarse".

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`.

The `x` data is an array of RGB image data with shape (num_samples, 3, 32, 32).

The `y` data is an array of category labels with shape (num_samples).

See Also

Other datasets:
dataset_boston_housing()
dataset_california_housing()
dataset_cifar10()
dataset_fashion_mnist()
dataset_imdb()
dataset_mnist()
dataset_reuters()

---

dataset_fashion_mnist *Fashion-MNIST database of fashion articles*

Description

Dataset of 60,000 28x28 grayscale images of the 10 fashion article classes, along with a test set of 10,000 images. This dataset can be used as a drop-in replacement for MNIST. The class labels are encoded as integers from 0-9 which correspond to T-shirt/top, Trouser, Pullover, Dress, Coat, Sandal, Shirt,

Usage

```
dataset_fashion_mnist()
```

Details

Dataset of 60,000 28x28 grayscale images of 10 fashion categories, along with a test set of 10,000 images. This dataset can be used as a drop-in replacement for MNIST. The class labels are:

- 0 - T-shirt/top
- 1 - Trouser
- 2 - Pullover
- 3 - Dress
- 4 - Coat
- 5 - Sandal
- 6 - Shirt
- 7 - Sneaker
- 8 - Bag
- 9 - Ankle boot

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`, where `x` is an array of grayscale image data with shape (num_samples, 28, 28) and `y` is an array of article labels (integers in range 0-9) with shape (num_samples).

See Also

Other datasets:
`dataset_boston_housing()`
`dataset_california_housing()`
`dataset_cifar10()`
`dataset_cifar100()`
`dataset_imdb()`
`dataset_mnist()`
`dataset_reuters()`

---

dataset_imdb *IMDB Movie reviews sentiment classification*

Description

Dataset of 25,000 movies reviews from IMDB, labeled by sentiment (positive/negative). Reviews have been preprocessed, and each review is encoded as a sequence of word indexes (integers). For convenience, words are indexed by overall frequency in the dataset, so that for instance the integer "3" encodes the 3rd most frequent word in the data. This allows for quick filtering operations such as: "only consider the top 10,000 most common words, but eliminate the top 20 most common words".

Usage

```
dataset_imdb(
  path = "imdb.npz",
  num_words = NULL,
  skip_top = 0L,
  maxlen = NULL,
  seed = 113L,
  start_char = 1L,
  oov_char = 2L,
  index_from = 3L
)

dataset_imdb_word_index(path = "imdb_word_index.json")
```

Arguments

`path`	Where to cache the data (relative to `~/.keras/dataset`).
`num_words`	Max number of words to include. Words are ranked by how often they occur (in the training set) and only the most frequent words are kept
`skip_top`	Skip the top N most frequently occuring words (which may not be informative).
`maxlen`	sequences longer than this will be filtered out.

`seed`	random seed for sample shuffling.
`start_char`	The start of a sequence will be marked with this character. Set to 1 because 0 is usually the padding character.
`oov_char`	Words that were cut out because of the `num_words` or `skip_top` limit will be replaced with this character.
`index_from`	Index actual words with this index and higher.

Details

As a convention, "0" does not stand for a specific word, but instead is used to encode any unknown word.

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`.

The `x` data includes integer sequences. If the `num_words` argument was specific, the maximum possible index value is `num_words-1`. If the `maxlen` argument was specified, the largest possible sequence length is `maxlen`.

The `y` data includes a set of integer labels (0 or 1).

The `dataset_imdb_word_index()` function returns a list where the names are words and the values are integer.

See Also

Other datasets:
`dataset_boston_housing()`
`dataset_california_housing()`
`dataset_cifar10()`
`dataset_cifar100()`
`dataset_fashion_mnist()`
`dataset_mnist()`
`dataset_reuters()`

`dataset_mnist` *MNIST database of handwritten digits*

Description

Dataset of 60,000 28x28 grayscale images of the 10 digits, along with a test set of 10,000 images.

Usage

```
dataset_mnist(path = "mnist.npz")
```

Arguments

`path`	Path where to cache the dataset locally (relative to ~/.keras/datasets).

Value

Lists of training and test data: `train$x, train$y, test$x, test$y`, where `x` is an array of grayscale image data with shape (num_samples, 28, 28) and `y` is an array of digit labels (integers in range 0-9) with shape (num_samples).

See Also

Other datasets:
`dataset_boston_housing()`
`dataset_california_housing()`
`dataset_cifar10()`
`dataset_cifar100()`
`dataset_fashion_mnist()`
`dataset_imdb()`
`dataset_reuters()`

`dataset_reuters` *Reuters newswire topics classification*

Description

Dataset of 11,228 newswires from Reuters, labeled over 46 topics. As with `dataset_imdb()` , each wire is encoded as a sequence of word indexes (same conventions).

Usage

```
dataset_reuters(
  path = "reuters.npz",
  num_words = NULL,
  skip_top = 0L,
  maxlen = NULL,
  test_split = 0.2,
  seed = 113L,
  start_char = 1L,
  oov_char = 2L,
  index_from = 3L
)

dataset_reuters_word_index(path = "reuters_word_index.pkl")
```

Arguments

path	Where to cache the data (relative to ~/.keras/dataset).
num_words	Max number of words to include. Words are ranked by how often they occur (in the training set) and only the most frequent words are kept
skip_top	Skip the top N most frequently occuring words (which may not be informative).
maxlen	Truncate sequences after this length.
test_split	Fraction of the dataset to be used as test data.
seed	Random seed for sample shuffling.
start_char	The start of a sequence will be marked with this character. Set to 1 because 0 is usually the padding character.
oov_char	words that were cut out because of the num_words or skip_top limit will be replaced with this character.
index_from	index actual words with this index and higher.

Value

Lists of training and test data: train$x, train$y, test$x, test$y with same format as dataset_imdb(). The dataset_reuters_word_index() function returns a list where the names are words and the values are integer. e.g. word_index[["giraffe"]] might return 1234.

See Also

Other datasets:
dataset_boston_housing()
dataset_california_housing()
dataset_cifar10()
dataset_cifar100()
dataset_fashion_mnist()
dataset_imdb()
dataset_mnist()

---

deserialize_keras_object

Retrieve the object by deserializing the config dict.

Description

The config dict is a Python dictionary that consists of a set of key-value pairs, and represents a Keras object, such as an Optimizer, Layer, Metrics, etc. The saving and loading library uses the following keys to record information of a Keras object:

- class_name: String. This is the name of the class, as exactly defined in the source code, such as "LossesContainer".

- `config`: Named List. Library-defined or user-defined key-value pairs that store the configuration of the object, as obtained by `object$get_config()`.
- `module`: String. The path of the python module. Built-in Keras classes expect to have prefix `keras`.
- `registered_name`: String. The key the class is registered under via `register_keras_serializable(package, name)` API. The key has the format of `'{package}>{name}'`, where `package` and `name` are the arguments passed to `register_keras_serializable()`. If `name` is not provided, it uses the class name. If `registered_name` successfully resolves to a class (that was registered), the `class_name` and `config` values in the config dict will not be used. `registered_name` is only used for non-built-in classes.

For example, the following config list represents the built-in Adam optimizer with the relevant config:

```
config <- list(
  class_name = "Adam",
  config = list(
    amsgrad = FALSE,
    beta_1 = 0.8999999761581421,
    beta_2 = 0.9990000128746033,
    epsilon = 1e-07,
    learning_rate = 0.0010000000474974513,
    name = "Adam"
  ),
  module = "keras.optimizers",
  registered_name = NULL
)
# Returns an `Adam` instance identical to the original one.
deserialize_keras_object(config)
```

```
## <keras.src.optimizers.adam.Adam object at 0x0>
```

If the class does not have an exported Keras namespace, the library tracks it by its `module` and `class_name`. For example:

```
config <- list(
  class_name = "MetricsList",
  config =  list(
    ...
  ),
  module = "keras.trainers.compile_utils",
  registered_name = "MetricsList"
)

# Returns a `MetricsList` instance identical to the original one.
deserialize_keras_object(config)
```

And the following config represents a user-customized MeanSquaredError loss:

```
# define a custom object
loss_modified_mse <- Loss(
  "ModifiedMeanSquaredError",
  inherit = loss_mean_squared_error)

# register the custom object
register_keras_serializable(loss_modified_mse)

# confirm object is registered
get_custom_objects()

## $`keras3>ModifiedMeanSquaredError`
## <class '<r-namespace:keras3>.ModifiedMeanSquaredError'>
##  signature: (
##    reduction='sum_over_batch_size',
##    name='mean_squared_error',
##    dtype=None
## )


get_registered_name(loss_modified_mse)

## [1] "keras3>ModifiedMeanSquaredError"


# now custom object instances can be serialized
full_config <- serialize_keras_object(loss_modified_mse())

# the `config` arguments will be passed to loss_modified_mse()
str(full_config)

## List of 4
##  $ module         : chr "<r-namespace:keras3>"
##  $ class_name     : chr "ModifiedMeanSquaredError"
##  $ config         :List of 2
##   ..$ name     : chr "mean_squared_error"
##   ..$ reduction: chr "sum_over_batch_size"
##  $ registered_name: chr "keras3>ModifiedMeanSquaredError"


# and custom object instances can be deserialized
deserialize_keras_object(full_config)

## <LossFunctionWrapper(<function mean_squared_error at 0x0>, kwargs={})>
##  signature: (y_true, y_pred, sample_weight=None)


# Returns the `ModifiedMeanSquaredError` object
```

Usage

```
deserialize_keras_object(config, custom_objects = NULL, safe_mode = TRUE, ...)
```

Arguments

config	Named list describing the object.
custom_objects	Named list containing a mapping between custom object names the corresponding classes or functions.
safe_mode	Boolean, whether to disallow unsafe lambda deserialization. When safe_mode=FALSE, loading an object has the potential to trigger arbitrary code execution. This argument is only applicable to the Keras v3 model format. Defaults to TRUE.
...	For forward/backward compatability.

Value

The object described by the config dictionary.

See Also

- https://keras.io/api/models/model_saving_apis/serialization_utils#deserializekerasobject-functi

Other serialization utilities:
get_custom_objects()
get_registered_name()
get_registered_object()
register_keras_serializable()
serialize_keras_object()
with_custom_object_scope()

---

evaluate.keras.src.models.model.Model
Evaluate a Keras Model

Description

This functions returns the loss value and metrics values for the model in test mode. Computation is done in batches (see the batch_size arg.)

Usage

```
## S3 method for class 'keras.src.models.model.Model'
evaluate(
  object,
  x = NULL,
  y = NULL,
  ...,
```

```
  batch_size = NULL,
  verbose = getOption("keras.verbose", default = "auto"),
  sample_weight = NULL,
  steps = NULL,
  callbacks = NULL
)
```

Arguments

`object`	Keras model object
`x`	Input data. It can be: • An R array (or array-like), or a list of arrays (in case the model has multiple inputs). • A backend-native tensor, or a list of tensors (in case the model has multiple inputs). • A named list mapping input names to the corresponding array/tensors, if the model has named inputs. • A `tf.data.Dataset`. Should return a tuple of either `(inputs, targets)` or `(inputs, targets, sample_weights)`. • A generator returning `(inputs, targets)` or `(inputs, targets, sample_weights)`.
`y`	Target data. Like the input data `x`, it could be either R array(s) or backend-native tensor(s). If `x` is a `tf.data.Dataset` or generator function, `y` should not be specified (since targets will be obtained from the iterator/dataset).
`...`	For forward/backward compatability.
`batch_size`	Integer or `NULL`. Number of samples per batch of computation. If unspecified, `batch_size` will default to 32. Do not specify the `batch_size` if your data is in the form of a a tf dataset or generator (since they generate batches).
`verbose`	`"auto"`, `0`, `1`, or `2`. Verbosity mode. `0` = silent, `1` = progress bar, `2` = single line. `"auto"` becomes `1` for most cases, `2` if in a knitr render or running on a distributed training server. Note that the progress bar is not particularly useful when logged to a file, so `verbose=2` is recommended when not running interactively (e.g. in a production environment). Defaults to `"auto"`.
`sample_weight`	Optional array or tensor of weights for the training samples, used for weighting the loss function (during training only). You can either pass a flat (1D) array or tensor with the same length as the input samples (1:1 mapping between weights and samples), or in the case of temporal data, you can pass a 2D array or tensor with shape `(samples, sequence_length)` to apply a different weight to every timestep of every sample. This argument is not supported when `x` is a `tf.data.Dataset`, or Python generator function. Instead, provide `sample_weights` as the third element of `x`. Note that sample weighting does not apply to metrics specified via the `metrics` argument in `compile()`. To apply sample weighting to your metrics, you can specify them via the `weighted_metrics` in `compile()` instead.
`steps`	Integer or `NULL`. Total number of steps (batches of samples) before declaring the evaluation round finished. Ignored with the default value of `NULL`. If `x` is a `tf.data.Dataset` and `steps` is `NULL`, evaluation will run until the dataset is exhausted. In the case of an infinitely repeating dataset, it will run indefinitely.

`callbacks`	List of `Callback` instances. List of callbacks to apply during evaluation.

Value

Scalar test loss (if the model has a single output and no metrics) or list of scalars (if the model has multiple outputs and/or metrics). The attribute `model$metrics_names` will give you the display labels for the scalar outputs.

See Also

- https://keras.io/api/models/model_training_apis#evaluate-method

Other model training:
`compile.keras.src.models.model.Model()`
`predict.keras.src.models.model.Model()`
`predict_on_batch()`
`test_on_batch()`
`train_on_batch()`

`export_savedmodel.keras.src.models.model.Model`
Export the model as an artifact for inference.

Description

(e.g. via TF-Serving).

Note: This can currently only be used with the TensorFlow or JAX backends.

This method lets you export a model to a lightweight SavedModel artifact that contains the model's forward pass only (its `call()` method) and can be served via e.g. TF-Serving. The forward pass is registered under the name `serve()` (see example below).

The original code of the model (including any custom layers you may have used) is *no longer* necessary to reload the artifact – it is entirely standalone.

Note: This feature is currently supported only with TensorFlow, JAX and Torch backends.

Note: Be aware that the exported artifact may contain information from the local file system when using `format="onnx"`, `verbose=TRUE` and Torch backend.

Usage

```
## S3 method for class 'keras.src.models.model.Model'
export_savedmodel(
  object,
  export_dir_base,
  ...,
  format = "tf_saved_model",
  verbose = NULL,
  input_signature = NULL
)
```

Arguments

`object` A keras model.

`export_dir_base` string, file path where to save the artifact.

`...` Additional keyword arguments:

- Specific to the JAX backend and `format="tf_saved_model"`:
  - `is_static`: Optional `bool`. Indicates whether `fn` is static. Set to `FALSE` if `fn` involves state updates (e.g., RNG seeds and counters).
  - `jax2tf_kwargs`: Optional `dict`. Arguments for `jax2tf.convert`. See the documentation for `jax2tf.convert`. If `native_serialization` and `polymorphic_shapes` are not provided, they will be automatically computed.

`format` string. The export format. Supported values: `"tf_saved_model"` and `"onnx"`. Defaults to `"tf_saved_model"`.

`verbose` Bool. Whether to print all the variables of the exported model. Defaults to `NULL`, which uses the default value set by different backends and formats.

`input_signature` Optional. Specifies the shape and dtype of the model inputs. Can be a structure of `keras.InputSpec`, `tf.TensorSpec`, `backend.KerasTensor`, or backend tensor. If not provided, it will be automatically computed. Defaults to `NULL`.

Value

This is called primarily for the side effect of exporting `object`. The first argument, `object` is also returned, invisibly, to enable usage with the pipe.

Examples

```
# Create the artifact
model |> tensorflow::export_savedmodel("path/to/location")

# Later, in a different process/environment...
library(tensorflow)
reloaded_artifact <- tf$saved_model$load("path/to/location")
predictions <- reloaded_artifact$serve(input_data)

# see tfdeploy::serve_savedmodel() for serving a model over a local web api.
```

Here's how to export an ONNX for inference.

```
# Export the model as a ONNX artifact
model |> export_savedmodel("path/to/location", format = "onnx")

# Load the artifact in a different process/environment
onnxruntime <- reticulate::import("onnxruntime")
ort_session <- onnxruntime$InferenceSession("path/to/location")
input_data <- list(....)
names(input_data) <- sapply(ort_session$get_inputs(), `[[`, "name")
predictions <- ort_session$run(NULL, input_data)
```

See Also

Other saving and loading functions:
layer_tfsm()
load_model()
load_model_weights()
register_keras_serializable()
save_model()
save_model_config()
save_model_weights()
with_custom_object_scope()

---

fit.keras.src.models.model.Model

Train a model for a fixed number of epochs (dataset iterations).

Description

Train a model for a fixed number of epochs (dataset iterations).

Usage

```
## S3 method for class 'keras.src.models.model.Model'
fit(
  object,
  x = NULL,
  y = NULL,
  ...,
  batch_size = NULL,
  epochs = 1L,
  callbacks = NULL,
  validation_split = 0,
  validation_data = NULL,
  shuffle = TRUE,
  class_weight = NULL,
  sample_weight = NULL,
  initial_epoch = 1L,
  steps_per_epoch = NULL,
  validation_steps = NULL,
  validation_batch_size = NULL,
  validation_freq = 1L,
  verbose = getOption("keras.verbose", default = "auto"),
  view_metrics = getOption("keras.view_metrics", default = "auto")
)
```

Arguments

`object` Keras model object

`x` Input data. It can be:

- An array (or array-like), or a list of arrays (in case the model has multiple inputs).
- A backend-native tensor, or a list of tensors (in case the model has multiple inputs).
- A named list mapping input names to the corresponding array/tensors, if the model has named inputs.
- A `tf.data.Dataset`. Should return a tuple of either `(inputs, targets)` or `(inputs, targets, sample_weights)`.
- A generator returning `(inputs, targets)` or `(inputs, targets, sample_weights)`.

`y` Target data. Like the input data `x`, it can be either array(s) or backend-native tensor(s). If `x` is a TF Dataset or generator, `y` should not be specified (since targets will be obtained from `x`).

`...` Additional arguments passed on to the model `fit()` method.

`batch_size` Integer or `NULL`. Number of samples per gradient update. If unspecified, `batch_size` will default to `32`. Do not specify the `batch_size` if your data is in the form of TF Datasets or generators, (since they generate batches).

`epochs` Integer. Number of epochs to train the model. An epoch is an iteration over the entire `x` and `y` data provided (unless the `steps_per_epoch` flag is set to something other than `NULL`). Note that in conjunction with `initial_epoch`, `epochs` is to be understood as "final epoch". The model is not trained for a number of iterations given by `epochs`, but merely until the epoch of index `epochs` is reached.

`callbacks` List of `Callback()` instances. List of callbacks to apply during training. See `callback_*`.

`validation_split`
Fraction of the training data to be used as validation data. The model will set apart this fraction of the training data, will not train on it, and will evaluate the loss and any model metrics on this data at the end of each epoch. The validation data is selected from the last samples in the `x` and `y` data provided, before shuffling. This argument is only supported when `x` and `y` are made of arrays or tensors. If both `validation_data` and `validation_split` are provided, `validation_data` will override `validation_split`.

`validation_data`
Data on which to evaluate the loss and any model metrics at the end of each epoch. The model will not be trained on this data. Thus, note the fact that the validation loss of data provided using `validation_split` or `validation_data` is not affected by regularization layers like noise and dropout. `validation_data` will override `validation_split`. It can be:

- A tuple `(x_val, y_val)` of arrays or tensors.
- A tuple `(x_val, y_val, val_sample_weights)` of arrays.
- A generator returning `(inputs, targets)` or `(inputs, targets, sample_weights)`.

shuffle
: Boolean, whether to shuffle the training data before each epoch. This argument is ignored when x is a generator or a TF Dataset.

class_weight
: Optional named list mapping class indices (integers, 0-based) to a weight (float) value, used for weighting the loss function (during training only). This can be useful to tell the model to "pay more attention" to samples from an under-represented class. When class_weight is specified and targets have a rank of 2 or greater, either y must be one-hot encoded, or an explicit final dimension of 1 must be included for sparse class labels.

sample_weight
: Optional array or tensor of weights for the training samples, used for weighting the loss function (during training only). You can either pass a flat (1D) array or tensor with the same length as the input samples (1:1 mapping between weights and samples), or in the case of temporal data, you can pass a 2D array or tensor with shape (samples, sequence_length) to apply a different weight to every timestep of every sample. This argument is not supported when x is a tf.data.Dataset, or Python generator function. Instead, provide sample_weights as the third element of x. Note that sample weighting does not apply to metrics specified via the metrics argument in compile(). To apply sample weighting to your metrics, you can specify them via the weighted_metrics in compile() instead.

initial_epoch
: Integer. Epoch at which to start training (useful for resuming a previous training run).

steps_per_epoch
: Integer or NULL. Total number of steps (batches of samples) before declaring one epoch finished and starting the next epoch. When training with input tensors or arrays, the default NULL means that the value used is the number of samples in your dataset divided by the batch size, or 1 if that cannot be determined. If x is a tf.data.Dataset or Python generator function, the epoch will run until the input dataset is exhausted. When passing an infinitely repeating dataset, you must specify the steps_per_epoch argument, otherwise the training will run indefinitely.

validation_steps
: Only relevant if validation_data is provided. Total number of steps (batches of samples) to draw before stopping when performing validation at the end of every epoch. If validation_steps is NULL, validation will run until the validation_data dataset is exhausted. In the case of an infinitely repeating dataset, it will run indefinitely. If validation_steps is specified and only part of the dataset is consumed, the evaluation will start from the beginning of the dataset at each epoch. This ensures that the same validation samples are used every time.

validation_batch_size
: Integer or NULL. Number of samples per validation batch. If unspecified, will default to batch_size. Do not specify the validation_batch_size if your data is in the form of TF Datasets or generator instances (since they generate batches).

validation_freq
: Only relevant if validation data is provided. Specifies how many training epochs to run before a new validation run is performed, e.g. validation_freq=2 runs validation every 2 epochs.

verbose — "auto", 0, 1, or 2. Verbosity mode. 0 = silent, 1 = progress bar, 2 = one line per epoch. "auto" becomes 1 for most cases, 2 if in a knitr render or running on a distributed training server. Note that the progress bar is not particularly useful when logged to a file, so verbose=2 is recommended when not running interactively (e.g., in a production environment). Defaults to "auto".

view_metrics — View realtime plot of training metrics (by epoch). The default ("auto") will display the plot when running within RStudio, metrics were specified during model compile(), epochs > 1 and verbose > 0. Set the global options(keras.view_metrics =) option to establish a different default.

Details

Unpacking behavior for iterator-like inputs:

A common pattern is to pass an iterator like object such as a tf.data.Dataset or a generator to fit(), which will in fact yield not only features (x) but optionally targets (y) and sample weights (sample_weight). Keras requires that the output of such iterator-likes be unambiguous. The iterator should return a tuple() of length 1, 2, or 3, where the optional second and third elements will be used for y and sample_weight respectively. Any other type provided will be wrapped in a length-one tuple(), effectively treating everything as x. When yielding named lists, they should still adhere to the top-level tuple structure, e.g. tuple(list(x0 = x0, x = x1), y). Keras will not attempt to separate features, targets, and weights from the keys of a single dict.

Value

A keras_training_history object, which is a named list: list(params = <params>, metrics = <metrics>"), with S3 methods print(), plot(), and as.data.frame(). The metrics field is a record of training loss values and metrics values at successive epochs, as well as validation loss values and validation metrics values (if applicable).

See Also

- https://keras.io/api/models/model_training_apis#fit-method

---

freeze_weights — *Freeze and unfreeze weights*

Description

Freeze weights in a model or layer so that they are no longer trainable.

Usage

```
freeze_weights(object, from = NULL, to = NULL, which = NULL)

unfreeze_weights(object, from = NULL, to = NULL, which = NULL)
```

Arguments

object	Keras model or layer object
from	Layer instance, layer name, or layer index within model
to	Layer instance, layer name, or layer index within model
which	layer names, integer positions, layers, logical vector (of `length(object$layers)`), or a function returning a logical vector.

Value

The input `object` with frozen weights is returned, invisibly. Note, `object` is modified in place, and the return value is only provided to make usage with the pipe convenient.

Examples

```
# instantiate a VGG16 model
conv_base <- application_vgg16(
  weights = "imagenet",
  include_top = FALSE,
  input_shape = c(150, 150, 3)
)

# freeze it's weights
freeze_weights(conv_base)

# Note the "Trainable" column
conv_base

## Model: "vgg16"
## +-----------------------------+----------------------+------------+-------+
## | Layer (type)               | Output Shape         |    Param # | Trai... |
## +=============================+======================+============+=======+
## | input_layer (InputLayer)    | (None, 150, 150, 3)  |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block1_conv1 (Conv2D)       | (None, 150, 150, 64) |      1,792 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block1_conv2 (Conv2D)       | (None, 150, 150, 64) |     36,928 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block1_pool (MaxPooling2D)  | (None, 75, 75, 64)   |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block2_conv1 (Conv2D)       | (None, 75, 75, 128)  |     73,856 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block2_conv2 (Conv2D)       | (None, 75, 75, 128)  |    147,584 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block2_pool (MaxPooling2D)  | (None, 37, 37, 128)  |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block3_conv1 (Conv2D)       | (None, 37, 37, 256)  |    295,168 |   N   |
## +-----------------------------+----------------------+------------+-------+
```

```
## | block3_conv2 (Conv2D)       | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_conv3 (Conv2D)       | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_pool (MaxPooling2D)  | (None, 18, 18, 256)   |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv1 (Conv2D)       | (None, 18, 18, 512)   |  1,180,160 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv2 (Conv2D)       | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv3 (Conv2D)       | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_pool (MaxPooling2D)  | (None, 9, 9, 512)     |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv1 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv2 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv3 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_pool (MaxPooling2D)  | (None, 4, 4, 512)     |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
##  Total params: 14,714,688 (56.13 MB)
##  Trainable params: 0 (0.00 B)
##  Non-trainable params: 14,714,688 (56.13 MB)


# create a composite model that includes the base + more layers
model <- keras_model_sequential(input_batch_shape = shape(conv_base$input)) |>
  conv_base() |>
  layer_flatten() |>
  layer_dense(units = 256, activation = "relu") |>
  layer_dense(units = 1, activation = "sigmoid")

# compile
model |> compile(
  loss = "binary_crossentropy",
  optimizer = optimizer_rmsprop(learning_rate = 2e-5),
  metrics = c("accuracy")
)

model

## Model: "sequential"
## +-----------------------------+-----------------------+------------+-------+
## | Layer (type)               | Output Shape          |    Param # | Trai... |
## +=============================+=======================+============+=======+
## | vgg16 (Functional)          | (None, 4, 4, 512)     | 14,714,688 |   N   |
## +-----------------------------+-----------------------+------------+-------+
```

```
## | flatten (Flatten)           | (None, 8192)          |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | dense (Dense)               | (None, 256)           |  2,097,408 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | dense_1 (Dense)             | (None, 1)             |        257 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
##  Total params: 16,812,353 (64.13 MB)
##  Trainable params: 2,097,665 (8.00 MB)
##  Non-trainable params: 14,714,688 (56.13 MB)
```

```
print(model, expand_nested = TRUE)
```

```
## Model: "sequential"
## +-----------------------------+-----------------------+------------+-------+
## | Layer (type)               | Output Shape          |    Param # | Trai... |
## +=============================+=======================+============+=======+
## | vgg16 (Functional)          | (None, 4, 4, 512)     | 14,714,688 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > input_layer            | (None, 150, 150, 3)   |          0 |   -   |
## | (InputLayer)                |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block1_conv1 (Conv2D)  | (None, 150, 150, 64)  |      1,792 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block1_conv2 (Conv2D)  | (None, 150, 150, 64)  |     36,928 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block1_pool            | (None, 75, 75, 64)    |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_conv1 (Conv2D)  | (None, 75, 75, 128)   |     73,856 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_conv2 (Conv2D)  | (None, 75, 75, 128)   |    147,584 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_pool            | (None, 37, 37, 128)   |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv1 (Conv2D)  | (None, 37, 37, 256)   |    295,168 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv2 (Conv2D)  | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv3 (Conv2D)  | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_pool            | (None, 18, 18, 256)   |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_conv1 (Conv2D)  | (None, 18, 18, 512)   |  1,180,160 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_conv2 (Conv2D)  | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
```

```
## |    > block4_conv3 (Conv2D)  | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_pool            | (None, 9, 9, 512)     |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv1 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv2 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv3 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_pool            | (None, 4, 4, 512)     |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## | flatten (Flatten)           | (None, 8192)          |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | dense (Dense)               | (None, 256)           |  2,097,408 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | dense_1 (Dense)             | (None, 1)             |        257 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
##  Total params: 16,812,353 (64.13 MB)
##  Trainable params: 2,097,665 (8.00 MB)
##  Non-trainable params: 14,714,688 (56.13 MB)
```

```
# unfreeze weights from "block5_conv1" on
unfreeze_weights(conv_base, from = "block5_conv1")

# compile again since we froze or unfroze weights
model |> compile(
  loss = "binary_crossentropy",
  optimizer = optimizer_rmsprop(learning_rate = 2e-5),
  metrics = c("accuracy")
)

conv_base
```

```
## Model: "vgg16"
## +-----------------------------+-----------------------+------------+-------+
## | Layer (type)               | Output Shape         |    Param # | Trai... |
## +=============================+=======================+============+=======+
## | input_layer (InputLayer)    | (None, 150, 150, 3)   |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_conv1 (Conv2D)       | (None, 150, 150, 64)  |      1,792 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_conv2 (Conv2D)       | (None, 150, 150, 64)  |     36,928 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_pool (MaxPooling2D)  | (None, 75, 75, 64)    |          0 |   -   |
```

```
## +-----------------------------+----------------------+------------+-------+
## | block2_conv1 (Conv2D)       | (None, 75, 75, 128)  |     73,856 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block2_conv2 (Conv2D)       | (None, 75, 75, 128)  |    147,584 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block2_pool (MaxPooling2D)  | (None, 37, 37, 128)  |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block3_conv1 (Conv2D)       | (None, 37, 37, 256)  |    295,168 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block3_conv2 (Conv2D)       | (None, 37, 37, 256)  |    590,080 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block3_conv3 (Conv2D)       | (None, 37, 37, 256)  |    590,080 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block3_pool (MaxPooling2D)  | (None, 18, 18, 256)  |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block4_conv1 (Conv2D)       | (None, 18, 18, 512)  |  1,180,160 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block4_conv2 (Conv2D)       | (None, 18, 18, 512)  |  2,359,808 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block4_conv3 (Conv2D)       | (None, 18, 18, 512)  |  2,359,808 |   N   |
## +-----------------------------+----------------------+------------+-------+
## | block4_pool (MaxPooling2D)  | (None, 9, 9, 512)    |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
## | block5_conv1 (Conv2D)       | (None, 9, 9, 512)    |  2,359,808 |   Y   |
## +-----------------------------+----------------------+------------+-------+
## | block5_conv2 (Conv2D)       | (None, 9, 9, 512)    |  2,359,808 |   Y   |
## +-----------------------------+----------------------+------------+-------+
## | block5_conv3 (Conv2D)       | (None, 9, 9, 512)    |  2,359,808 |   Y   |
## +-----------------------------+----------------------+------------+-------+
## | block5_pool (MaxPooling2D)  | (None, 4, 4, 512)    |          0 |   -   |
## +-----------------------------+----------------------+------------+-------+
##  Total params: 14,714,688 (56.13 MB)
##  Trainable params: 7,079,424 (27.01 MB)
##  Non-trainable params: 7,635,264 (29.13 MB)
```

```
print(model, expand_nested = TRUE)
```

```
## Model: "sequential"
## +-----------------------------+----------------------+------------+-------+
## | Layer (type)                | Output Shape         |    Param # | Trai… |
## +=============================+======================+============+=======+
## | vgg16 (Functional)          | (None, 4, 4, 512)    | 14,714,688 |   Y   |
## +-----------------------------+----------------------+------------+-------+
## |    > input_layer            | (None, 150, 150, 3)  |          0 |   -   |
## | (InputLayer)                |                      |            |       |
## +-----------------------------+----------------------+------------+-------+
## |    > block1_conv1 (Conv2D)  | (None, 150, 150, 64) |      1,792 |   N   |
## +-----------------------------+----------------------+------------+-------+
```

```
## |    > block1_conv2 (Conv2D)  | (None, 150, 150, 64)  |     36,928 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block1_pool            | (None, 75, 75, 64)    |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_conv1 (Conv2D)  | (None, 75, 75, 128)   |     73,856 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_conv2 (Conv2D)  | (None, 75, 75, 128)   |    147,584 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block2_pool            | (None, 37, 37, 128)   |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv1 (Conv2D)  | (None, 37, 37, 256)   |    295,168 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv2 (Conv2D)  | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_conv3 (Conv2D)  | (None, 37, 37, 256)   |    590,080 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block3_pool            | (None, 18, 18, 256)   |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_conv1 (Conv2D)  | (None, 18, 18, 512)   |  1,180,160 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_conv2 (Conv2D)  | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_conv3 (Conv2D)  | (None, 18, 18, 512)   |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block4_pool            | (None, 9, 9, 512)     |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv1 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv2 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_conv3 (Conv2D)  | (None, 9, 9, 512)     |  2,359,808 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## |    > block5_pool            | (None, 4, 4, 512)     |          0 |   -   |
## | (MaxPooling2D)              |                       |            |       |
## +-----------------------------+-----------------------+------------+-------+
## | flatten (Flatten)           | (None, 8192)          |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | dense (Dense)               | (None, 256)           |  2,097,408 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | dense_1 (Dense)             | (None, 1)             |        257 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
##  Total params: 16,812,353 (64.13 MB)
##  Trainable params: 9,177,089 (35.01 MB)
##  Non-trainable params: 7,635,264 (29.13 MB)
```

```
# freeze only the last 5 layers
freeze_weights(conv_base, from = -5)
conv_base

## Model: "vgg16"
## +-----------------------------+----------------------+-----------+-------+
## | Layer (type)               | Output Shape         |    Param # | Trai... |
## +=============================+======================+===========+=======+
## | input_layer (InputLayer)    | (None, 150, 150, 3)  |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
## | block1_conv1 (Conv2D)       | (None, 150, 150, 64)  |     1,792 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block1_conv2 (Conv2D)       | (None, 150, 150, 64)  |    36,928 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block1_pool (MaxPooling2D)  | (None, 75, 75, 64)   |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
## | block2_conv1 (Conv2D)       | (None, 75, 75, 128)  |    73,856 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block2_conv2 (Conv2D)       | (None, 75, 75, 128)  |   147,584 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block2_pool (MaxPooling2D)  | (None, 37, 37, 128)  |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
## | block3_conv1 (Conv2D)       | (None, 37, 37, 256)  |   295,168 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block3_conv2 (Conv2D)       | (None, 37, 37, 256)  |   590,080 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block3_conv3 (Conv2D)       | (None, 37, 37, 256)  |   590,080 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block3_pool (MaxPooling2D)  | (None, 18, 18, 256)  |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
## | block4_conv1 (Conv2D)       | (None, 18, 18, 512)  | 1,180,160 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block4_conv2 (Conv2D)       | (None, 18, 18, 512)  | 2,359,808 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block4_conv3 (Conv2D)       | (None, 18, 18, 512)  | 2,359,808 |   Y   |
## +-----------------------------+----------------------+-----------+-------+
## | block4_pool (MaxPooling2D)  | (None, 9, 9, 512)    |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
## | block5_conv1 (Conv2D)       | (None, 9, 9, 512)    | 2,359,808 |   N   |
## +-----------------------------+----------------------+-----------+-------+
## | block5_conv2 (Conv2D)       | (None, 9, 9, 512)    | 2,359,808 |   N   |
## +-----------------------------+----------------------+-----------+-------+
## | block5_conv3 (Conv2D)       | (None, 9, 9, 512)    | 2,359,808 |   N   |
## +-----------------------------+----------------------+-----------+-------+
## | block5_pool (MaxPooling2D)  | (None, 4, 4, 512)    |         0 |   -   |
## +-----------------------------+----------------------+-----------+-------+
##  Total params: 14,714,688 (56.13 MB)
```

```
##  Trainable params: 7,635,264 (29.13 MB)
##  Non-trainable params: 7,079,424 (27.01 MB)
```

```
# freeze only the last 5 layers, a different way
unfreeze_weights(conv_base, to = -6)
conv_base
```

```
## Model: "vgg16"
## +-----------------------------+-----------------------+------------+-------+
## | Layer (type)                | Output Shape          |    Param # | Trai… |
## +=============================+=======================+============+=======+
## | input_layer (InputLayer)    | (None, 150, 150, 3)   |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_conv1 (Conv2D)       | (None, 150, 150, 64)  |      1,792 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_conv2 (Conv2D)       | (None, 150, 150, 64)  |     36,928 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block1_pool (MaxPooling2D)  | (None, 75, 75, 64)    |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block2_conv1 (Conv2D)       | (None, 75, 75, 128)   |     73,856 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block2_conv2 (Conv2D)       | (None, 75, 75, 128)   |    147,584 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block2_pool (MaxPooling2D)  | (None, 37, 37, 128)   |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_conv1 (Conv2D)       | (None, 37, 37, 256)   |    295,168 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_conv2 (Conv2D)       | (None, 37, 37, 256)   |    590,080 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_conv3 (Conv2D)       | (None, 37, 37, 256)   |    590,080 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block3_pool (MaxPooling2D)  | (None, 18, 18, 256)   |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv1 (Conv2D)       | (None, 18, 18, 512)   |  1,180,160 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv2 (Conv2D)       | (None, 18, 18, 512)   |  2,359,808 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_conv3 (Conv2D)       | (None, 18, 18, 512)   |  2,359,808 |   Y   |
## +-----------------------------+-----------------------+------------+-------+
## | block4_pool (MaxPooling2D)  | (None, 9, 9, 512)     |          0 |   -   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv1 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv2 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_conv3 (Conv2D)       | (None, 9, 9, 512)     |  2,359,808 |   N   |
## +-----------------------------+-----------------------+------------+-------+
## | block5_pool (MaxPooling2D)  | (None, 4, 4, 512)     |          0 |   -   |
```

```
## +-----------------------------+-----------------------+-----------+-------+
##  Total params: 14,714,688 (56.13 MB)
##  Trainable params: 7,635,264 (29.13 MB)
##  Non-trainable params: 7,079,424 (27.01 MB)


# Freeze only layers of a certain type, e.g, BatchNorm layers
batch_norm_layer_class_name <- class(layer_batch_normalization())[1]
is_batch_norm_layer <- function(x) inherits(x, batch_norm_layer_class_name)

model <- application_efficientnet_b0()
freeze_weights(model, which = is_batch_norm_layer)
# print(model)

# equivalent to:
for(layer in model$layers) {
  if(is_batch_norm_layer(layer))
    layer$trainable <- FALSE
  else
    layer$trainable <- TRUE
}
```

Note

The `from` and `to` layer arguments are both inclusive.

When applied to a model, the freeze or unfreeze is a global operation over all layers in the model (i.e. layers not within the specified range will be set to the opposite value, e.g. unfrozen for a call to freeze).

Models must be compiled again after weights are frozen or unfrozen.

---

get_config — *Layer/Model configuration*

Description

A layer config is an object returned from `get_config()` that contains the configuration of a layer or model. The same layer or model can be reinstantiated later (without its trained weights) from this configuration using `from_config()`. The config does not include connectivity information, nor the class name (those are handled externally).

Usage

```
get_config(object)

from_config(config, custom_objects = NULL)
```

Arguments

`object`	Layer or model object
`config`	Object with layer or model configuration
`custom_objects`	list of custom objects needed to instantiate the layer, e.g., custom layers defined by `new_layer_class()` or similar.

Value

`get_config()` returns an object with the configuration, `from_config()` returns a re-instantiation of the object.

Note

Objects returned from `get_config()` are not serializable via RDS. If you want to save and restore a model across sessions, you can use `save_model_config()` (for model configuration only, not weights) or `save_model()` to save the model configuration and weights to the filesystem.

See Also

Other model functions:
`get_layer()`
`get_state_tree()`
`keras_model()`
`keras_model_sequential()`
`pop_layer()`
`set_state_tree()`
`summary.keras.src.models.model.Model()`

Other layer methods:
`count_params()`
`get_weights()`
`quantize_weights()`
`reset_state()`

`get_custom_objects` *Get/set the currently registered custom objects.*

Description

Custom objects set using `custom_object_scope()` are not added to the global list of custom objects, and will not appear in the returned list.

Usage

```
get_custom_objects()

set_custom_objects(objects = named_list(), clear = TRUE)
```

Arguments

`objects`	A named list of custom objects, as returned by `get_custom_objects()` and `set_custom_objects()`.
`clear`	bool, whether to clear the custom object registry before populating it with `objects`.

Value

An R named list mapping registered names to registered objects. `set_custom_objects()` returns the registry values before updating, invisibly.

Examples

```
get_custom_objects()
```

You can use `set_custom_objects()` to restore a previous registry state.

```
# within a function, if you want to temporarily modify the registry,
function() {
  orig_objects <- set_custom_objects(clear = TRUE)
  on.exit(set_custom_objects(orig_objects))

  ## temporarily modify the global registry
  # register_keras_serializable(....)
  # ....  <do work>
  # on.exit(), the previous registry state is restored.
}
```

Note

`register_keras_serializable()` is preferred over `set_custom_objects()` for registering new objects.

See Also

Other serialization utilities:
`deserialize_keras_object()`
`get_registered_name()`
`get_registered_object()`
`register_keras_serializable()`
`serialize_keras_object()`
`with_custom_object_scope()`

get_file — *Downloads a file from a URL if it not already in the cache.*

Description

By default the file at the url `origin` is downloaded to the cache_dir `~/.keras`, placed in the cache_subdir `datasets`, and given the filename `fname`. The final location of a file `example.txt` would therefore be `~/.keras/datasets/example.txt`. Files in `.tar`, `.tar.gz`, `.tar.bz`, and `.zip` formats can also be extracted.

Passing a hash will verify the file after download. The command line programs `shasum` and `sha256sum` can compute the hash.

Usage

```
get_file(
  fname = NULL,
  origin = NULL,
  ...,
  file_hash = NULL,
  cache_subdir = "datasets",
  hash_algorithm = "auto",
  extract = FALSE,
  archive_format = "auto",
  cache_dir = NULL,
  force_download = FALSE
)
```

Arguments

`fname`	If the target is a single file, this is your desired local name for the file. If `NULL`, the name of the file at `origin` will be used. If downloading and extracting a directory archive, the provided `fname` will be used as extraction directory name (only if it doesn't have an extension).
`origin`	Original URL of the file.
`...`	For forward/backward compatability.
`file_hash`	The expected hash string of the file after download. The sha256 and md5 hash algorithms are both supported.
`cache_subdir`	Subdirectory under the Keras cache dir where the file is saved. If an absolute path, e.g. `"/path/to/folder"` is specified, the file will be saved at that location.
`hash_algorithm`	Select the hash algorithm to verify the file. options are `"md5'`, `"sha256'`, and `"auto'`. The default 'auto' detects the hash algorithm in use.
`extract`	If `TRUE`, extracts the archive. Only applicable to compressed archive files like tar or zip.

archive_format	Archive format to try for extracting the file. Options are "auto', "tar', "zip', and NULL. "tar" includes tar, tar.gz, and tar.bz files. The default "auto" corresponds to c("tar", "zip"). NULL or an empty list will return no matches found.
cache_dir	Location to store cached files, when NULL it defaults to Sys.getenv("KERAS_HOME", "~/.keras/").
force_download	If TRUE, the file will always be re-downloaded regardless of the cache state.

Value

Path to the downloaded file.

** Warning on malicious downloads **

Downloading something from the Internet carries a risk. NEVER download a file/archive if you do not trust the source. We recommend that you specify the file_hash argument (if the hash of the source file is known) to make sure that the file you are getting is the one you expect.

Examples

```
path_to_downloaded_file <- get_file(
    "flower_photos",
   origin = "https://storage.googleapis.com/download.tensorflow.org/example_images/flower_photos.tgz
    extract = TRUE
)
```

See Also

- https://keras.io/api/utils/python_utils#getfile-function

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()

text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

get_layer — *Retrieves a layer based on either its name (unique) or index.*

Description

Indices are based on order of horizontal graph traversal (bottom-up) and are 1-based. If name and index are both provided, index will take precedence.

Usage

```
get_layer(object, name = NULL, index = NULL)
```

Arguments

object	Keras model object
name	String, name of layer.
index	Integer, index of layer (1-based). Also valid are negative values, which count from the end of model.

Value

A layer instance.

See Also

Other model functions:
get_config()
get_state_tree()
keras_model()
keras_model_sequential()
pop_layer()
set_state_tree()
summary.keras.src.models.model.Model()

get_registered_name — *Returns the name registered to an object within the Keras framework.*

Description

This function is part of the Keras serialization and deserialization framework. It maps objects to the string names associated with those objects for serialization/deserialization.

Usage

```
get_registered_name(obj)
```

Arguments

obj	The object to look up.

Value

The name associated with the object, or the default name if the object is not registered.

See Also

Other serialization utilities:
deserialize_keras_object()
get_custom_objects()
get_registered_object()
register_keras_serializable()
serialize_keras_object()
with_custom_object_scope()

get_registered_object — *Returns the class associated with* name *if it is registered with Keras.*

Description

This function is part of the Keras serialization and deserialization framework. It maps strings to the objects associated with them for serialization/deserialization.

Usage

```
get_registered_object(name, custom_objects = NULL, module_objects = NULL)
```

Arguments

`name`	The name to look up.
`custom_objects`	A named list of custom objects to look the name up in. Generally, custom_objects is provided by the user.
`module_objects`	A named list of custom objects to look the name up in. Generally, `module_objects` is provided by midlevel library implementers.

Value

An instantiable class associated with `name`, or `NULL` if no such class exists.

Examples

```
from_config <- function(cls, config, custom_objects = NULL) {
  if ('my_custom_object_name' \%in\% names(config)) {
    config$hidden_cls <- get_registered_object(
      config$my_custom_object_name,
      custom_objects = custom_objects)
  }
}
```

See Also

Other serialization utilities:
`deserialize_keras_object()`
`get_custom_objects()`
`get_registered_name()`
`register_keras_serializable()`
`serialize_keras_object()`
`with_custom_object_scope()`

`get_source_inputs` *Returns the list of input tensors necessary to compute* `tensor`.

Description

Output will always be a list of tensors (potentially with 1 element).

Usage

```
get_source_inputs(tensor)
```

Arguments

`tensor`	The tensor to start from.

Value

List of input tensors.

Example

```
input <- keras_input(c(3))
output <- input |> layer_dense(4) |> op_multiply(5)
reticulate::py_id(get_source_inputs(output)[[1]]) ==
reticulate::py_id(input)
```

```
## [1] TRUE
```

See Also

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

`get_state_tree` *Retrieves tree-like structure of model variables.*

Description

This method allows retrieval of different model variables (trainable, non-trainable, optimizer, and metrics). The variables are returned in a nested dictionary format, where the keys correspond to the variable names and the values are the nested representations of the variables.

Usage

```
get_state_tree(object, value_format = "backend_tensor")
```

Arguments

`object`	A Keras Model.
`value_format`	One of `"backend_tensor"`, `"numpy_array"`, `"array"`. The kind of array to return as the leaves of the nested state tree.

Value

A named list containing the nested representations of the requested variables. The names are the variable names, and the values are the corresponding nested named lists.

Examples

```
model <- keras_model_sequential(name = "my_sequential",
                                input_shape = c(1),
                                input_name = "my_input") |>
  layer_dense(1, activation = "sigmoid", name = "my_dense")

model |> compile(optimizer="adam", loss="mse", metrics=c("mae"))
model |> fit(matrix(1), matrix(1), verbose = 0)
state_tree <- model |> get_state_tree()
```

The `state_tree` list returned looks like:

```
list(
  metrics_variables = list(
    loss = list(
      count = ...,
      total = ...
    ),
    mean_absolute_error = list(
      count = ...,
      total = ...
    )
  ),
  trainable_variables = list(
    my_sequential = list(
      my_dense = list(
        bias = ...,
        kernel = ...
```

```
    )
  )
),
non_trainable_variables = list(),
optimizer_variables = list(
  adam = list(
    iteration = ...,
    learning_rate = ...,
    my_sequential_my_dense_bias_momentum = ...,
    my_sequential_my_dense_bias_velocity = ...,
    my_sequential_my_dense_kernel_momentum = ...,
    my_sequential_my_dense_kernel_velocity = ...
  )
)
)
```

For example:

```
str(state_tree)
```

```
## List of 4
##  $ trainable_variables    :List of 1
##   ..$ my_sequential:List of 1
##   .. ..$ my_dense:List of 2
##  .. .. ..$ kernel:<tf.Variable 'my_sequential/my_dense/kernel:0' shape=(1, 1) dtype=float32, numpy=
##  .. .. ..$ bias  :<tf.Variable 'my_sequential/my_dense/bias:0' shape=(1) dtype=float32, numpy=array
##  $ non_trainable_variables: Named list()
##  $ optimizer_variables    :List of 1
##   ..$ adam:List of 6
##  .. ..$ iteration                   :<tf.Variable 'adam/iteration:0' shape=() dtype=int64, numpy=1
##  .. ..$ learning_rate                :<tf.Variable 'adam/learning_rate:0' shape=() dtype=float32,
##  .. ..$ my_sequential_my_dense_kernel_momentum:<tf.Variable 'adam/my_sequential_my_dense_kernel_m
##  .. ..$ my_sequential_my_dense_kernel_velocity:<tf.Variable 'adam/my_sequential_my_dense_kernel_v
##  .. ..$ my_sequential_my_dense_bias_momentum  :<tf.Variable 'adam/my_sequential_my_dense_bias_mome
##  .. ..$ my_sequential_my_dense_bias_velocity  :<tf.Variable 'adam/my_sequential_my_dense_bias_velo
##  $ metrics_variables      :List of 2
##   ..$ loss               :List of 2
##  .. ..$ total:<tf.Variable 'loss/total:0' shape=() dtype=float32, numpy=0.4863377809524536>
##   .. ..$ count:<tf.Variable 'loss/count:0' shape=() dtype=float32, numpy=1.0>
##   ..$ mean_absolute_error:List of 2
##  .. ..$ total:<tf.Variable 'mean_absolute_error/total:0' shape=() dtype=float32, numpy=0.697379231
##  .. ..$ count:<tf.Variable 'mean_absolute_error_1/count:0' shape=() dtype=float32, numpy=1.0>
```

See Also

Other model functions:
get_config()
get_layer()

keras_model()
keras_model_sequential()
pop_layer()
set_state_tree()
summary.keras.src.models.model.Model()

---

get_weights *Layer/Model weights as R arrays*

Description

Layer/Model weights as R arrays

Usage

```
get_weights(object, trainable = NA)

set_weights(object, weights)
```

Arguments

object	Layer or model object
trainable	if NA (the default), all weights are returned. If TRUE, only weights of trainable variables are returned. If FALSE, only weights of non-trainable variables are returned.
weights	Weights as R array

Value

A list of R arrays.

Note

You can access the Layer/Model as KerasVariables (which are also backend-native tensors like tf.Variable) at object$weights, object$trainable_weights, or object$non_trainable_weights

See Also

Other layer methods:
count_params()
get_config()
quantize_weights()
reset_state()

`image_array_save` *Saves an image stored as an array to a path or file object.*

Description

Saves an image stored as an array to a path or file object.

Usage

```
image_array_save(
  x,
  path,
  data_format = NULL,
  file_format = NULL,
  scale = TRUE,
  ...
)
```

Arguments

`x`	An array.
`path`	Path or file object.
`data_format`	Image data format, either `"channels_first"` or `"channels_last"`.
`file_format`	Optional file format override. If omitted, the format to use is determined from the filename extension. If a file object was used instead of a filename, this parameter should always be used.
`scale`	Whether to rescale image values to be within `[0, 255]`.
`...`	Additional keyword arguments passed to `PIL.Image.save()`.

Value

Called primarily for side effects. The input `x` is returned, invisibly, to enable usage with the pipe.

See Also

- https://keras.io/api/data_loading/image#saveimg-function

Other image utils:
`image_from_array()`
`image_load()`
`image_smart_resize()`
`image_to_array()`
`op_image_affine_transform()`
`op_image_crop()`
`op_image_extract_patches()`
`op_image_gaussian_blur()`

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

`image_dataset_from_directory`

Generates a `tf.data.Dataset` *from image files in a directory.*

Description

If your directory structure is:

```
main_directory/
...class_a/
......a_image_1.jpg
```

```
......a_image_2.jpg
...class_b/
......b_image_1.jpg
......b_image_2.jpg
```

Then calling `image_dataset_from_directory(main_directory, labels = 'inferred')` will return a `tf.data.Dataset` that yields batches of images from the subdirectories `class_a` and `class_b`, together with labels 0 and 1 (0 corresponding to `class_a` and 1 corresponding to `class_b`).

Supported image formats: `.jpeg`, `.jpg`, `.png`, `.bmp`, `.gif`. Animated gifs are truncated to the first frame.

Usage

```
image_dataset_from_directory(
  directory,
  labels = "inferred",
  label_mode = "int",
  class_names = NULL,
  color_mode = "rgb",
  batch_size = 32L,
  image_size = c(256L, 256L),
  shuffle = TRUE,
  seed = NULL,
  validation_split = NULL,
  subset = NULL,
  interpolation = "bilinear",
  follow_links = FALSE,
  crop_to_aspect_ratio = FALSE,
  pad_to_aspect_ratio = FALSE,
  data_format = NULL,
  verbose = TRUE
)
```

Arguments

`directory`	Directory where the data is located. If `labels` is `"inferred"`, it should contain subdirectories, each containing images for a class. Otherwise, the directory structure is ignored.
`labels`	Either `"inferred"` (labels are generated from the directory structure), `NULL` (no labels), or a list/tuple of integer labels of the same size as the number of image files found in the directory. Labels should be sorted according to the alphanumeric order of the image file paths (obtained via `os.walk(directory)` in Python).
`label_mode`	String describing the encoding of `labels`. Options are: • `"int"`: means that the labels are encoded as integers (e.g. for `sparse_categorical_crossentropy` loss). • `"categorical"` means that the labels are encoded as a categorical vector (e.g. for `categorical_crossentropy` loss).

- "binary" means that the labels (there can be only 2) are encoded as float32 scalars with values 0 or 1 (e.g. for binary_crossentropy).
- NULL (no labels).

class_names Only valid if labels is "inferred". This is the explicit list of class names (must match names of subdirectories). Used to control the order of the classes (otherwise alphanumerical order is used).

color_mode One of "grayscale", "rgb", "rgba". Whether the images will be converted to have 1, 3, or 4 channels. Defaults to "rgb".

batch_size Size of the batches of data. Defaults to 32. If NULL, the data will not be batched (the dataset will yield individual samples).

image_size Size to resize images to after they are read from disk, specified as (height, width). Since the pipeline processes batches of images that must all have the same size, this must be provided. Defaults to (256, 256).

shuffle Whether to shuffle the data. Defaults to TRUE. If set to FALSE, sorts the data in alphanumeric order.

seed Optional random seed for shuffling and transformations.

validation_split
Optional float between 0 and 1, fraction of data to reserve for validation.

subset Subset of the data to return. One of "training", "validation", or "both". Only used if validation_split is set. When subset = "both", the utility returns a tuple of two datasets (the training and validation datasets respectively).

interpolation String, the interpolation method used when resizing images. Supports "bilinear", "nearest", "bicubic", "area", "lanczos3", "lanczos5", "gaussian", "mitchellcubic". Defaults to "bilinear".

follow_links Whether to visit subdirectories pointed to by symlinks. Defaults to FALSE.

crop_to_aspect_ratio
If TRUE, resize the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be cropped so as to return the largest possible window in the image (of size image_size) that matches the target aspect ratio. By default (crop_to_aspect_ratio = FALSE), aspect ratio may not be preserved.

pad_to_aspect_ratio
If TRUE, resize the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be padded so as to return the largest possible window in the image (of size image_size) that matches the target aspect ratio. By default (pad_to_aspect_ratio=FALSE), aspect ratio may not be preserved.

data_format If NULL uses config_image_data_format() otherwise either 'channel_last' or 'channel_first'.

verbose Whether to display number information on classes and number of files found. Defaults to TRUE.

Value

A tf.data.Dataset object.

- If `label_mode` is `NULL`, it yields `float32` tensors of shape `(batch_size, image_size[1], image_size[2], num_cha`
  encoding images (see below for rules regarding `num_channels`).
- Otherwise, it yields a tuple `(images, labels)`, where `images` has shape `(batch_size, image_size[1], image_size`
  and `labels` follows the format described below.

Rules regarding labels format:

- if `label_mode` is `"int"`, the labels are an `int32` tensor of shape `(batch_size,)`.
- if `label_mode` is `"binary"`, the labels are a `float32` tensor of 1s and 0s of shape `(batch_size, 1)`.
- if `label_mode` is `"categorical"`, the labels are a `float32` tensor of shape `(batch_size, num_classes)`, representing a one-hot encoding of the class index.

Rules regarding number of channels in the yielded images:

- if `color_mode` is `"grayscale"`, there's 1 channel in the image tensors.
- if `color_mode` is `"rgb"`, there are 3 channels in the image tensors.
- if `color_mode` is `"rgba"`, there are 4 channels in the image tensors.

See Also

- https://keras.io/api/data_loading/image#imagedatasetfromdirectory-function

Other dataset utils:
`audio_dataset_from_directory()`
`split_dataset()`
`text_dataset_from_directory()`
`timeseries_dataset_from_array()`

Other utils:
`audio_dataset_from_directory()`
`clear_session()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`get_file()`
`get_source_inputs()`
`image_array_save()`
`image_from_array()`
`image_load()`
`image_smart_resize()`
`image_to_array()`
`layer_feature_space()`
`normalize()`
`pad_sequences()`
`set_random_seed()`
`split_dataset()`

text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other preprocessing:
image_smart_resize()
text_dataset_from_directory()
timeseries_dataset_from_array()

---

image_from_array *Converts a 3D array to a PIL Image instance.*

Description

Converts a 3D array to a PIL Image instance.

Usage

```
image_from_array(x, data_format = NULL, scale = TRUE, dtype = NULL)
```

Arguments

x	Input data, in any form that can be converted to an array.
data_format	Image data format, can be either "channels_first" or "channels_last". Defaults to NULL, in which case the global setting config_image_data_format() is used (unless you changed it, it defaults to "channels_last").
scale	Whether to rescale the image such that minimum and maximum values are 0 and 255 respectively. Defaults to TRUE.
dtype	Dtype to use. NULL means the global setting config_floatx() is used (unless you changed it, it defaults to "float32"). Defaults to NULL.

Value

A PIL Image instance.

Example

```
img <- array(runif(30000), dim = c(100, 100, 3))
pil_img <- image_from_array(img)
pil_img
```

```
## <PIL.Image.Image image mode=RGB size=100x100 at 0x0>
```

See Also

Other image utils:
image_array_save()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

image_load *Loads an image into PIL format.*

Description

Loads an image into PIL format.

Usage

```
image_load(
  path,
  color_mode = "rgb",
  target_size = NULL,
  interpolation = "nearest",
  keep_aspect_ratio = FALSE
)
```

Arguments

path	Path to image file.
color_mode	One of "grayscale", "rgb", "rgba". Default: "rgb". The desired image format.
target_size	Either NULL (default to original size) or tuple of ints (img_height, img_width).
interpolation	Interpolation method used to resample the image if the target size is different from that of the loaded image. Supported methods are "nearest", "bilinear", and "bicubic". If PIL version 1.1.3 or newer is installed, "lanczos" is also supported. If PIL version 3.4.0 or newer is installed, "box" and "hamming" are also supported. By default, "nearest" is used.
keep_aspect_ratio	Boolean, whether to resize images to a target size without aspect ratio distortion. The image is cropped in the center with target aspect ratio before resizing.

Value

A PIL Image instance.

Example

```
image_path <- get_file(origin = "https://www.r-project.org/logo/Rlogo.png")
(image <- image_load(image_path))

## <PIL.Image.Image image mode=RGB size=724x561 at 0x0>


input_arr <- image_to_array(image)
str(input_arr)
```

```
##  num [1:561, 1:724, 1:3] 0 0 0 0 0 0 0 0 0 0 ...


input_arr %<>% array_reshape(dim = c(1, dim(input_arr))) # Convert single image to a batch.

model |> predict(input_arr)
```

See Also

- https://keras.io/api/data_loading/image#loadimg-function

Other image utils:
image_array_save()
image_from_array()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()

text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

image_smart_resize *Resize images to a target size without aspect ratio distortion.*

Description

Image datasets typically yield images that have each a different size. However, these images need to be batched before they can be processed by Keras layers. To be batched, images need to share the same height and width.

You could simply do, in TF (or JAX equivalent):

```
size <- c(200, 200)
ds <- ds$map(\(img) tf$image$resize(img, size))
```

However, if you do this, you distort the aspect ratio of your images, since in general they do not all have the same aspect ratio as `size`. This is fine in many cases, but not always (e.g. for image generation models this can be a problem).

Note that passing the argument `preserve_aspect_ratio = TRUE` to `tf$image$resize()` will preserve the aspect ratio, but at the cost of no longer respecting the provided target size.

This calls for:

```
size <- c(200, 200)
ds <- ds$map(\(img) image_smart_resize(img, size))
```

Your output images will actually be `(200, 200)`, and will not be distorted. Instead, the parts of the image that do not fit within the target size get cropped out.

The resizing process is:

1. Take the largest centered crop of the image that has the same aspect ratio as the target size. For instance, if `size = c(200, 200)` and the input image has size `(340, 500)`, we take a crop of `(340, 340)` centered along the width.
2. Resize the cropped image to the target size. In the example above, we resize the `(340, 340)` crop to `(200, 200)`.

Usage

```
image_smart_resize(
  x,
  size,
  interpolation = "bilinear",
  data_format = "channels_last",
  backend_module = NULL
)
```

Arguments

x	Input image or batch of images (as a tensor or array). Must be in format (height, width, channels) or (batch_size, height, width, channels).
size	Tuple of (height, width) integer. Target size.
interpolation	String, interpolation to use for resizing. Supports "bilinear", "nearest", "bicubic", "lanczos3", "lanczos5". Defaults to 'bilinear'.
data_format	"channels_last" or "channels_first".
backend_module	Backend module to use (if different from the default backend).

Value

Array with shape (size[1], size[2], channels). If the input image was an array, the output is an array, and if it was a backend-native tensor, the output is a backend-native tensor.

See Also

Other image utils:
image_array_save()
image_from_array()
image_load()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()

image_load()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

Other preprocessing:
image_dataset_from_directory()
text_dataset_from_directory()
timeseries_dataset_from_array()

---

image_to_array *Converts a PIL Image instance to a matrix.*

Description

Converts a PIL Image instance to a matrix.

Usage

```
image_to_array(img, data_format = NULL, dtype = NULL)
```

Arguments

img	Input PIL Image instance.
data_format	Image data format, can be either "channels_first" or "channels_last". Defaults to NULL, in which case the global setting config_image_data_format() is used (unless you changed it, it defaults to "channels_last").
dtype	Dtype to use. NULL and "double" return an R double array. "integer" returns an R integer array. All other values (e.g., "float32") return a NumPy array.

Value

A 3D array.

Example

```
image_path <- get_file(origin = "https://www.r-project.org/logo/Rlogo.png")
(img <- image_load(image_path))

## <PIL.Image.Image image mode=RGB size=724x561 at 0x0>


array <- image_to_array(img)
str(array)

##  num [1:561, 1:724, 1:3] 0 0 0 0 0 0 0 0 0 0 ...
```

See Also

- https://keras.io/api/data_loading/image#imgtoarray-function

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()

image_load()
image_smart_resize()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

initializer_constant *Initializer that generates tensors with constant values.*

Description

Only scalar values are allowed. The constant value provided must be convertible to the dtype requested when calling the initializer.

Usage

```
initializer_constant(value = 0)
```

Arguments

value	A numeric scalar.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_constant(10)
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_constant(10)
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#constant-class

Other constant initializers:
initializer_identity()
initializer_ones()
initializer_stft()
initializer_zeros()

Other initializers:
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_glorot_normal

The Glorot normal initializer, also called Xavier normal initializer.

Description

Draws samples from a truncated normal distribution centered on 0 with `stddev = sqrt(2 / (fan_in + fan_out))` where `fan_in` is the number of input units in the weight tensor and `fan_out` is the number of output units in the weight tensor.

Usage

```
initializer_glorot_normal(seed = NULL)
```

Arguments

seed	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_glorot_normal()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_glorot_normal()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- Glorot et al., 2010

See Also

- `https://keras.io/api/layers/initializers#glorotnormal-class`

Other random initializers:
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`

Other initializers:
`initializer_constant()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_ones()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_stft()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`

`initializer_zeros()`

`initializer_glorot_uniform` *The Glorot uniform initializer, also called Xavier uniform initializer.*

Description

Draws samples from a uniform distribution within `[-limit, limit]`, where `limit = sqrt(6 / (fan_in + fan_out))` (`fan_in` is the number of input units in the weight tensor and `fan_out` is the number of output units).

Usage

```
initializer_glorot_uniform(seed = NULL)
```

Arguments

`seed`	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_glorot_uniform()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_glorot_uniform()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- Glorot et al., 2010

See Also

- https://keras.io/api/layers/initializers#glorotuniform-class

Other random initializers:
initializer_glorot_normal()
initializer_he_normal()
initializer_he_uniform()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_he_normal *He normal initializer.*

Description

It draws samples from a truncated normal distribution centered on 0 with `stddev = sqrt(2 / fan_in)` where `fan_in` is the number of input units in the weight tensor.

Usage

```
initializer_he_normal(seed = NULL)
```

Arguments

seed	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_he_normal()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_he_normal()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- He et al., 2015

See Also

- `https://keras.io/api/layers/initializers#henormal-class`

Other random initializers:
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`

initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_he_uniform

He uniform variance scaling initializer.

Description

Draws samples from a uniform distribution within [-limit, limit], where limit = sqrt(6 / fan_in) (fan_in is the number of input units in the weight tensor).

Usage

```
initializer_he_uniform(seed = NULL)
```

Arguments

seed	A integer or instance of random_seed_generator(). Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or NULL (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of random_seed_generator().

Value

An Initializer instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_he_uniform()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_he_uniform()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- He et al., 2015

See Also

- https://keras.io/api/layers/initializers#heuniform-class

Other random initializers:
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_identity — *Initializer that generates the identity matrix.*

Description

Only usable for generating 2D matrices.

Usage

```
initializer_identity(gain = 1)
```

Arguments

`gain`	Multiplicative factor to apply to the identity matrix.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_identity()
values <- initializer(shape = c(2, 2))


# Usage in a Keras layer:
initializer <- initializer_identity()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

Other constant initializers:
`initializer_constant()`
`initializer_ones()`
`initializer_stft()`
`initializer_zeros()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_ones()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_stft()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`
`initializer_zeros()`

`initializer_lecun_normal`

Lecun normal initializer.

Description

Initializers allow you to pre-specify an initialization strategy, encoded in the Initializer object, without knowing the shape and dtype of the variable being initialized.

Draws samples from a truncated normal distribution centered on 0 with `stddev = sqrt(1 / fan_in)` where `fan_in` is the number of input units in the weight tensor.

Usage

```
initializer_lecun_normal(seed = NULL)
```

Arguments

`seed`	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a `shape` to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_lecun_normal()
values <- initializer(shape = c(2, 2))


# Usage in a Keras layer:
initializer <- initializer_lecun_normal()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- Klambauer et al., 2017

See Also

Other random initializers:
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_lecun_uniform

Lecun uniform initializer.

Description

Draws samples from a uniform distribution within `[-limit, limit]`, where `limit = sqrt(3 / fan_in)` (`fan_in` is the number of input units in the weight tensor).

Usage

```
initializer_lecun_uniform(seed = NULL)
```

Arguments

seed — An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_lecun_uniform()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_lecun_uniform()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- Klambauer et al., 2017

See Also

Other random initializers:
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`

initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_ones   *Initializer that generates tensors initialized to 1.*

Description

Also available via the shortcut function ones.

Usage

```
initializer_ones()
```

Value

An Initializer instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_ones()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_ones()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#ones-class

Other constant initializers:
initializer_constant()
initializer_identity()
initializer_stft()
initializer_zeros()

Other initializers:
initializer_constant()

initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

`initializer_orthogonal` *Initializer that generates an orthogonal matrix.*

Description

If the shape of the tensor to initialize is two-dimensional, it is initialized with an orthogonal matrix obtained from the QR decomposition of a matrix of random numbers drawn from a normal distribution. If the matrix has fewer rows than columns then the output will have orthogonal rows. Otherwise, the output will have orthogonal columns.

If the shape of the tensor to initialize is more than two-dimensional, a matrix of shape `(shape[1] * ... * shape[n - 1], sha` is initialized, where `n` is the length of the shape vector. The matrix is subsequently reshaped to give a tensor of the desired shape.

Usage

```
initializer_orthogonal(gain = 1, seed = NULL)
```

Arguments

`gain`	Multiplicative factor to apply to the orthogonal matrix.
`seed`	An integer. Used to make the behavior of the initializer deterministic.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a `shape` to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_orthogonal()
values <- initializer(shape = c(2, 2))


# Usage in a Keras layer:
initializer <- initializer_orthogonal()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

Reference

- Saxe et al., 2014

See Also

Other random initializers:
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

`initializer_random_normal`
Random normal initializer.

Description

Draws samples from a normal distribution for given parameters.

Usage

```
initializer_random_normal(mean = 0, stddev = 0.05, seed = NULL)
```

Arguments

mean	A numeric scalar. Mean of the random values to generate.
stddev	A numeric scalar. Standard deviation of the random values to generate.
seed	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_random_normal(mean = 0.0, stddev = 1.0)
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_random_normal(mean = 0.0, stddev = 1.0)
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#randomnormal-class

Other random initializers:
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`

initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

---

initializer_random_uniform
Random uniform initializer.

Description

Draws samples from a uniform distribution for given parameters.

Usage

```
initializer_random_uniform(minval = -0.05, maxval = 0.05, seed = NULL)
```

Arguments

minval	A numeric scalar or a scalar keras tensor. Lower bound of the range of random values to generate (inclusive).
maxval	A numeric scalar or a scalar keras tensor. Upper bound of the range of random values to generate (exclusive).
seed	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_random_uniform(minval = 0.0, maxval = 1.0)
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_random_uniform(minval = 0.0, maxval = 1.0)
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#randomuniform-class

Other random initializers:
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_ones()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_stft()`
`initializer_truncated_normal()`
`initializer_variance_scaling()`
`initializer_zeros()`

`initializer_stft` *Initializer of Conv kernels for Short-term Fourier Transformation (STFT).*

Description

Since the formula involves complex numbers, this class compute either the real or the imaginary components of the final output.

Additionally, this initializer supports windowing functions across the time dimension as commonly used in STFT. Windowing functions from the Python module `scipy.signal.windows` are supported, including the common `hann` and `hamming` windowing functions. This layer supports periodic windows and scaling-based normalization.

This is primarily intended for use in the `STFTSpectrogram` layer.

Usage

```
initializer_stft(
  side = "real",
  window = "hann",
  scaling = "density",
  periodic = FALSE
)
```

Arguments

`side`	String, `"real"` or `"imag"` deciding if the kernel will compute the real side or the imaginary side of the output. Defaults to `"real"`.
`window`	String for the name of the windowing function in the `scipy.signal.windows` module, or array_like for the window values, or `NULL` for no windowing.
`scaling`	String, `"density"` or `"spectrum"` for scaling of the window for normalization, either L2 or L1 normalization. `NULL` for no scaling.
`periodic`	Boolean, if True, the window function will be treated as periodic. Defaults to `FALSE`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_stft("real", "hann", "density", FALSE)
values <- initializer(shape = c(128, 1, 513))
```

See Also

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()
initializer_variance_scaling()
initializer_zeros()

Other constant initializers:
initializer_constant()
initializer_identity()
initializer_ones()
initializer_zeros()

---

initializer_truncated_normal

Initializer that generates a truncated normal distribution.

Description

The values generated are similar to values from a `RandomNormal` initializer, except that values more than two standard deviations from the mean are discarded and re-drawn.

Usage

```
initializer_truncated_normal(mean = 0, stddev = 0.05, seed = NULL)
```

Arguments

mean	A numeric scalar. Mean of the random values to generate.
stddev	A numeric scalar. Standard deviation of the random values to generate.
seed	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_truncated_normal(mean = 0, stddev = 1)
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_truncated_normal(mean = 0, stddev = 1)
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#truncatednormal-class

Other random initializers:
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_variance_scaling()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_ones()`
`initializer_orthogonal()`
`initializer_random_normal()`
`initializer_random_uniform()`
`initializer_stft()`
`initializer_variance_scaling()`
`initializer_zeros()`

initializer_variance_scaling
Initializer that adapts its scale to the shape of its input tensors.

Description

With `distribution = "truncated_normal" or "untruncated_normal"`, samples are drawn from a truncated/untruncated normal distribution with a mean of zero and a standard deviation (after truncation, if used) `stddev = sqrt(scale / n)`, where `n` is:

- number of input units in the weight tensor, if `mode = "fan_in"`
- number of output units, if `mode = "fan_out"`
- average of the numbers of input and output units, if `mode = "fan_avg"`

With `distribution = "uniform"`, samples are drawn from a uniform distribution within `[-limit, limit]`, where `limit = sqrt(3 * scale / n)`.

Usage

```
initializer_variance_scaling(
  scale = 1,
  mode = "fan_in",
  distribution = "truncated_normal",
  seed = NULL
)
```

Arguments

`scale`	Scaling factor (positive float).
`mode`	One of `"fan_in"`, `"fan_out"`, `"fan_avg"`.
`distribution`	Random distribution to use. One of `"truncated_normal"`, `"untruncated_normal"`, or `"uniform"`.
`seed`	An integer or instance of `random_seed_generator()`. Used to make the behavior of the initializer deterministic. Note that an initializer seeded with an integer or `NULL` (unseeded) will produce the same random values across multiple calls. To get different random values across multiple calls, use as seed an instance of `random_seed_generator()`.

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_variance_scaling(scale = 0.1, mode = 'fan_in',
                                            distribution = 'uniform')
values <- initializer(shape = c(2, 2))


# Usage in a Keras layer:
initializer <- initializer_variance_scaling(scale = 0.1, mode = 'fan_in',
                                            distribution = 'uniform')
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#variancescaling-class

Other random initializers:
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_truncated_normal()

Other initializers:
initializer_constant()
initializer_glorot_normal()
initializer_glorot_uniform()
initializer_he_normal()
initializer_he_uniform()
initializer_identity()
initializer_lecun_normal()
initializer_lecun_uniform()
initializer_ones()
initializer_orthogonal()
initializer_random_normal()
initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_zeros()

initializer_zeros *Initializer that generates tensors initialized to 0.*

Description

Initializer that generates tensors initialized to 0.

Usage

```
initializer_zeros()
```

Value

An `Initializer` instance that can be passed to layer or variable constructors, or called directly with a shape to return a Tensor.

Examples

```
# Standalone usage:
initializer <- initializer_zeros()
values <- initializer(shape = c(2, 2))

# Usage in a Keras layer:
initializer <- initializer_zeros()
layer <- layer_dense(units = 3, kernel_initializer = initializer)
```

See Also

- https://keras.io/api/layers/initializers#zeros-class

Other constant initializers:
`initializer_constant()`
`initializer_identity()`
`initializer_ones()`
`initializer_stft()`

Other initializers:
`initializer_constant()`
`initializer_glorot_normal()`
`initializer_glorot_uniform()`
`initializer_he_normal()`
`initializer_he_uniform()`
`initializer_identity()`
`initializer_lecun_normal()`
`initializer_lecun_uniform()`
`initializer_ones()`
`initializer_orthogonal()`
`initializer_random_normal()`

initializer_random_uniform()
initializer_stft()
initializer_truncated_normal()
initializer_variance_scaling()

---

install_keras *Install Keras*

Description

This function will install Keras along with a selected backend, including all Python dependencies.

Usage

```
install_keras(
  envname = "r-keras",
  ...,
  extra_packages = c("scipy", "pandas", "Pillow", "pydot", "ipython",
    "tensorflow_datasets"),
  python_version = ">=3.9,<=3.11",
  backend = c("tensorflow", "jax"),
  gpu = NA,
  restart_session = TRUE
)
```

Arguments

envname	Name of or path to a Python virtual environment
...	reserved for future compatibility.
extra_packages	Additional Python packages to install alongside Keras
python_version	Passed on to `reticulate::virtualenv_starter()`
backend	Which backend(s) to install. Accepted values include "tensorflow", "jax" and "torch"
gpu	whether to install a GPU capable version of the backend.
restart_session	Whether to restart the R session after installing (note this will only occur within RStudio).

Value

No return value, called for side effects.

See Also

tensorflow::install_tensorflow()

keras — *Main Keras module*

Description

The `keras` module object is the equivalent of `reticulate::import("keras")` and provided mainly as a convenience.

Format

An object of class `python.builtin.module`

Value

the keras Python module

keras_input — *Create a Keras tensor (Functional API input).*

Description

A Keras tensor is a symbolic tensor-like object, which we augment with certain attributes that allow us to build a Keras model just by knowing the inputs and outputs of the model.

For instance, if `a`, `b` and `c` are Keras tensors, it becomes possible to do: `model <- keras_model(input = c(a, b), output = c)`

Usage

```
keras_input(
  shape = NULL,
  batch_size = NULL,
  dtype = NULL,
  sparse = NULL,
  ragged = NULL,
  batch_shape = NULL,
  name = NULL,
  tensor = NULL,
  optional = FALSE
)
```

Arguments

`shape`	A shape list (list of integers or `NULL` objects), not including the batch size. For instance, `shape = c(32)` indicates that the expected input will be batches of 32-dimensional vectors. Elements of this list can be `NULL` or `NA`; `NULL`/`NA` elements represent dimensions where the shape is not known and may vary (e.g. sequence length).
`batch_size`	Optional static batch size (integer).
`dtype`	The data type expected by the input, as a string (e.g. `"float32"`, `"int32"`...)
`sparse`	A boolean specifying whether the expected input will be sparse tensors. Note that, if `sparse` is `FALSE`, sparse tensors can still be passed into the input - they will be densified with a default value of 0. This feature is only supported with the TensorFlow backend. Defaults to `FALSE`.
`ragged`	A boolean specifying whether the expected input will be ragged tensors. Note that, if `ragged` is `FALSE`, ragged tensors can still be passed into the input - they will be densified with a default value of 0. This feature is only supported with the TensorFlow backend. Defaults to `FALSE`.
`batch_shape`	Optional shape list (list of integers or `NULL` objects), including the batch size.
`name`	Optional name string for the layer. Should be unique in a model (do not reuse the same name twice). It will be autogenerated if it isn't provided.
`tensor`	Optional existing tensor to wrap into the `Input` layer. If set, the layer will use this tensor rather than creating a new placeholder tensor.
`optional`	Boolean, whether the input is optional or not. An optional input can accept `NULL` values.

Value

A Keras tensor, which can passed to the `inputs` argument of (`keras_model()`).

Examples

```
# This is a logistic regression in Keras
input <- layer_input(shape=c(32))
output <- input |> layer_dense(16, activation='softmax')
model <- keras_model(input, output)
```

See Also

Other model creation:
`keras_model()`
`keras_model_sequential()`

keras_model *Keras Model (Functional API)*

Description

A model is a directed acyclic graph of layers.

Usage

```
keras_model(inputs = NULL, outputs = NULL, ...)
```

Arguments

inputs	Input tensor(s) (from keras_input())
outputs	Output tensors (from calling layers with inputs)
...	Any additional arguments

Value

A Model instance.

Examples

```
library(keras3)

# input tensor
inputs <- keras_input(shape = c(784))

# outputs compose input + dense layers
predictions <- inputs |>
  layer_dense(units = 64, activation = 'relu') |>
  layer_dense(units = 64, activation = 'relu') |>
  layer_dense(units = 10, activation = 'softmax')

# create and compile model
model <- keras_model(inputs = inputs, outputs = predictions)
model |> compile(
  optimizer = 'rmsprop',
  loss = 'categorical_crossentropy',
  metrics = c('accuracy')
)
```

See Also

Other model functions:
get_config()
get_layer()

get_state_tree()
keras_model_sequential()
pop_layer()
set_state_tree()
summary.keras.src.models.model.Model()

Other model creation:
keras_input()
keras_model_sequential()

---

keras_model_sequential   *Keras Model composed of a linear stack of layers*

Description

Keras Model composed of a linear stack of layers

Usage

```
keras_model_sequential(
  input_shape = NULL,
  name = NULL,
  ...,
  input_dtype = NULL,
  input_batch_size = NULL,
  input_sparse = NULL,
  input_ragged = NULL,
  input_batch_shape = NULL,
  input_name = NULL,
  input_tensor = NULL,
  input_optional = FALSE,
  trainable = TRUE,
  layers = list()
)
```

Arguments

input_shape	A shape integer vector, not including the batch size. For instance, shape=c(32) indicates that the expected input will be batches of 32-dimensional vectors. Elements of this shape can be NA; NA elements represent dimensions where the shape is not known and may vary (e.g. sequence length).
name	Name of model
...	additional arguments passed on to keras.layers.InputLayer.
input_dtype	The data type expected by the input, as a string (e.g. "float32", "int32"...)

input_batch_size
: Optional static batch size (integer).

input_sparse
: A boolean specifying whether the expected input will be sparse tensors. Note that, if sparse is FALSE, sparse tensors can still be passed into the input - they will be densified with a default value of 0. This feature is only supported with the TensorFlow backend. Defaults to FALSE.

input_ragged
: bool.

input_batch_shape
: An optional way to specify batch_size and input_shape as one argument.

input_name
: Optional name string for the input layer. Should be unique in a model (do not reuse the same name twice). It will be autogenerated if it isn't provided.

input_tensor
: Optional existing tensor to wrap into the InputLayer. If set, the layer will use this tensor rather than creating a new placeholder tensor.

input_optional
: Boolean, whether the input is optional or not. An optional input can accept NULL values.

trainable
: Boolean, whether the model's variables should be trainable. You can also change the trainable status of a model/layer with freeze_weights() and unfreeze_weights().

layers
: List of layers to add to the model.

Value

A Sequential model instance.

Examples

```
model <- keras_model_sequential(input_shape = c(784))
model |>
  layer_dense(units = 32) |>
  layer_activation('relu') |>
  layer_dense(units = 10) |>
  layer_activation('softmax')

model |> compile(
  optimizer = 'rmsprop',
  loss = 'categorical_crossentropy',
  metrics = c('accuracy')
)

model

## Model: "sequential"
## +---------------------------------+------------------------+---------------+
## | Layer (type)                    | Output Shape           |       Param # |
## +=================================+========================+===============+
## | dense (Dense)                   | (None, 32)             |        25,120 |
## +---------------------------------+------------------------+---------------+
## | activation (Activation)         | (None, 32)             |             0 |
```

```
## +--------------------------------+-----------------------+---------------+
## | dense_1 (Dense)                | (None, 10)            |           330 |
## +--------------------------------+-----------------------+---------------+
## | activation_1 (Activation)      | (None, 10)            |             0 |
## +--------------------------------+-----------------------+---------------+
##  Total params: 25,450 (99.41 KB)
##  Trainable params: 25,450 (99.41 KB)
##  Non-trainable params: 0 (0.00 B)
```

Note

If `input_shape` is omitted, then the model layer shapes, including the final model output shape, will not be known until the model is built, either by calling the model with an input tensor/array like `model(input)`, (possibly via `fit()`/`evaluate()`/`predict()`), or by explicitly calling `model$build(input_shape)`.

See Also

Other model functions:
`get_config()`
`get_layer()`
`get_state_tree()`
`keras_model()`
`pop_layer()`
`set_state_tree()`
`summary.keras.src.models.model.Model()`

Other model creation:
`keras_input()`
`keras_model()`

`keras_variable` *Represents a backend-agnostic variable in Keras.*

Description

A `Variable` acts as a container for state. It holds a tensor value and can be updated. With the JAX backend, variables are used to implement "functionalization", the pattern of lifting stateful operations out of a piece of computation to turn it into a stateless function.

Usage

```
keras_variable(
  initializer,
  shape = NULL,
  dtype = NULL,
```

```
  trainable = TRUE,
  autocast = TRUE,
  aggregation = "none",
  name = NULL
)
```

Arguments

initializer	Initial value or callable for initialization. If a callable is used, it should take the arguments shape and dtype.
shape	Optional. Tuple for the variable's shape. Required if initializer is a callable.
dtype	Optional. Data type of the variable. Defaults to the global float dtype type ("float32" if never configured).
trainable	Optional. Boolean indicating if variable is trainable. Defaults to TRUE.
autocast	Optional. Boolean indicating whether the variable supports autocasting. If TRUE, the layer may first convert the variable to the compute data type when accessed. Defaults to TRUE.
aggregation	Optional string, one of NULL, "none", "mean", "sum" or "only_first_replica" specifying how a distributed variable will be aggregated. This serves as a semantic annotation, to be taken into account by downstream backends or users. Defaults to "none".
name	Optional. A unique name for the variable. Automatically generated if not set.

Attributes

- shape: The shape of the variable (tuple of integers).
- ndim: The number of dimensions of the variable (integer).
- dtype: The data type of the variable (string).
- trainable: Whether the variable is trainable (boolean).
- autocast: Whether the variable supports autocasting (boolean).
- aggregation: How a distributed variable will be aggregated (string).
- value: The current value of the variable (NumPy array or tensor).
- name: The name of the variable (string).
- path: The path of the variable within the Keras model or layer (string).

Examples

Initializing a `Variable` with a NumPy array:

```
initial_array <- array(1, c(3, 3))
variable_from_array <- keras_variable(initializer = initial_array)
```

Using a Keras initializer to create a `Variable`:

```
variable_from_initializer <- keras_variable(
  initializer = initializer_ones(),
  shape = c(3, 3),
  dtype = "float32"
)

new_value <- array(0, c(3, 3))
variable_from_array$assign(new_value)

## tf.Tensor(
## [[0. 0. 0.]
##  [0. 0. 0.]
##  [0. 0. 0.]], shape=(3, 3), dtype=float64)


# To modify a subset of values
value <- variable_from_array$value
value@r[1,] <- 99
invisible(variable_from_array$assign(value))
variable_from_array

## <Variable path=variable, shape=(3, 3), dtype=float64, value=[[99. 99. 99.]
##  [ 0.  0.  0.]
##  [ 0.  0.  0.]]>
```

Marking a `Variable` as non-trainable:

```
non_trainable_variable <- keras_variable(
  initializer = array(1, c(3, 3)),
  dtype = "float32",
  trainable = FALSE
)
```

`Layer` *Define a custom* `Layer` *class.*

Description

A layer is a callable object that takes as input one or more tensors and that outputs one or more tensors. It involves *computation*, defined in the `call()` method, and a *state* (weight variables). State can be created:

- in `initialize()`, for instance via `self$add_weight()`;
- in the optional `build()` method, which is invoked by the first `call()` to the layer, and supplies the shape(s) of the input(s), which may not have been known at initialization time.

Layers are recursively composable: If you assign a Layer instance as an attribute of another Layer, the outer layer will start tracking the weights created by the inner layer. Nested layers should be instantiated in the `initialize()` method or `build()` method.

Users will just instantiate a layer and then treat it as a callable.

Usage

```
Layer(
  classname,
  initialize = NULL,
  call = NULL,
  build = NULL,
  get_config = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

`classname`	String, the name of the custom class. (Conventionally, CamelCase).
`initialize`, `call`, `build`, `get_config`	Recommended methods to implement. See description and details sections.
`...`, `public`	Additional methods or public members of the custom class.
`private`	Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.
`inherit`	What the custom class will subclass. By default, the base keras class.
`parent_env`	The R environment that all class methods will have as a grandparent.

Value

A composing layer constructor, with similar behavior to other layer functions like `layer_dense()`. The first argument of the returned function will be `object`, enabling `initialize()`ing and `call()` the layer in one step while composing the layer with the pipe, like

```
layer_foo <- Layer("Foo", ....)
output <- inputs |> layer_foo()
```

To only `initialize()` a layer instance and not `call()` it, pass a missing or `NULL` value to `object`, or pass all arguments to `initialize()` by name.

```
layer <- layer_dense(units = 2, activation = "relu")
layer <- layer_dense(NULL, 2, activation = "relu")
layer <- layer_dense(, 2, activation = "relu")

# then you can call() the layer in a separate step
outputs <- inputs |> layer()
```

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

Attributes

- `name`: The name of the layer (string).
- `dtype`: Dtype of the layer's weights. Alias of `layer$variable_dtype`.
- `variable_dtype`: Dtype of the layer's weights.
- `compute_dtype`: The dtype of the layer's computations. Layers automatically cast inputs to this dtype, which causes the computations and output to also be in this dtype. When mixed precision is used with a `keras$mixed_precision$DTypePolicy`, this will be different than `variable_dtype`.
- `trainable_weights`: List of variables to be included in backprop.
- `non_trainable_weights`: List of variables that should not be included in backprop.
- `weights`: The concatenation of the lists `trainable_weights` and `non_trainable_weights` (in this order).
- `trainable`: Whether the layer should be trained (boolean), i.e. whether its potentially-trainable weights should be returned as part of `layer$trainable_weights`.
- `input_spec`: Optional (list of) `InputSpec` object(s) specifying the constraints on inputs that can be accepted by the layer.

We recommend that custom `Layers` implement the following methods:

- `initialize()`: Defines custom layer attributes, and creates layer weights that do not depend on input shapes, using `add_weight()`, or other state.
- `build(input_shape)`: This method can be used to create weights that depend on the shape(s) of the input(s), using `add_weight()`, or other state. Calling `call()` will automatically build the layer (if it has not been built yet) by calling `build()`.
- `call(...)`: Method called after making sure `build()` has been called. `call()` performs the logic of applying the layer to the input arguments. Two reserved arguments you can optionally use in `call()` are:
  1. `training` (boolean, whether the call is in inference mode or training mode).

2. `mask` (boolean tensor encoding masked timesteps in the input, used e.g. in RNN layers).

A typical signature for this method is `call(inputs)`, and user could optionally add `training` and `mask` if the layer need them.

- `get_config()`: Returns a named list containing the configuration used to initialize this layer. If the list names differ from the arguments in `initialize()`, then override `from_config()` as well. This method is used when saving the layer or a model that contains this layer.

Examples

Here's a basic example: a layer with two variables, `w` and `b`, that returns `y <- (w %*% x) + b`. It shows how to implement `build()` and `call()`. Variables set as attributes of a layer are tracked as weights of the layers (in `layer$weights`).

```
layer_simple_dense <- Layer(
  "SimpleDense",
  initialize = function(units = 32) {
    super$initialize()
    self$units <- units
  },

  # Create the state of the layer (weights)
  build = function(input_shape) {
    self$kernel <- self$add_weight(
      shape = shape(tail(input_shape, 1), self$units),
      initializer = "glorot_uniform",
      trainable = TRUE,
      name = "kernel"
    )
    self$bias = self$add_weight(
      shape = shape(self$units),
      initializer = "zeros",
      trainable = TRUE,
      name = "bias"
    )
  },

  # Defines the computation
  call = function(self, inputs) {
    op_matmul(inputs, self$kernel) + self$bias
  }
)

# Instantiates the layer.
# Supply missing `object` arg to skip invoking `call()` and instead return
# the Layer instance
linear_layer <- layer_simple_dense(, 4)

# This will call `build(input_shape)` and create the weights,
```

```
# and then invoke `call()`.
y <- linear_layer(op_ones(c(2, 2)))
stopifnot(length(linear_layer$weights) == 2)

# These weights are trainable, so they're listed in `trainable_weights`:
stopifnot(length(linear_layer$trainable_weights) == 2)
```

Besides trainable weights, updated via backpropagation during training, layers can also have non-trainable weights. These weights are meant to be updated manually during `call()`. Here's a example layer that computes the running sum of its inputs:

```
layer_compute_sum <- Layer(
  classname = "ComputeSum",

  initialize = function(input_dim) {
    super$initialize()

    # Create a non-trainable weight.
    self$total <- self$add_weight(
      shape = shape(),
      initializer = "zeros",
      trainable = FALSE,
      name = "total"
    )
  },

  call = function(inputs) {
    self$total$assign(self$total + op_sum(inputs))
    self$total
  }
)

my_sum <- layer_compute_sum(, 2)
x <- op_ones(c(2, 2))
y <- my_sum(x)

stopifnot(exprs = {
  all.equal(my_sum$weights,               list(my_sum$total))
  all.equal(my_sum$non_trainable_weights, list(my_sum$total))
  all.equal(my_sum$trainable_weights,     list())
})
```

Methods available

- ```
  initialize(...,
             activity_regularizer = NULL,
             trainable = TRUE,
             dtype = NULL,
             autocast = TRUE,
  ```
  ```

```
            name = NULL)
```

Initialize self. This method is typically called from a custom `initialize()` method. Example:

```
layer_my_layer <- Layer("MyLayer",
  initialize = function(units, ..., dtype = NULL, name = NULL) {
    super$initialize(..., dtype = dtype, name = name)
    # .... finish initializing `self` instance
  }
)
```

Args:

  – trainable: Boolean, whether the layer's variables should be trainable.
  – name: String name of the layer.
  – dtype: The dtype of the layer's computations and weights. Can also be a `keras$DTypePolicy`, which allows the computation and weight dtype to differ. Defaults to `NULL`. `NULL` means to use `config_dtype_policy()`, which is a `"float32"` policy unless set to different value (via `config_set_dtype_policy()`).

- `add_loss(loss)`

  Can be called inside of the `call()` method to add a scalar loss.

  Example:

```
Layer("MyLayer",
  ...
  call = function(x) {
    self$add_loss(op_sum(x))
    x
  }
```

- `add_metric(...)`
- `add_variable(...)`

  Add a weight variable to the layer.

  Alias of `add_weight()`.

- `add_weight(shape = NULL,`
```
           initializer = NULL,
           dtype = NULL,
           trainable = TRUE,
           autocast = TRUE,
           regularizer = NULL,
           constraint = NULL,
           aggregation = 'none',
           name = NULL)
```

  Add a weight variable to the layer.

  Args:

  – shape: shape for the variable (as defined by `shape()`) Must be fully-defined (no `NA`/`NULL`/`-1` entries). Defaults to `()` (scalar) if unspecified.

- initializer: Initializer object to use to populate the initial variable value, or string name of a built-in initializer (e.g. "random_normal"). If unspecified, defaults to "glorot_uniform" for floating-point variables and to "zeros" for all other types (e.g. int, bool).
- dtype: Dtype of the variable to create, e.g. "float32". If unspecified, defaults to the layer's variable dtype (which itself defaults to "float32" if unspecified).
- trainable: Boolean, whether the variable should be trainable via backprop or whether its updates are managed manually. Defaults to TRUE.
- autocast: Boolean, whether to autocast layers variables when accessing them. Defaults to TRUE.
- regularizer: Regularizer object to call to apply penalty on the weight. These penalties are summed into the loss function during optimization. Defaults to NULL.
- constraint: Constraint object to call on the variable after any optimizer update, or string name of a built-in constraint. Defaults to NULL.
- aggregation: Optional string, one of NULL, "none", "mean", "sum" or "only_first_replica". Annotates the variable with the type of multi-replica aggregation to be used for this variable when writing custom data parallel training loops. Defaults to "none".
- name: String name of the variable. Useful for debugging purposes.

Returns:

A backend tensor, wrapped in a KerasVariable class. The KerasVariable class has

Methods:

- assign(value)
- assign_add(value)
- assign_sub(value)
- numpy() (calling as.array(<variable>) is preferred)

Properties/Attributes:

- value
- dtype
- ndim
- shape (calling shape(<variable>) is preferred)
- trainable

• build(input_shape)

• build_from_config(config)

Builds the layer's states with the supplied config (named list of args).

By default, this method calls the do.call(build, config$input_shape) method, which creates weights based on the layer's input shape in the supplied config. If your config contains other information needed to load the layer's state, you should override this method.

Args:

- config: Named list containing the input shape associated with this layer.

• call(...)

See description above

• compute_mask(inputs, previous_mask)

• compute_output_shape(...)

- `compute_output_spec(...)`
- `count_params()`

  Count the total number of scalars composing the weights.

  Returns: An integer count.
- `get_build_config()`

  Returns a named list with the layer's input shape.

  This method returns a config (named list) that can be used by `build_from_config(config)` to create all states (e.g. Variables and Lookup tables) needed by the layer.

  By default, the config only contains the input shape that the layer was built with. If you're writing a custom layer that creates state in an unusual way, you should override this method to make sure this state is already created when Keras attempts to load its value upon model loading.

  Returns: A named list containing the input shape associated with the layer.
- `get_config()`

  Returns the config of the object.

  An object config is a named list (serializable) containing the information needed to re-instantiate it. The config is expected to be serializable to JSON, and is expected to consist of a (potentially complex, nested) structure of names lists consisting of simple objects like strings, ints.
- `get_weights()`

  Return the values of `layer$weights` as a list of R or NumPy arrays.
- `quantize(mode, type_check = TRUE)`

  Currently, only the `Dense`, `EinsumDense` and `Embedding` layers support in-place quantization via this `quantize()` method.

  Example:

  ```
  model$quantize("int8") # quantize model in-place
  model |> predict(data) # faster inference
  ```
- `quantized_build(input_shape, mode)`
- `quantized_call(...)`
- `rematerialized_call(layer_call, ...)`

  Enable rematerialization dynamically for a layer's `call` method.

  Args:

  - `layer_call`: The original `call` method of a layer.
  - `...`: additional args

  Returns: A rematerialized version of the layer's `call` method.
- `load_own_variables(store)`

  Loads the state of the layer.

  You can override this method to take full control of how the state of the layer is loaded upon calling `load_model()`.

  Args:

  - `store`: Named list from which the state of the model will be loaded.

- `save_own_variables(store)`

  Saves the state of the layer.

  You can override this method to take full control of how the state of the layer is saved upon calling `save_model()`.

  Args:

  - `store`: Named list where the state of the model will be saved.

- `set_weights(weights)`

  Sets the values of `weights` from a list of R or NumPy arrays.

- ```
  stateless_call(trainable_variables, non_trainable_variables,
                 ..., return_losses = FALSE)
  ```

  Call the layer without any side effects.

  Args:

  - `trainable_variables`: List of trainable variables of the model.
  - `non_trainable_variables`: List of non-trainable variables of the model.
  - `...`: Positional and named arguments to be passed to `call()`.
  - `return_losses`: If `TRUE`, `stateless_call()` will return the list of losses created during `call()` as part of its return values.

  Returns: An unnamed list. By default, returns `list(outputs, non_trainable_variables)`. If `return_losses = TRUE`, then returns `list(outputs, non_trainable_variables, losses)`.

  Note: `non_trainable_variables` include not only non-trainable weights such as `BatchNormalization` statistics, but also RNG seed state (if there are any random operations part of the layer, such as dropout), and `Metric` state (if there are any metrics attached to the layer). These are all elements of state of the layer.

  Example:

  ```
  model <- ...
  data <- ...
  trainable_variables <- model$trainable_variables
  non_trainable_variables <- model$non_trainable_variables
  # Call the model with zero side effects
  c(outputs, non_trainable_variables) %<-% model$stateless_call(
      trainable_variables,
      non_trainable_variables,
      data
  )
  # Attach the updated state to the model
  # (until you do this, the model is still in its pre-call state).
  purrr::walk2(
    model$non_trainable_variables, non_trainable_variables,
    \(variable, value) variable$assign(value))
  ```

- `symbolic_call(...)`

- `from_config(config)`

  Creates a layer from its config.

  This is a class method, meaning, the R function will not have a `self` symbol (a class instance) in scope. Use `__class__` or the classname symbol provided when the `Layer()` was constructed) to resolve the class definition. The default implementation is:
  ```

```
from_config = function(config) {
  do.call(`__class__`, config)
}
```

This method is the reverse of `get_config()`, capable of instantiating the same layer from the config named list. It does not handle layer connectivity (handled by Network), nor weights (handled by `set_weights()`).

Args:

– `config`: A named list, typically the output of `get_config()`.

Returns: A layer instance.

Readonly properties:

- `compute_dtype` The dtype of the computations performed by the layer.
- `dtype` Alias of `layer$variable_dtype`.
- `input_dtype` The dtype layer inputs should be converted to.
- `losses` List of scalar losses from `add_loss()`, regularizers and sublayers.
- `metrics` List of all metrics.
- `metrics_variables` List of all metric variables.
- `non_trainable_variables` List of all non-trainable layer state.
  This extends `layer$non_trainable_weights` to include all state used by the layer including state for metrics and `SeedGenerators`.
- `non_trainable_weights` List of all non-trainable weight variables of the layer.
  These are the weights that should not be updated by the optimizer during training. Unlike, `layer$non_trainable_variables` this excludes metric state and random seeds.
- `trainable_variables` List of all trainable layer state.
  This is equivalent to `layer$trainable_weights`.
- `trainable_weights` List of all trainable weight variables of the layer.
  These are the weights that get updated by the optimizer during training.
- `path` The path of the layer.
  If the layer has not been built yet, it will be `NULL`.
- `quantization_mode` The quantization mode of this layer, `NULL` if not quantized.
- `variable_dtype` The dtype of the state (weights) of the layer.
- `variables` List of all layer state, including random seeds.
  This extends `layer$weights` to include all state used by the layer including `SeedGenerators`.
  Note that metrics variables are not included here, use `metrics_variables` to visit all the metric variables.
- `weights` List of all weight variables of the layer.
  Unlike, `layer$variables` this excludes metric state and random seeds.
- `input` Retrieves the input tensor(s) of a symbolic operation.
  Only returns the tensor(s) corresponding to the *first time* the operation was called.
  Returns: Input tensor or list of input tensors.
- `output` Retrieves the output tensor(s) of a layer.
  Only returns the tensor(s) corresponding to the *first time* the operation was called.
  Returns: Output tensor or list of output tensors.

Data descriptors (Attributes):

- dtype_policy
- input_spec
- supports_masking Whether this layer supports computing a mask using compute_mask.
- trainable Settable boolean, whether this layer should be trainable or not.

See Also

- https://keras.io/api/layers/base_layer#layer-class

Other layers:
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()

layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()

layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
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layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_activation *Applies an activation function to an output.*

Description

Applies an activation function to an output.

Usage

```
layer_activation(object, activation, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
activation	Activation function. It could be a callable, or the name of an activation from the `keras3::activation_*` namespace.
...	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
x <- array(c(-3, -1, 0, 2))
layer <- layer_activation(activation = 'relu')
layer(x)

## tf.Tensor([0. 0. 0. 2.], shape=(4), dtype=float32)


layer <- layer_activation(activation = activation_relu)
layer(x)

## tf.Tensor([0. 0. 0. 2.], shape=(4), dtype=float32)


layer <- layer_activation(activation = op_relu)
layer(x)

## tf.Tensor([0. 0. 0. 2.], shape=(4), dtype=float32)
```

See Also

- https://keras.io/api/layers/core_layers/activation#activation-class

Other activation layers:
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()

Other layers:
Layer()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
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layer_attention()
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layer_depthwise_conv_2d()
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layer_flax_module_wrapper()
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layer_random_color_jitter()
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layer_random_crop()

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layer_random_hue()
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layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_activation_elu *Applies an Exponential Linear Unit function to an output.*

Description

Formula:

```
f(x) = alpha * (exp(x) - 1.) for x < 0
f(x) = x for x >= 0
```

Usage

```
layer_activation_elu(object, alpha = 1, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
alpha	float, slope of negative section. Defaults to `1.0`.
...	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

See Also

- https://keras.io/api/layers/activation_layers/elu#elu-class

Other activation layers:
`layer_activation()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`

layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
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layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()

layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
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layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
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layer_multiply()
layer_normalization()
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layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()

layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
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layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_activation_leaky_relu

Leaky version of a Rectified Linear Unit activation layer.

Description

This layer allows a small gradient when the unit is not active.

Formula:

```
f <- function(x) ifelse(x >= 0, x, alpha * x)
```

Usage

```
layer_activation_leaky_relu(object, negative_slope = 0.3, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`negative_slope`	Float >= 0.0. Negative slope coefficient. Defaults to `0.3`.
`...`	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
leaky_relu_layer <- layer_activation_leaky_relu(negative_slope=0.5)
input <- array(c(-10, -5, 0.0, 5, 10))
result <- leaky_relu_layer(input)
as.array(result)

## [1] -5.0 -2.5  0.0  5.0 10.0
```

See Also

- https://keras.io/api/layers/activation_layers/leaky_relu#leakyrelu-class

Other activation layers:
`layer_activation()`
`layer_activation_elu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`

layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()

layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
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layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
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layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()

layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
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layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_activation_parametric_relu
Parametric Rectified Linear Unit activation layer.

Description

Formula:

```
f <- function(x) ifelse(x >= 0, x, alpha * x)
```

where alpha is a learned array with the same shape as x.

Usage

```
layer_activation_parametric_relu(
  object,
  alpha_initializer = "Zeros",
  alpha_regularizer = NULL,
  alpha_constraint = NULL,
  shared_axes = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
alpha_initializer	Initializer function for the weights.
alpha_regularizer	Regularizer for the weights.
alpha_constraint	Constraint for the weights.
shared_axes	The axes along which to share learnable parameters for the activation function. For example, if the incoming feature maps are from a 2D convolution with output shape `(batch, height, width, channels)`, and you wish to share parameters across space so that each filter only has one set of parameters, set `shared_axes=[1, 2]`.
...	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

See Also

- https://keras.io/api/layers/activation_layers/prelu#prelu-class

Other activation layers:
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`

layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
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layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
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layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
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layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
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layer_hashing()
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layer_jax_model_wrapper()
layer_lambda()
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layer_masking()
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layer_random_color_jitter()
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layer_rnn()
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layer_separable_conv_2d()

layer_simple_rnn()
layer_solarization()
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layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_activation_relu *Rectified Linear Unit activation function layer.*

Description

Formula:

```
f <- function(x, max_value = Inf, negative_slope = 0, threshold = 0) {
 x <- max(x,0)
 if (x >= max_value)
   max_value
 else if (threshold <= x && x < max_value)
   x
 else
   negative_slope * (x - threshold)
}
```

Usage

```
layer_activation_relu(
  object,
```

```
  max_value = NULL,
  negative_slope = 0,
  threshold = 0,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`max_value`	Float >= 0. Maximum activation value. `NULL` means unlimited. Defaults to `NULL`.
`negative_slope`	Float >= 0. Negative slope coefficient. Defaults to `0.0`.
`threshold`	Float >= 0. Threshold value for thresholded activation. Defaults to `0.0`.
`...`	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
relu_layer <- layer_activation_relu(max_value = 10,
                                    negative_slope = 0.5,
                                    threshold = 0)
input <- array(c(-10, -5, 0.0, 5, 10))
result <- relu_layer(input)
as.array(result)

## [1] -5.0 -2.5  0.0  5.0 10.0
```

See Also

- https://keras.io/api/layers/activation_layers/relu#relu-class

Other activation layers:
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_softmax()`

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()

layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
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layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
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layer_random_saturation()

layer_random_sharpness()
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layer_random_translation()
layer_random_zoom()
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layer_reshape()
layer_resizing()
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layer_rnn()
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layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
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layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_activation_softmax

Softmax activation layer.

Description

Formula:

```
exp_x = exp(x - max(x))
f(x) = exp_x / sum(exp_x)
```

Usage

```
layer_activation_softmax(object, axis = -1L, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
axis	Integer, or list of Integers, axis along which the softmax normalization is applied.
...	Base layer keyword arguments, such as name and dtype.

Value

Softmaxed output with the same shape as inputs.

Examples

```
softmax_layer <- layer_activation_softmax()
input <- op_array(c(1, 2, 1))
softmax_layer(input)

## tf.Tensor([0.21194157 0.5761169  0.21194157], shape=(3), dtype=float32)
```

Call Arguments

- inputs: The inputs (logits) to the softmax layer.
- mask: A boolean mask of the same shape as inputs. The mask specifies 1 to keep and 0 to mask. Defaults to NULL.

See Also

- https://keras.io/api/layers/activation_layers/softmax#softmax-class

Other activation layers:
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activity_regularization()

layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()

layer_group_normalization()
layer_group_query_attention()
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layer_random_color_jitter()
layer_random_contrast()
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layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
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layer_resizing()

layer_rms_normalization()
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layer_separable_conv_2d()
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layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
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layer_tfsm()
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layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_activity_regularization

Layer that applies an update to the cost function based input activity.

Description

Layer that applies an update to the cost function based input activity.

Usage

```
layer_activity_regularization(object, l1 = 0, l2 = 0, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
l1	L1 regularization factor (positive float).
l2	L2 regularization factor (positive float).
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

Arbitrary. Use the keyword argument `input_shape` (tuple of integers, does not include the samples axis) when using this layer as the first layer in a model.

Output Shape

Same shape as input.

See Also

- https://keras.io/api/layers/regularization_layers/activity_regularization#activityregularizatio

Other regularization layers:
`layer_alpha_dropout()`
`layer_dropout()`
`layer_gaussian_dropout()`
`layer_gaussian_noise()`
`layer_spatial_dropout_1d()`
`layer_spatial_dropout_2d()`
`layer_spatial_dropout_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`

layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()

layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
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layer_random_color_degeneration()
layer_random_color_jitter()
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layer_random_shear()
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layer_random_zoom()
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layer_reshape()
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layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()

layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_add *Performs elementwise addition operation.*

Description

It takes as input a list of tensors, all of the same shape, and returns a single tensor (also of the same shape).

Usage

```
layer_add(inputs, ...)
```

Arguments

inputs	layers to combine
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(1, 2, 3)
x1 <- op_ones(input_shape)
x2 <- op_ones(input_shape)
layer_add(x1, x2)

## tf.Tensor(
## [[[2. 2. 2.]
##   [2. 2. 2.]]], shape=(1, 2, 3), dtype=float32)
```

Usage in a Keras model:

```
input1 <- layer_input(shape = c(16))
x1 <- input1 |> layer_dense(8, activation = 'relu')

input2 <- layer_input(shape = c(32))
x2 <- input2 |> layer_dense(8, activation = 'relu')

# equivalent to `added = layer_add([x1, x2])`
added <- layer_add(x1, x2)
output <- added |> layer_dense(4)

model <- keras_model(inputs = c(input1, input2), outputs = output)
```

See Also

- https://keras.io/api/layers/merging_layers/add#add-class

Other merging layers:
layer_average()
layer_concatenate()
layer_dot()
layer_maximum()
layer_minimum()
layer_multiply()
layer_subtract()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_additive_attention()

layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
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layer_global_average_pooling_2d()
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layer_random_flip()
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layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
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layer_random_sharpness()
layer_random_shear()
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layer_rnn()

layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
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layer_spatial_dropout_3d()
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layer_stft_spectrogram()
layer_string_lookup()
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layer_tfsm()
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layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_additive_attention

Additive attention layer, a.k.a. Bahdanau-style attention.

Description

Inputs are a list with 2 or 3 elements:

1. A `query` tensor of shape `(batch_size, Tq, dim)`.
2. A `value` tensor of shape `(batch_size, Tv, dim)`.
3. A optional `key` tensor of shape `(batch_size, Tv, dim)`. If none supplied, `value` will be used as `key`.

The calculation follows the steps:

1. Calculate attention scores using `query` and `key` with shape `(batch_size, Tq, Tv)` as a non-linear sum `scores = reduce_sum(tanh(query + key), axis=-1)`.
2. Use scores to calculate a softmax distribution with shape `(batch_size, Tq, Tv)`.
3. Use the softmax distribution to create a linear combination of `value` with shape `(batch_size, Tq, dim)`.

Usage

```
layer_additive_attention(object, use_scale = TRUE, dropout = 0, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`use_scale`	If `TRUE`, will create a scalar variable to scale the attention scores.
`dropout`	Float between 0 and 1. Fraction of the units to drop for the attention scores. Defaults to `0.0`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: List of the following tensors:
  - `query`: Query tensor of shape `(batch_size, Tq, dim)`.
  - `value`: Value tensor of shape `(batch_size, Tv, dim)`.
  - `key`: Optional key tensor of shape `(batch_size, Tv, dim)`. If not given, will use `value` for both `key` and `value`, which is the most common case.
- `mask`: List of the following tensors:
  - `query_mask`: A boolean mask tensor of shape `(batch_size, Tq)`. If given, the output will be zero at the positions where `mask==FALSE`.
  - `value_mask`: A boolean mask tensor of shape `(batch_size, Tv)`. If given, will apply the mask such that values at positions where `mask==FALSE` do not contribute to the result.
- `return_attention_scores`: bool, it `TRUE`, returns the attention scores (after masking and softmax) as an additional output argument.
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (no dropout).
- `use_causal_mask`: Boolean. Set to `TRUE` for decoder self-attention. Adds a mask such that position `i` cannot attend to positions `j > i`. This prevents the flow of information from the future towards the past. Defaults to `FALSE`.

Output

Attention outputs of shape `(batch_size, Tq, dim)`. (Optional) Attention scores after masking and softmax with shape `(batch_size, Tq, Tv)`.

See Also

- https://keras.io/api/layers/attention_layers/additive_attention#additiveattention-class

Other attention layers:
layer_attention()
layer_group_query_attention()
layer_multi_head_attention()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
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layer_average_pooling_2d()
layer_average_pooling_3d()
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layer_bidirectional()
layer_category_encoding()
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layer_concatenate()
layer_conv_1d()
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layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()

layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()

layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_alpha_dropout *Applies Alpha Dropout to the input.*

Description

Alpha Dropout is a `Dropout` that keeps mean and variance of inputs to their original values, in order to ensure the self-normalizing property even after this dropout. Alpha Dropout fits well to Scaled Exponential Linear Units (SELU) by randomly setting activations to the negative saturation value.

Usage

```
layer_alpha_dropout(object, rate, noise_shape = NULL, seed = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`rate`	Float between 0 and 1. The multiplicative noise will have standard deviation `sqrt(rate / (1 - rate))`.
`noise_shape`	1D integer tensor representing the shape of the binary alpha dropout mask that will be multiplied with the input. For instance, if your inputs have shape `(batch_size, timesteps, feat` and you want the alpha dropout mask to be the same for all timesteps, you can use `noise_shape = (batch_size, 1, features)`.
`seed`	An integer to use as random seed.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor (of any rank).
- `training`: R boolean indicating whether the layer should behave in training mode (adding alpha dropout) or in inference mode (doing nothing).

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/layers/AlphaDropout

Other regularization layers:
`layer_activity_regularization()`
`layer_dropout()`
`layer_gaussian_dropout()`
`layer_gaussian_noise()`
`layer_spatial_dropout_1d()`
`layer_spatial_dropout_2d()`

layer_spatial_dropout_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()

layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()

layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_attention` *Dot-product attention layer, a.k.a. Luong-style attention.*

Description

Inputs are a list with 2 or 3 elements:

1. A `query` tensor of shape `(batch_size, Tq, dim)`.
2. A `value` tensor of shape `(batch_size, Tv, dim)`.
3. A optional `key` tensor of shape `(batch_size, Tv, dim)`. If none supplied, `value` will be used as a `key`.

The calculation follows the steps:

1. Calculate attention scores using `query` and `key` with shape `(batch_size, Tq, Tv)`.
2. Use scores to calculate a softmax distribution with shape `(batch_size, Tq, Tv)`.
3. Use the softmax distribution to create a linear combination of `value` with shape `(batch_size, Tq, dim)`.

Usage

```
layer_attention(
  object,
  use_scale = FALSE,
  score_mode = "dot",
  dropout = 0,
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`use_scale`	If `TRUE`, will create a scalar variable to scale the attention scores.
`score_mode`	Function to use to compute attention scores, one of `{"dot", "concat"}`. `"dot"` refers to the dot product between the query and key vectors. `"concat"` refers to the hyperbolic tangent of the concatenation of the `query` and `key` vectors.
`dropout`	Float between 0 and 1. Fraction of the units to drop for the attention scores. Defaults to `0.0`.
`seed`	An integer to use as random seed in case of `dropout`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: List of the following tensors:
  - `query`: Query tensor of shape `(batch_size, Tq, dim)`.
  - `value`: Value tensor of shape `(batch_size, Tv, dim)`.
  - `key`: Optional key tensor of shape `(batch_size, Tv, dim)`. If not given, will use `value` for both `key` and `value`, which is the most common case.
- `mask`: List of the following tensors:
  - `query_mask`: A boolean mask tensor of shape `(batch_size, Tq)`. If given, the output will be zero at the positions where `mask==FALSE`.
  - `value_mask`: A boolean mask tensor of shape `(batch_size, Tv)`. If given, will apply the mask such that values at positions where `mask==FALSE` do not contribute to the result.
- `return_attention_scores`: bool, it `TRUE`, returns the attention scores (after masking and softmax) as an additional output argument.
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (no dropout).
- `use_causal_mask`: Boolean. Set to `TRUE` for decoder self-attention. Adds a mask such that position `i` cannot attend to positions `j > i`. This prevents the flow of information from the future towards the past. Defaults to `FALSE`.

Output

Attention outputs of shape `(batch_size, Tq, dim)`. (Optional) Attention scores after masking and softmax with shape `(batch_size, Tq, Tv)`.

See Also

- https://keras.io/api/layers/attention_layers/attention#attention-class

Other attention layers:
`layer_additive_attention()`
`layer_group_query_attention()`
`layer_multi_head_attention()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_aug_mix()`

layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()

layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()

layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_aug_mix *Performs the AugMix data augmentation technique.*

Description

AugMix aims to produce images with variety while preserving the image semantics and local statistics. During the augmentation process, the same augmentation is applied across all images in the batch in num_chains different ways, with each chain consisting of chain_depth augmentations.

Usage

```
layer_aug_mix(
  object,
  value_range = c(0L, 255L),
  num_chains = 3L,
  chain_depth = 3L,
  factor = 0.3,
  alpha = 1,
  all_ops = TRUE,
  interpolation = "bilinear",
  seed = NULL,
  data_format = NULL,
```

```
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`value_range`	the range of values the incoming images will have. Represented as a two number tuple written (low, high). This is typically either `(0, 1)` or `(0, 255)` depending on how your preprocessing pipeline is set up.
`num_chains`	an integer representing the number of different chains to be mixed, defaults to 3.
`chain_depth`	an integer representing the maximum number of transformations to be applied in each chain. The actual number of transformations in each chain will be sampled randomly from the range `[0, chain_depth]`. Defaults to 3.
`factor`	The strength of the augmentation as a normalized value between 0 and 1. Default is 0.3.
`alpha`	a float value used as the probability coefficients for the Beta and Dirichlet distributions, defaults to 1.0.
`all_ops`	Use all operations (including random_brightness, random_color_degeneration, random_contrast and random_sharpness). Default is True.
`interpolation`	The interpolation method to use for resizing operations. Options include `"nearest"`, `"bilinear"`. Default is `"bilinear"`.
`seed`	Integer. Used to create a random seed.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`...`	For forward/backward compatability.

References

- AugMix paper
- Official Code

See Also

Other image preprocessing layers:
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`

layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()

layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()

layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
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layer_separable_conv_2d()
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layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_auto_contrast` *Performs the auto-contrast operation on an image.*

Description

Auto contrast stretches the values of an image across the entire available `value_range`. This makes differences between pixels more obvious. An example of this is if an image only has values `[0, 1]` out of the range `[0, 255]`, auto contrast will change the `1` values to be `255`.

This layer is active at both training and inference time.

Usage

```
layer_auto_contrast(object, value_range = tuple(0L, 255L), ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`value_range`	Range of values the incoming images will have. Represented as a two number tuple written `(low, high)`. This is typically either `(0, 1)` or `(0, 255)` depending on how your preprocessing pipeline is set up. Defaults to `(0, 255)`.
`...`	For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_random_shear()`
`layer_rescaling()`
`layer_resizing()`

layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()

layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()

layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()

layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_average *Averages a list of inputs element-wise..*

Description

It takes as input a list of tensors, all of the same shape, and returns a single tensor (also of the same shape).

Usage

```
layer_average(inputs, ...)
```

Arguments

`inputs`	layers to combine
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(1, 2, 3)
x1 <- op_ones(input_shape)
x2 <- op_zeros(input_shape)
layer_average(x1, x2)

## tf.Tensor(
## [[[0.5 0.5 0.5]
##   [0.5 0.5 0.5]]], shape=(1, 2, 3), dtype=float32)
```

Usage in a Keras model:

```
input1 <- layer_input(shape = c(16))
x1 <- input1 |> layer_dense(8, activation = 'relu')

input2 <- layer_input(shape = c(32))
x2 <- input2 |> layer_dense(8, activation = 'relu')

added <- layer_average(x1, x2)
output <- added |> layer_dense(4)

model <- keras_model(inputs = c(input1, input2), outputs = output)
```

See Also

- https://keras.io/api/layers/merging_layers/average#average-class

Other merging layers:
`layer_add()`
`layer_concatenate()`
`layer_dot()`
`layer_maximum()`
`layer_minimum()`

layer_multiply()
layer_subtract()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_average_pooling_1d

Average pooling for temporal data.

Description

Downsamples the input representation by taking the average value over the window defined by `pool_size`. The window is shifted by `strides`. The resulting output when using "valid" padding option has a shape of: `output_shape = (input_shape - pool_size + 1) / strides)`

The resulting output shape when using the "same" padding option is: `output_shape = input_shape / strides`

Usage

```
layer_average_pooling_1d(
  object,
  pool_size,
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`pool_size`	int, size of the max pooling window.
`strides`	int or `NULL`. Specifies how much the pooling window moves for each pooling step. If `NULL`, it will default to `pool_size`.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format="channels_last"`: 3D tensor with shape `(batch_size, steps, features)`.
- If `data_format="channels_first"`: 3D tensor with shape `(batch_size, features, steps)`.

Output Shape

- If `data_format="channels_last"`: 3D tensor with shape `(batch_size, downsampled_steps, features)`.
- If `data_format="channels_first"`: 3D tensor with shape `(batch_size, features, downsampled_steps)`.

Examples

`strides=1` and `padding="valid"`:

```
x <- op_array(c(1., 2., 3., 4., 5.)) |> op_reshape(c(1, 5, 1))
output <- x |>
  layer_average_pooling_1d(pool_size = 2,
                           strides = 1,
                           padding = "valid")
output

## tf.Tensor(
## [[[1.5]
##   [2.5]
##   [3.5]
##   [4.5]]], shape=(1, 4, 1), dtype=float32)
```

`strides=2` and `padding="valid"`:

```
x <- op_array(c(1., 2., 3., 4., 5.)) |> op_reshape(c(1, 5, 1))
output <- x |>
  layer_average_pooling_1d(pool_size = 2,
                           strides = 2,
                           padding = "valid")
output

## tf.Tensor(
## [[[1.5]
##   [3.5]]], shape=(1, 2, 1), dtype=float32)
```

`strides=1` and `padding="same"`:

```
x <- op_array(c(1., 2., 3., 4., 5.)) |> op_reshape(c(1, 5, 1))
output <- x |>
  layer_average_pooling_1d(pool_size = 2,
                           strides = 1,
                           padding = "same")
output
```

```
## tf.Tensor(
## [[[1.5]
##   [2.5]
##   [3.5]
##   [4.5]
##   [5. ]]], shape=(1, 5, 1), dtype=float32)
```

See Also

- https://keras.io/api/layers/pooling_layers/average_pooling1d#averagepooling1d-class

Other pooling layers:
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()

layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()

layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_average_pooling_2d

Average pooling operation for 2D spatial data.

Description

Downsamples the input along its spatial dimensions (height and width) by taking the average value over an input window (of size defined by `pool_size`) for each channel of the input. The window is shifted by `strides` along each dimension.

The resulting output when using the `"valid"` padding option has a spatial shape (number of rows or columns) of: `output_shape = math.floor((input_shape - pool_size) / strides) + 1` (when `input_shape >= pool_size`)

The resulting output shape when using the `"same"` padding option is: `output_shape = math.floor((input_shape - 1) / strides) + 1`

Usage

```
layer_average_pooling_2d(
  object,
  pool_size,
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`pool_size`	int or list of 2 integers, factors by which to downscale (dim1, dim2). If only one integer is specified, the same window length will be used for all dimensions.

`strides`	int or list of 2 integers, or `NULL`. Strides values. If `NULL`, it will default to `pool_size`. If only one int is specified, the same stride size will be used for all dimensions.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format="channels_last"`: 4D tensor with shape `(batch_size, height, width, channels)`.
- If `data_format="channels_first"`: 4D tensor with shape `(batch_size, channels, height, width)`.

Output Shape

- If `data_format="channels_last"`: 4D tensor with shape `(batch_size, pooled_height, pooled_width, channel`
- If `data_format="channels_first"`: 4D tensor with shape `(batch_size, channels, pooled_height, pooled_wid`

Examples

`strides=(1, 1)` and `padding="valid"`:

```
x <- op_array(1:9, "float32") |> op_reshape(c(1, 3, 3, 1))
output <- x |>
  layer_average_pooling_2d(pool_size = c(2, 2),
                           strides = c(1, 1),
                           padding = "valid")
output
```

```
## tf.Tensor(
## [[[[3.]
```

```
##    [4.]]
##
##   [[6.]
##    [7.]]]], shape=(1, 2, 2, 1), dtype=float32)
```

strides=(2, 2) and padding="valid":

```
x <- op_array(1:12, "float32") |> op_reshape(c(1, 3, 4, 1))
output <- x |>
  layer_average_pooling_2d(pool_size = c(2, 2),
                           strides = c(2, 2),
                           padding = "valid")
output
```

```
## tf.Tensor(
## [[[[3.5]
##    [5.5]]]], shape=(1, 1, 2, 1), dtype=float32)
```

stride=(1, 1) and padding="same":

```
x <- op_array(1:9, "float32") |> op_reshape(c(1, 3, 3, 1))
output <- x |>
  layer_average_pooling_2d(pool_size = c(2, 2),
                           strides = c(1, 1),
                           padding = "same")
output
```

```
## tf.Tensor(
## [[[[3. ]
##    [4. ]
##    [4.5]]
##
##   [[6. ]
##    [7. ]
##    [7.5]]
##
##   [[7.5]
##    [8.5]
##    [9. ]]]], shape=(1, 3, 3, 1), dtype=float32)
```

See Also

- https://keras.io/api/layers/pooling_layers/average_pooling2d#averagepooling2d-class

Other pooling layers:
layer_average_pooling_1d()

layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()

layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
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layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()

layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_average_pooling_3d
Average pooling operation for 3D data (spatial or spatio-temporal).

Description

Downsamples the input along its spatial dimensions (depth, height, and width) by taking the average value over an input window (of size defined by `pool_size`) for each channel of the input. The window is shifted by `strides` along each dimension.

Usage

```
layer_average_pooling_3d(
  object,
  pool_size,
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`pool_size`	int or list of 3 integers, factors by which to downscale (dim1, dim2, dim3). If only one integer is specified, the same window length will be used for all dimensions.
`strides`	int or list of 3 integers, or `NULL`. Strides values. If `NULL`, it will default to `pool_size`. If only one int is specified, the same stride size will be used for all dimensions.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, spatial_dim1, spatial_di` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, pooled_dim1, pooled_dim2, pooled_di`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, pooled_dim1, pooled_dim2`

Examples

```
depth <- height <- width <- 30
channels <- 3

inputs <- layer_input(shape = c(depth, height, width, channels))
outputs <- inputs |> layer_average_pooling_3d(pool_size = 3)
outputs # Shape: (batch_size, 10, 10, 10, 3)

## <KerasTensor shape=(None, 10, 10, 10, 3), dtype=float32, sparse=False, ragged=False, name=keras_tens
```

See Also

- https://keras.io/api/layers/pooling_layers/average_pooling3d#averagepooling3d-class

Other pooling layers:
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_global_average_pooling_1d()`
`layer_global_average_pooling_2d()`
`layer_global_average_pooling_3d()`
`layer_global_max_pooling_1d()`
`layer_global_max_pooling_2d()`
`layer_global_max_pooling_3d()`
`layer_max_pooling_1d()`
`layer_max_pooling_2d()`
`layer_max_pooling_3d()`

Other layers:
`Layer()`

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()

layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
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layer_group_query_attention()
layer_gru()
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layer_hashing()
layer_identity()
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layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_minimum()
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layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
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layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
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rnn_cell_simple()
rnn_cells_stack()

---

layer_batch_normalization

Layer that normalizes its inputs.

Description

Batch normalization applies a transformation that maintains the mean output close to 0 and the output standard deviation close to 1.

Importantly, batch normalization works differently during training and during inference.

During training (i.e. when using `fit()` or when calling the layer/model with the argument `training = TRUE`), the layer normalizes its output using the mean and standard deviation of the current batch of inputs. That is to say, for each channel being normalized, the layer returns `gamma * (batch - mean(batch)) / sqrt(var(batch) + epsilon) + beta`, where:

- `epsilon` is small constant (configurable as part of the constructor arguments)
- `gamma` is a learned scaling factor (initialized as 1), which can be disabled by passing `scale = FALSE` to the constructor.
- `beta` is a learned offset factor (initialized as 0), which can be disabled by passing `center = FALSE` to the constructor.

During inference (i.e. when using `evaluate()` or `predict()` or when calling the layer/model with the argument `training = FALSE` (which is the default), the layer normalizes its output using a moving average of the mean and standard deviation of the batches it has seen during training. That is to say, it returns `gamma * (batch - self$moving_mean) / sqrt(self$moving_var+epsilon) + beta`.

`self$moving_mean` and `self$moving_var` are non-trainable variables that are updated each time the layer in called in training mode, as such:

- `moving_mean = moving_mean * momentum + mean(batch) * (1 - momentum)`
- `moving_var = moving_var * momentum + var(batch) * (1 - momentum)`

As such, the layer will only normalize its inputs during inference *after having been trained on data that has similar statistics as the inference data*.

About setting `layer$trainable <- FALSE` on a `BatchNormalization` layer:

The meaning of setting `layer$trainable <- FALSE` is to freeze the layer, i.e. its internal state will not change during training: its trainable weights will not be updated during `fit()` or `train_on_batch()`, and its state updates will not be run.

Usually, this does not necessarily mean that the layer is run in inference mode (which is normally controlled by the `training` argument that can be passed when calling a layer). "Frozen state" and "inference mode" are two separate concepts.

However, in the case of the `BatchNormalization` layer, **setting `trainable <- FALSE` on the layer means that the layer will be subsequently run in inference mode** (meaning that it will use the moving mean and the moving variance to normalize the current batch, rather than using the mean and variance of the current batch).

Note that:

- Setting `trainable` on an model containing other layers will recursively set the `trainable` value of all inner layers.
- If the value of the `trainable` attribute is changed after calling `compile()` on a model, the new value doesn't take effect for this model until `compile()` is called again.

Usage

```
layer_batch_normalization(
  object,
  axis = -1L,
  momentum = 0.99,
  epsilon = 0.001,
```

```
  center = TRUE,
  scale = TRUE,
  beta_initializer = "zeros",
  gamma_initializer = "ones",
  moving_mean_initializer = "zeros",
  moving_variance_initializer = "ones",
  beta_regularizer = NULL,
  gamma_regularizer = NULL,
  beta_constraint = NULL,
  gamma_constraint = NULL,
  synchronized = FALSE,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
axis	Integer, the axis that should be normalized (typically the features axis). For instance, after a Conv2D layer with data_format = "channels_first", use axis = 2.
momentum	Momentum for the moving average.
epsilon	Small float added to variance to avoid dividing by zero.
center	If TRUE, add offset of beta to normalized tensor. If FALSE, beta is ignored.
scale	If TRUE, multiply by gamma. If FALSE, gamma is not used. When the next layer is linear this can be disabled since the scaling will be done by the next layer.
beta_initializer	Initializer for the beta weight.
gamma_initializer	Initializer for the gamma weight.
moving_mean_initializer	Initializer for the moving mean.
moving_variance_initializer	Initializer for the moving variance.
beta_regularizer	Optional regularizer for the beta weight.
gamma_regularizer	Optional regularizer for the gamma weight.
beta_constraint	Optional constraint for the beta weight.
gamma_constraint	Optional constraint for the gamma weight.
synchronized	Only applicable with the TensorFlow backend. If TRUE, synchronizes the global batch statistics (mean and variance) for the layer across all devices at each training step in a distributed training strategy. If FALSE, each replica uses its own local batch statistics.
...	Base layer keyword arguments (e.g. name and dtype).

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor (of any rank).
- `training`: R boolean indicating whether the layer should behave in training mode or in inference mode.
  - `training = TRUE`: The layer will normalize its inputs using the mean and variance of the current batch of inputs.
  - `training = FALSE`: The layer will normalize its inputs using the mean and variance of its moving statistics, learned during training.
- `mask`: Binary tensor of shape broadcastable to `inputs` tensor, with `TRUE` values indicating the positions for which mean and variance should be computed. Masked elements of the current inputs are not taken into account for mean and variance computation during training. Any prior unmasked element values will be taken into account until their momentum expires.

Reference

- Ioffe and Szegedy, 2015.

See Also

- `https://keras.io/api/layers/normalization_layers/batch_normalization#batchnormalization-class`

Other normalization layers:
`layer_group_normalization()`
`layer_layer_normalization()`
`layer_rms_normalization()`
`layer_spectral_normalization()`
`layer_unit_normalization()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`

layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
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layer_group_query_attention()
layer_gru()

layer_hashed_crossing()
layer_hashing()
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layer_integer_lookup()
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layer_max_pooling_3d()
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layer_mel_spectrogram()
layer_minimum()
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layer_separable_conv_2d()
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layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_bidirectional *Bidirectional wrapper for RNNs.*

Description

Bidirectional wrapper for RNNs.

Usage

```
layer_bidirectional(
  object,
  layer,
  merge_mode = "concat",
  weights = NULL,
  backward_layer = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
layer	RNN instance, such as layer_lstm() or layer_gru(). It could also be a Layer() instance that meets the following criteria: 1. Be a sequence-processing layer (accepts 3D+ inputs). 2. Have a go_backwards, return_sequences and return_state attribute (with the same semantics as for the RNN class). 3. Have an input_spec attribute. 4. Implement serialization via get_config() and from_config(). Note that the recommended way to create new RNN layers is to write a custom RNN cell and use it with layer_rnn(), instead of subclassing with Layer() directly. When return_sequences is TRUE, the output of the masked timestep will be zero regardless of the layer's original zero_output_for_mask value.
merge_mode	Mode by which outputs of the forward and backward RNNs will be combined. One of {"sum", "mul", "concat", "ave", NULL}. If NULL, the outputs will not be combined, they will be returned as a list. Defaults to "concat".
weights	see description
backward_layer	Optional RNN, or Layer() instance to be used to handle backwards input processing. If backward_layer is not provided, the layer instance passed as the layer argument will be used to generate the backward layer automatically. Note that the provided backward_layer layer should have properties matching those of the layer argument, in particular it should have the same values for stateful, return_states, return_sequences, etc. In addition, backward_layer and layer should have different go_backwards argument values. A ValueError will be raised if these requirements are not met.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Call Arguments

The call arguments for this layer are the same as those of the wrapped RNN layer. Beware that when passing the initial_state argument during the call of this layer, the first half in the list of elements in the initial_state list will be passed to the forward RNN call and the last half in the list of elements will be passed to the backward RNN call.

Note

instantiating a Bidirectional layer from an existing RNN layer instance will not reuse the weights state of the RNN layer instance – the Bidirectional layer will have freshly initialized weights.

Examples

```
model <- keras_model_sequential(input_shape = c(5, 10)) %>%
  layer_bidirectional(layer_lstm(units = 10, return_sequences = TRUE)) %>%
  layer_bidirectional(layer_lstm(units = 10)) %>%
  layer_dense(5, activation = "softmax")

model %>% compile(loss = "categorical_crossentropy",
                  optimizer = "rmsprop")

# With custom backward layer
forward_layer <- layer_lstm(units = 10, return_sequences = TRUE)
backward_layer <- layer_lstm(units = 10, activation = "relu",
                             return_sequences = TRUE, go_backwards = TRUE)

model <- keras_model_sequential(input_shape = c(5, 10)) %>%
  bidirectional(forward_layer, backward_layer = backward_layer) %>%
  layer_dense(5, activation = "softmax")

model %>% compile(loss = "categorical_crossentropy",
                  optimizer = "rmsprop")
```

States

A `Bidirectional` layer instance has property `states`, which you can access with `layer$states`. You can also reset states using `reset_state()`

See Also

- https://keras.io/api/layers/recurrent_layers/bidirectional#bidirectional-class

Other rnn layers:
`layer_conv_lstm_1d()`
`layer_conv_lstm_2d()`
`layer_conv_lstm_3d()`
`layer_gru()`
`layer_lstm()`
`layer_rnn()`
`layer_simple_rnn()`
`layer_time_distributed()`
`rnn_cell_gru()`
`rnn_cell_lstm()`
`rnn_cell_simple()`
`rnn_cells_stack()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`

layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
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layer_average_pooling_3d()
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layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
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layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
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layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_category_encoding`
A preprocessing layer which encodes integer features.

Description

This layer provides options for condensing data into a categorical encoding when the total number of tokens are known in advance. It accepts integer values as inputs, and it outputs a dense or sparse representation of those inputs. For integer inputs where the total number of tokens is not known, use `layer_integer_lookup()` instead.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_category_encoding(
  object,
  num_tokens = NULL,
  output_mode = "multi_hot",
  sparse = FALSE,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`num_tokens`	The total number of tokens the layer should support. All inputs to the layer must integers in the range `0 <= value < num_tokens`, or an error will be thrown.
`output_mode`	Specification for the output of the layer. Values can be `"one_hot"`, `"multi_hot"` or `"count"`, configuring the layer as follows: - `"one_hot"`: Encodes each individual element in the input into an array of `num_tokens` size, containing a 1 at the element index. If the last dimension is size 1, will encode on that dimension. If the last dimension is not size 1, will append a new dimension for the encoded output. - `"multi_hot"`: Encodes each sample in the input into a single array of `num_tokens` size, containing a 1 for each vocabulary term present in the sample. Treats the last dimension as the sample dimension, if input shape is `(..., sample_length)`, output shape will be `(..., num_tokens)`. - `"count"`: Like `"multi_hot"`, but the int array contains a count of the number of times the token at that index appeared in the sample. For all output modes, currently only output up to rank 2 is supported. Defaults to `"multi_hot"`.
`sparse`	Whether to return a sparse tensor; for backends that support sparse tensors.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

One-hot encoding data

```
layer <- layer_category_encoding(num_tokens = 4, output_mode = "one_hot")
x <- op_array(c(3, 2, 0, 1), "int32")
layer(x)
```

```
## tf.Tensor(
## [[0. 0. 0. 1.]
##  [0. 0. 1. 0.]
##  [1. 0. 0. 0.]
##  [0. 1. 0. 0.]], shape=(4, 4), dtype=float32)
```

Multi-hot encoding data

```
layer <- layer_category_encoding(num_tokens = 4, output_mode = "multi_hot")
x <- op_array(rbind(c(0, 1),
                   c(0, 0),
                   c(1, 2),
                   c(3, 1)), "int32")
layer(x)
```

```
## tf.Tensor(
## [[1. 1. 0. 0.]
##  [1. 0. 0. 0.]
##  [0. 1. 1. 0.]
##  [0. 1. 0. 1.]], shape=(4, 4), dtype=float32)
```

Using weighted inputs in "count" mode

```
layer <- layer_category_encoding(num_tokens = 4, output_mode = "count")
count_weights <- op_array(rbind(c(.1, .2),
                               c(.1, .1),
                               c(.2, .3),
                               c(.4, .2)))
x <- op_array(rbind(c(0, 1),
                   c(0, 0),
                   c(1, 2),
                   c(3, 1)), "int32")
layer(x, count_weights = count_weights)
#   array([[01, 02, 0. , 0. ],
#          [02, 0. , 0. , 0. ],
#          [0. , 02, 03, 0. ],
#          [0. , 02, 0. , 04]]>
```

Call Arguments

- `inputs`: A 1D or 2D tensor of integer inputs.
- `count_weights`: A tensor in the same shape as `inputs` indicating the weight for each sample value when summing up in `count` mode. Not used in "`multi_hot`" or "`one_hot`" modes.

See Also

- https://keras.io/api/layers/preprocessing_layers/categorical/category_encoding#categoryencoding-class

Other categorical features preprocessing layers:
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_string_lookup()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()

layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()

layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()

layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_center_crop` *A preprocessing layer which crops images.*

Description

This layers crops the central portion of the images to a target size. If an image is smaller than the target size, it will be resized and cropped so as to return the largest possible window in the image that matches the target aspect ratio.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`).

Usage

```
layer_center_crop(object, height, width, data_format = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`height`	Integer, the height of the output shape.
`width`	Integer, the width of the output shape.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`, or `(..., channels, target_height, target_width)`, in `"channels_first"` format.

If the input height/width is even and the target height/width is odd (or inversely), the input image is left-padded by 1 pixel.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

See Also

- https://keras.io/api/layers/preprocessing_layers/image_preprocessing/center_crop#centercrop-class

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()

layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()

layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()

layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_concatenate   *Concatenates a list of inputs.*

Description

It takes as input a list of tensors, all of the same shape except for the concatenation axis, and returns a single tensor that is the concatenation of all inputs.

Usage

```
layer_concatenate(inputs, ..., axis = -1L)
```

Arguments

inputs	layers to combine
...	Standard layer keyword arguments.
axis	Axis along which to concatenate.

Value

A tensor, the concatenation of the inputs alongside axis `axis`.

Examples

```
x <- op_arange(20) |> op_reshape(c(2, 2, 5))
y <- op_arange(21, 40) |> op_reshape(c(2, 2, 5))
layer_concatenate(x, y, axis = 2)

## tf.Tensor(
## [[[ 1.  2.  3.  4.  5.]
##   [ 6.  7.  8.  9. 10.]
##   [21. 22. 23. 24. 25.]
##   [26. 27. 28. 29. 30.]]
##
##  [[11. 12. 13. 14. 15.]
```

```
##   [16. 17. 18. 19. 20.]
##   [31. 32. 33. 34. 35.]
##   [36. 37. 38. 39. 40.]]], shape=(2, 4, 5), dtype=float32)
```

Usage in a Keras model:

```
x1 <- op_arange(10)     |> op_reshape(c(5, 2)) |> layer_dense(8)
x2 <- op_arange(11, 20) |> op_reshape(c(5, 2)) |> layer_dense(8)
y <- layer_concatenate(x1, x2)
```

See Also

- https://keras.io/api/layers/merging_layers/concatenate#concatenate-class

Other merging layers:
layer_add()
layer_average()
layer_dot()
layer_maximum()
layer_minimum()
layer_multiply()
layer_subtract()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_conv_1d()
layer_conv_1d_transpose()

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_conv_1d *1D convolution layer (e.g. temporal convolution).*

Description

This layer creates a convolution kernel that is convolved with the layer input over a single spatial (or temporal) dimension to produce a tensor of outputs. If `use_bias` is `TRUE`, a bias vector is created and added to the outputs. Finally, if `activation` is not `NULL`, it is applied to the outputs as well.

Usage

```
layer_conv_1d(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  groups = 1L,
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the convolution).
`kernel_size`	int or list of 1 integer, specifying the size of the convolution window.
`strides`	int or list of 1 integer, specifying the stride length of the convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, `"valid"`, `"same"` or `"causal"`(case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input. `"causal"` results in causal (dilated) convolutions, e.g. `output[t]` does not depend on`tail(input, t+1)`. Useful when modeling temporal data where the model should not violate the temporal order. See WaveNet: A Generative Model for Raw Audio, section2.1.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`dilation_rate`	int or list of 1 integers, specifying the dilation rate to use for dilated convolution.
`groups`	A positive int specifying the number of groups in which the input is split along the channel axis. Each group is convolved separately with `filters // groups` filters. The output is the concatenation of all the `groups` results along the channel axis. Input channels and `filters` must both be divisible by `groups`.
`activation`	Activation function. If `NULL`, no activation is applied.
`use_bias`	bool, if `TRUE`, bias will be added to the output.
`kernel_initializer`	Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.
`bias_initializer`	Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.
`kernel_regularizer`	Optional regularizer for the convolution kernel.
`bias_regularizer`	Optional regularizer for the bias vector.
`activity_regularizer`	Optional regularizer function for the output.
`kernel_constraint`	Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

bias_constraint
: Optional projection function to be applied to the bias after being updated by an Optimizer.

...
: For forward/backward compatability.

Value

A 3D tensor representing activation(conv1d(inputs, kernel) + bias).

Input Shape

- If data_format="channels_last": A 3D tensor with shape: (batch_shape, steps, channels)
- If data_format="channels_first": A 3D tensor with shape: (batch_shape, channels, steps)

Output Shape

- If data_format="channels_last": A 3D tensor with shape: (batch_shape, new_steps, filters)
- If data_format="channels_first": A 3D tensor with shape: (batch_shape, filters, new_steps)

Raises

ValueError: when both strides > 1 and dilation_rate > 1.

Example

```
# The inputs are 128-length vectors with 10 timesteps, and the
# batch size is 4.
x <- random_uniform(c(4, 10, 128))
y <- x |> layer_conv_1d(32, 3, activation='relu')
shape(y)

## shape(4, 8, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution1d#conv1d-class

Other convolutional layers:
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()

layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()

layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_conv_1d_transpose`

1D transposed convolution layer.

Description

The need for transposed convolutions generally arise from the desire to use a transformation going in the opposite direction of a normal convolution, i.e., from something that has the shape of the output of some convolution to something that has the shape of its input while maintaining a connectivity pattern that is compatible with said convolution.

Usage

```
layer_conv_1d_transpose(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the transpose convolution).
`kernel_size`	int or list of 1 integer, specifying the size of the transposed convolution window.
`strides`	int or list of 1 integer, specifying the stride length of the transposed convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`dilation_rate`	int or list of 1 integers, specifying the dilation rate to use for dilated transposed convolution.
`activation`	Activation function. If `NULL`, no activation is applied.
`use_bias`	bool, if `TRUE`, bias will be added to the output.
`kernel_initializer`	Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.

`bias_initializer`
: Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.

`kernel_regularizer`
: Optional regularizer for the convolution kernel.

`bias_regularizer`
: Optional regularizer for the bias vector.

`activity_regularizer`
: Optional regularizer function for the output.

`kernel_constraint`
: Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

`bias_constraint`
: Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...`
: For forward/backward compatability.

Value

A 3D tensor representing `activation(conv1d_transpose(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, steps, channels)`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, channels, steps)`

Output Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, new_steps, filters)`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, filters, new_steps)`

Raises

ValueError: when both `strides > 1` and `dilation_rate > 1`.

References

- A guide to convolution arithmetic for deep learning
- Deconvolutional Networks

Example

```
x <- random_uniform(c(4, 10, 128))
y <- x |> layer_conv_1d_transpose(32, 3, 2, activation='relu')
shape(y)

## shape(4, 21, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution1d_transpose#conv1dtranspose-class

Other convolutional layers:
layer_conv_1d()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_conv_2d *2D convolution layer.*

Description

This layer creates a convolution kernel that is convolved with the layer input over a 2D spatial (or temporal) dimension (height and width) to produce a tensor of outputs. If `use_bias` is `TRUE`, a bias vector is created and added to the outputs. Finally, if `activation` is not `NULL`, it is applied to the outputs as well.

Note on numerical precision: While in general Keras operation execution results are identical across backends up to 1e-7 precision in float32, `Conv2D` operations may show larger variations. Due to the large number of element-wise multiplications and additions in convolution operations, especially with large inputs or kernel sizes, accumulated floating-point differences can exceed this 1e-7 threshold. These variations are particularly noticeable when using different backends (e.g., TensorFlow vs JAX) or different hardware.

Usage

```
layer_conv_2d(
  object,
  filters,
  kernel_size,
  strides = list(1L, 1L),
  padding = "valid",
  data_format = NULL,
  dilation_rate = list(1L, 1L),
  groups = 1L,
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
```

```
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`filters` int, the dimension of the output space (the number of filters in the convolution).

`kernel_size` int or list of 2 integer, specifying the size of the convolution window.

`strides` int or list of 2 integer, specifying the stride length of the convolution. `strides > 1` is incompatible with `dilation_rate > 1`.

`padding` string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.

`data_format` string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

`dilation_rate` int or list of 2 integers, specifying the dilation rate to use for dilated convolution.

`groups` A positive int specifying the number of groups in which the input is split along the channel axis. Each group is convolved separately with `filters // groups` filters. The output is the concatenation of all the `groups` results along the channel axis. Input channels and `filters` must both be divisible by `groups`.

`activation` Activation function. If `NULL`, no activation is applied.

`use_bias` bool, if `TRUE`, bias will be added to the output.

`kernel_initializer`
Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.

`bias_initializer`
Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.

`kernel_regularizer`
Optional regularizer for the convolution kernel.

`bias_regularizer`
Optional regularizer for the bias vector.

`activity_regularizer`
Optional regularizer function for the output.

`kernel_constraint`
Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

`bias_constraint`
Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...` For forward/backward compatability.

Value

A 4D tensor representing `activation(conv2d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 4D tensor with shape: `(batch_size, height, width, channels)`
- If `data_format="channels_first"`: A 4D tensor with shape: `(batch_size, channels, height, width)`

Output Shape

- If `data_format="channels_last"`: A 4D tensor with shape: `(batch_size, new_height, new_width, filters)`
- If `data_format="channels_first"`: A 4D tensor with shape: `(batch_size, filters, new_height, new_width)`

Raises

ValueError: when both `strides` > 1 and `dilation_rate` > 1.

Example

```
x <- random_uniform(c(4, 10, 10, 128))
y <- x |> layer_conv_2d(32, 3, activation='relu')
shape(y)

## shape(4, 8, 8, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution2d#conv2d-class

Other convolutional layers:
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d_transpose()`
`layer_conv_3d()`
`layer_conv_3d_transpose()`
`layer_depthwise_conv_1d()`
`layer_depthwise_conv_2d()`
`layer_separable_conv_1d()`
`layer_separable_conv_2d()`

Other layers:
`Layer()`

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()

layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_conv_2d_transpose
2D transposed convolution layer.

Description

The need for transposed convolutions generally arise from the desire to use a transformation going in the opposite direction of a normal convolution, i.e., from something that has the shape of the output of some convolution to something that has the shape of its input while maintaining a connectivity pattern that is compatible with said convolution.

Usage

```
layer_conv_2d_transpose(
  object,
  filters,
  kernel_size,
  strides = list(1L, 1L),
  padding = "valid",
  data_format = NULL,
  dilation_rate = list(1L, 1L),
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
filters	int, the dimension of the output space (the number of filters in the transposed convolution).
kernel_size	int or list of 1 integer, specifying the size of the transposed convolution window.
strides	int or list of 1 integer, specifying the stride length of the transposed convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
padding	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.
data_format	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
dilation_rate	int or list of 1 integers, specifying the dilation rate to use for dilated transposed convolution.
activation	Activation function. If `NULL`, no activation is applied.
use_bias	bool, if `TRUE`, bias will be added to the output.
kernel_initializer	Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.

bias_initializer
: Initializer for the bias vector. If NULL, the default initializer ("zeros") will be used.

kernel_regularizer
: Optional regularizer for the convolution kernel.

bias_regularizer
: Optional regularizer for the bias vector.

activity_regularizer
: Optional regularizer function for the output.

kernel_constraint
: Optional projection function to be applied to the kernel after being updated by an Optimizer (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

bias_constraint
: Optional projection function to be applied to the bias after being updated by an Optimizer.

...
: For forward/backward compatability.

Value

A 4D tensor representing `activation(conv2d_transpose(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 4D tensor with shape: `(batch_size, height, width, channels)`
- If `data_format="channels_first"`: A 4D tensor with shape: `(batch_size, channels, height, width)`

Output Shape

- If `data_format="channels_last"`: A 4D tensor with shape: `(batch_size, new_height, new_width, filters)`
- If `data_format="channels_first"`: A 4D tensor with shape: `(batch_size, filters, new_height, new_width)`

Raises

ValueError: when both `strides` > 1 and `dilation_rate` > 1.

References

- A guide to convolution arithmetic for deep learning
- Deconvolutional Networks

Example

```
x <- random_uniform(c(4, 10, 8, 128))
y <- x |> layer_conv_2d_transpose(32, 2, 2, activation='relu')
shape(y)

## shape(4, 20, 16, 32)


# (4, 20, 16, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution2d_transpose#conv2dtranspose-class

Other convolutional layers:
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()

layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()

layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()

layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_conv_3d *3D convolution layer.*

Description

This layer creates a convolution kernel that is convolved with the layer input over a 3D spatial (or temporal) dimension (width,height and depth) to produce a tensor of outputs. If `use_bias` is `TRUE`, a bias vector is created and added to the outputs. Finally, if `activation` is not `NULL`, it is applied to the outputs as well.

Usage

```
layer_conv_3d(
  object,
  filters,
  kernel_size,
  strides = list(1L, 1L, 1L),
  padding = "valid",
  data_format = NULL,
  dilation_rate = list(1L, 1L, 1L),
  groups = 1L,
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`filters` int, the dimension of the output space (the number of filters in the convolution).

`kernel_size` int or list of 3 integer, specifying the size of the convolution window.

`strides` int or list of 3 integer, specifying the stride length of the convolution. `strides` > `1` is incompatible with `dilation_rate` > `1`.

`padding` string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.

`data_format` string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, spatial_dim1, s` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

`dilation_rate` int or list of 3 integers, specifying the dilation rate to use for dilated convolution.

`groups` A positive int specifying the number of groups in which the input is split along the channel axis. Each group is convolved separately with `filters %/% groups` filters. The output is the concatenation of all the `groups` results along the channel axis. Input channels and `filters` must both be divisible by `groups`.

`activation` Activation function. If `NULL`, no activation is applied.

`use_bias` bool, if `TRUE`, bias will be added to the output.

`kernel_initializer`
Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.

`bias_initializer`
Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.

`kernel_regularizer`
Optional regularizer for the convolution kernel.

`bias_regularizer`
Optional regularizer for the bias vector.

`activity_regularizer`
Optional regularizer function for the output.

`kernel_constraint`
Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

`bias_constraint`
Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...` For forward/backward compatability.

Value

A 5D tensor representing `activation(conv3d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, new_spatial_dim1, new_spatial_dim2,`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, filters, new_spatial_dim1, new_spa`

Raises

ValueError: when both `strides > 1` and `dilation_rate > 1`.

Example

```
x <- random_uniform(c(4, 10, 10, 10, 128))
y <- x |> layer_conv_3d(32, 3, activation = 'relu')
shape(y)

## shape(4, 8, 8, 8, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution3d#conv3d-class

Other convolutional layers:
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d()`
`layer_conv_2d_transpose()`
`layer_conv_3d_transpose()`
`layer_depthwise_conv_1d()`
`layer_depthwise_conv_2d()`
`layer_separable_conv_1d()`
`layer_separable_conv_2d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`

layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()

layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()

layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_conv_3d_transpose

3D transposed convolution layer.

Description

The need for transposed convolutions generally arise from the desire to use a transformation going in the opposite direction of a normal convolution, i.e., from something that has the shape of the output of some convolution to something that has the shape of its input while maintaining a connectivity pattern that is compatible with said convolution.

Usage

```
layer_conv_3d_transpose(
  object,
  filters,
  kernel_size,
```

```
  strides = list(1L, 1L, 1L),
  padding = "valid",
  data_format = NULL,
  dilation_rate = list(1L, 1L, 1L),
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the transposed convolution).
`kernel_size`	int or list of 1 integer, specifying the size of the transposed convolution window.
`strides`	int or list of 1 integer, specifying the stride length of the transposed convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, spatial_dim1, s` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`dilation_rate`	int or list of 1 integers, specifying the dilation rate to use for dilated transposed convolution.
`activation`	Activation function. If `NULL`, no activation is applied.
`use_bias`	bool, if `TRUE`, bias will be added to the output.
`kernel_initializer`	Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.
`bias_initializer`	Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.
`kernel_regularizer`	Optional regularizer for the convolution kernel.

`bias_regularizer`
: Optional regularizer for the bias vector.

`activity_regularizer`
: Optional regularizer function for the output.

`kernel_constraint`
: Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

`bias_constraint`
: Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...`
: For forward/backward compatability.

Value

A 5D tensor representing `activation(conv3d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, new_spatial_dim1, new_spatial_dim2,`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, filters, new_spatial_dim1, new_spa`

Raises

ValueError: when both `strides` > 1 and `dilation_rate` > 1.

References

- A guide to convolution arithmetic for deep learning
- Deconvolutional Networks

Example

```
x <- random_uniform(c(4, 10, 8, 12, 128))
y <- x |> layer_conv_3d_transpose(32, 2, 2, activation = 'relu')
shape(y)
```

```
## shape(4, 20, 16, 24, 32)
```

See Also

- https://keras.io/api/layers/convolution_layers/convolution3d_transpose#conv3dtranspose-class

Other convolutional layers:
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()

layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()

layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()

```
rnn_cell_simple()
rnn_cells_stack()
```

---

layer_conv_lstm_1d *1D Convolutional LSTM.*

Description

Similar to an LSTM layer, but the input transformations and recurrent transformations are both convolutional.

Usage

```
layer_conv_lstm_1d(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  unit_forget_bias = TRUE,
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  ...,
  unroll = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the convolution).
`kernel_size`	int or tuple/list of 1 integer, specifying the size of the convolution window.
`strides`	int or tuple/list of 1 integer, specifying the stride length of the convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`dilation_rate`	int or tuple/list of 1 integers, specifying the dilation rate to use for dilated convolution.
`activation`	Activation function to use. By default hyperbolic tangent activation function is applied (`tanh(x)`).
`recurrent_activation`	Activation function to use for the recurrent step.
`use_bias`	Boolean, whether the layer uses a bias vector.
`kernel_initializer`	Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs.
`recurrent_initializer`	Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state.
`bias_initializer`	Initializer for the bias vector.
`unit_forget_bias`	Boolean. If `TRUE`, add 1 to the bias of the forget gate at initialization. Use in combination with `bias_initializer="zeros"`. This is recommended in Jozefowicz et al., 2015
`kernel_regularizer`	Regularizer function applied to the `kernel` weights matrix.
`recurrent_regularizer`	Regularizer function applied to the `recurrent_kernel` weights matrix.
`bias_regularizer`	Regularizer function applied to the bias vector.
`activity_regularizer`	Regularizer function applied to.
`kernel_constraint`	Constraint function applied to the `kernel` weights matrix.

recurrent_constraint
: Constraint function applied to the recurrent_kernel weights matrix.

bias_constraint
: Constraint function applied to the bias vector.

dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs.

recurrent_dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state.

seed
: Random seed for dropout.

return_sequences
: Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: FALSE.

return_state
: Boolean. Whether to return the last state in addition to the output. Default: FALSE.

go_backwards
: Boolean (default: FALSE). If TRUE, process the input sequence backwards and return the reversed sequence.

stateful
: Boolean (default FALSE). If TRUE, the last state for each sample at index i in a batch will be used as initial state for the sample of index i in the following batch.

...
: For forward/backward compatability.

unroll
: Boolean (default: FALSE). If TRUE, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Call Arguments

- inputs: A 4D tensor.
- initial_state: List of initial state tensors to be passed to the first call of the cell.
- mask: Binary tensor of shape (samples, timesteps) indicating whether a given timestep should be masked.
- training: Python boolean indicating whether the layer should behave in training mode or in inference mode. This is only relevant if dropout or recurrent_dropout are set.

Input Shape

- If data_format="channels_first": 4D tensor with shape: (samples, time, channels, rows)
- If data_format="channels_last": 4D tensor with shape: (samples, time, rows, channels)

Output Shape

- If `return_state`: a list of tensors. The first tensor is the output. The remaining tensors are the last states, each 3D tensor with shape: `(samples, filters, new_rows)` if `data_format='channels_first'` or shape: `(samples, new_rows, filters)` if `data_format='channels_last'`. `rows` values might have changed due to padding.
- If `return_sequences`: 4D tensor with shape: `(samples, timesteps, filters, new_rows)` if data_format='channels_first' or shape: `(samples, timesteps, new_rows, filters)` if `data_format='channels_last'`.
- Else, 3D tensor with shape: `(samples, filters, new_rows)` if `data_format='channels_first'` or shape: `(samples, new_rows, filters)` if `data_format='channels_last'`.

References

- Shi et al., 2015 (the current implementation does not include the feedback loop on the cells output).

See Also

- `https://keras.io/api/layers/recurrent_layers/conv_lstm1d#convlstm1d-class`

Other rnn layers:
`layer_bidirectional()`
`layer_conv_lstm_2d()`
`layer_conv_lstm_3d()`
`layer_gru()`
`layer_lstm()`
`layer_rnn()`
`layer_simple_rnn()`
`layer_time_distributed()`
`rnn_cell_gru()`
`rnn_cell_lstm()`
`rnn_cell_simple()`
`rnn_cells_stack()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`

layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()

layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()

layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_conv_lstm_2d` *2D Convolutional LSTM.*

Description

Similar to an LSTM layer, but the input transformations and recurrent transformations are both convolutional.

Usage

```
layer_conv_lstm_2d(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
```

```
  bias_initializer = "zeros",
  unit_forget_bias = TRUE,
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  ...,
  unroll = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the convolution).
`kernel_size`	int or tuple/list of 2 integers, specifying the size of the convolution window.
`strides`	int or tuple/list of 2 integers, specifying the stride length of the convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`dilation_rate`	int or tuple/list of 2 integers, specifying the dilation rate to use for dilated convolution.
`activation`	Activation function to use. By default hyperbolic tangent activation function is applied (`tanh(x)`).
`recurrent_activation`	Activation function to use for the recurrent step.
`use_bias`	Boolean, whether the layer uses a bias vector.
`kernel_initializer`	Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs.

`recurrent_initializer`
: Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state.

`bias_initializer`
: Initializer for the bias vector.

`unit_forget_bias`
: Boolean. If `TRUE`, add 1 to the bias of the forget gate at initialization. Use in combination with `bias_initializer="zeros"`. This is recommended in Jozefowicz et al., 2015

`kernel_regularizer`
: Regularizer function applied to the `kernel` weights matrix.

`recurrent_regularizer`
: Regularizer function applied to the `recurrent_kernel` weights matrix.

`bias_regularizer`
: Regularizer function applied to the bias vector.

`activity_regularizer`
: Regularizer function applied to.

`kernel_constraint`
: Constraint function applied to the `kernel` weights matrix.

`recurrent_constraint`
: Constraint function applied to the `recurrent_kernel` weights matrix.

`bias_constraint`
: Constraint function applied to the bias vector.

`dropout`
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs.

`recurrent_dropout`
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state.

`seed`
: Random seed for dropout.

`return_sequences`
: Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: `FALSE`.

`return_state`
: Boolean. Whether to return the last state in addition to the output. Default: `FALSE`.

`go_backwards`
: Boolean (default: `FALSE`). If `TRUE`, process the input sequence backwards and return the reversed sequence.

`stateful`
: Boolean (default FALSE). If `TRUE`, the last state for each sample at index i in a batch will be used as initial state for the sample of index i in the following batch.

`...`
: For forward/backward compatability.

`unroll`
: Boolean (default: `FALSE`). If `TRUE`, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 5D tensor.
- `mask`: Binary tensor of shape `(samples, timesteps)` indicating whether a given timestep should be masked.
- `training`: Python boolean indicating whether the layer should behave in training mode or in inference mode. This is only relevant if `dropout` or `recurrent_dropout` are set.
- `initial_state`: List of initial state tensors to be passed to the first call of the cell.

Input Shape

- If `data_format='channels_first'`: 5D tensor with shape: `(samples, time, channels, rows, cols)`
- If `data_format='channels_last'`: 5D tensor with shape: `(samples, time, rows, cols, channels)`

Output Shape

- If `return_state`: a list of tensors. The first tensor is the output. The remaining tensors are the last states, each 4D tensor with shape: `(samples, filters, new_rows, new_cols)` if `data_format='channels_first'` or shape: `(samples, new_rows, new_cols, filters)` if `data_format='channels_last'`. `rows` and `cols` values might have changed due to padding.
- If `return_sequences`: 5D tensor with shape: `(samples, timesteps, filters, new_rows, new_cols)` if data_format='channels_first' or shape: `(samples, timesteps, new_rows, new_cols, filters)` if `data_format='channels_last'`.
- Else, 4D tensor with shape: `(samples, filters, new_rows, new_cols)` if `data_format='channels_first'` or shape: `(samples, new_rows, new_cols, filters)` if `data_format='channels_last'`.

References

- Shi et al., 2015 (the current implementation does not include the feedback loop on the cells output).

See Also

- https://keras.io/api/layers/recurrent_layers/conv_lstm2d#convlstm2d-class

Other rnn layers:
`layer_bidirectional()`
`layer_conv_lstm_1d()`
`layer_conv_lstm_3d()`
`layer_gru()`

layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()

layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()

layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_conv_lstm_3d *3D Convolutional LSTM.*

Description

Similar to an LSTM layer, but the input transformations and recurrent transformations are both convolutional.

Usage

```
layer_conv_lstm_3d(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  unit_forget_bias = TRUE,
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  ...,
  unroll = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimension of the output space (the number of filters in the convolution).

kernel_size — int or tuple/list of 3 integers, specifying the size of the convolution window.

strides — int or tuple/list of 3 integers, specifying the stride length of the convolution. strides > 1 is incompatible with dilation_rate > 1.

padding — string, "valid" or "same" (case-insensitive). "valid" means no padding. "same" results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.

data_format — string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, steps, features) while "channels_first" corresponds to inputs with shape (batch, features, steps). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".

dilation_rate — int or tuple/list of 3 integers, specifying the dilation rate to use for dilated convolution.

activation — Activation function to use. By default hyperbolic tangent activation function is applied (tanh(x)).

recurrent_activation — Activation function to use for the recurrent step.

use_bias — Boolean, whether the layer uses a bias vector.

kernel_initializer — Initializer for the kernel weights matrix, used for the linear transformation of the inputs.

recurrent_initializer — Initializer for the recurrent_kernel weights matrix, used for the linear transformation of the recurrent state.

bias_initializer — Initializer for the bias vector.

unit_forget_bias — Boolean. If TRUE, add 1 to the bias of the forget gate at initialization. Use in combination with bias_initializer="zeros". This is recommended in Jozefowicz et al., 2015

kernel_regularizer — Regularizer function applied to the kernel weights matrix.

recurrent_regularizer — Regularizer function applied to the recurrent_kernel weights matrix.

bias_regularizer — Regularizer function applied to the bias vector.

activity_regularizer — Regularizer function applied to.

kernel_constraint — Constraint function applied to the kernel weights matrix.

recurrent_constraint — Constraint function applied to the recurrent_kernel weights matrix.

bias_constraint — Constraint function applied to the bias vector.

`dropout`	Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs.
`recurrent_dropout`	Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state.
`seed`	Random seed for dropout.
`return_sequences`	Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: `FALSE`.
`return_state`	Boolean. Whether to return the last state in addition to the output. Default: `FALSE`.
`go_backwards`	Boolean (default: `FALSE`). If `TRUE`, process the input sequence backwards and return the reversed sequence.
`stateful`	Boolean (default `FALSE`). If `TRUE`, the last state for each sample at index i in a batch will be used as initial state for the sample of index i in the following batch.
`...`	For forward/backward compatability.
`unroll`	Boolean (default: `FALSE`). If `TRUE`, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 6D tensor.
- `mask`: Binary tensor of shape `(samples, timesteps)` indicating whether a given timestep should be masked.
- `training`: Python boolean indicating whether the layer should behave in training mode or in inference mode. This is only relevant if `dropout` or `recurrent_dropout` are set.
- `initial_state`: List of initial state tensors to be passed to the first call of the cell.

Input Shape

- If `data_format='channels_first'`: 5D tensor with shape: `(samples, time, channels, *spatial_dims)`
- If `data_format='channels_last'`: 5D tensor with shape: `(samples, time, *spatial_dims, channels)`

Output Shape

- If return_state: a list of tensors. The first tensor is the output. The remaining tensors are the last states, each 4D tensor with shape: (samples, filters, *spatial_dims) if data_format='channels_first' or shape: (samples, *spatial_dims, filters) if data_format='channels_last'.
- If return_sequences: 5D tensor with shape: (samples, timesteps, filters, *spatial_dims) if data_format='channels_first' or shape: (samples, timesteps, *spatial_dims, filters) if data_format='channels_last'.
- Else, 4D tensor with shape: (samples, filters, *spatial_dims) if data_format='channels_first' or shape: (samples, *spatial_dims, filters) if data_format='channels_last'.

References

- Shi et al., 2015 (the current implementation does not include the feedback loop on the cells output).

See Also

- https://keras.io/api/layers/recurrent_layers/conv_lstm3d#convlstm3d-class

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_gru()
layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()

layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()

layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()

layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_cropping_1d *Cropping layer for 1D input (e.g. temporal sequence).*

Description

It crops along the time dimension (axis 2).

Usage

```
layer_cropping_1d(object, cropping = list(1L, 1L), ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
cropping	Int, or list of int (length 2). • If int: how many units should be trimmed off at the beginning and end of the cropping dimension (axis 1). • If list of 2 ints: how many units should be trimmed off at the beginning and end of the cropping dimension ((left_crop, right_crop)).
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 3, 2)
x <- op_arange(prod(input_shape)) |> op_reshape(input_shape)
x

## tf.Tensor(
## [[[ 1.  2.]
##   [ 3.  4.]
##   [ 5.  6.]]
##
##  [[ 7.  8.]
##   [ 9. 10.]
##   [11. 12.]]], shape=(2, 3, 2), dtype=float32)


y <- x |> layer_cropping_1d(cropping = 1)
y

## tf.Tensor(
## [[[ 3.  4.]]
##
##  [[ 9. 10.]]], shape=(2, 1, 2), dtype=float32)
```

Input Shape

3D tensor with shape `(batch_size, axis_to_crop, features)`

Output Shape

3D tensor with shape `(batch_size, cropped_axis, features)`

See Also

- https://keras.io/api/layers/reshaping_layers/cropping1d#cropping1d-class

Other reshaping layers:
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_flatten()`

layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()

layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()

layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_cropping_2d *Cropping layer for 2D input (e.g. picture).*

Description

It crops along spatial dimensions, i.e. height and width.

Usage

```
layer_cropping_2d(
  object,
  cropping = list(list(0L, 0L), list(0L, 0L)),
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`cropping`	Int, or list of 2 ints, or list of 2 lists of 2 ints. • If int: the same symmetric cropping is applied to height and width. • If list of 2 ints: interpreted as two different symmetric cropping values for height and width: `(symmetric_height_crop, symmetric_width_crop)`. • If list of 2 lists of 2 ints: interpreted as `((top_crop, bottom_crop), (left_crop, right_crop))`.
`data_format`	A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, height, width)`. When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists). Defaults to `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 28, 28, 3)
x <- op_arange(prod(input_shape), dtype ='int32') |> op_reshape(input_shape)
y <- x |> layer_cropping_2d(cropping=list(c(2, 2), c(4, 4)))
shape(y)

## shape(2, 24, 20, 3)
```

Input Shape

4D tensor with shape:

- If data_format is "channels_last": (batch_size, height, width, channels)
- If data_format is "channels_first": (batch_size, channels, height, width)

Output Shape

4D tensor with shape:

- If data_format is "channels_last": (batch_size, cropped_height, cropped_width, channels)
- If data_format is "channels_first": (batch_size, channels, cropped_height, cropped_width)

See Also

- https://keras.io/api/layers/reshaping_layers/cropping2d#cropping2d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()

layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()

layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()

layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_cropping_3d *Cropping layer for 3D data (e.g. spatial or spatio-temporal).*

Description

Cropping layer for 3D data (e.g. spatial or spatio-temporal).

Usage

```
layer_cropping_3d(
  object,
  cropping = list(list(1L, 1L), list(1L, 1L), list(1L, 1L)),
  data_format = NULL,
  ...
)
```

Arguments

- `object` — Object to compose the layer with. A tensor, array, or sequential model.
- `cropping` — Int, or list of 3 ints, or list of 3 lists of 2 ints.
  - If int: the same symmetric cropping is applied to depth, height, and width.
  - If list of 3 ints: interpreted as three different symmetric cropping values for depth, height, and width: `(symmetric_dim1_crop, symmetric_dim2_crop, symmetric_dim3_cro`
  - If list of 3 lists of 2 ints: interpreted as `((left_dim1_crop, right_dim1_crop), (left_dim2_crop`
- `data_format` — A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, spatial_dim1, s` When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists). Defaults to `"channels_last"`.
- `...` — For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 28, 28, 10, 3)
x <- input_shape %>% { op_reshape(seq(prod(.)), .) }
y <- x |> layer_cropping_3d(cropping = c(2, 4, 2))
shape(y)

## shape(2, 24, 20, 6, 3)
```

Input Shape

5D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, first_axis_to_crop, second_axis_to_crop, third_axis_`
- If `data_format` is `"channels_first"`: `(batch_size, channels, first_axis_to_crop, second_axis_to_crop,`

Output Shape

5D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, first_cropped_axis, second_cropped_axis, third_cropp`
- If `data_format` is `"channels_first"`: `(batch_size, channels, first_cropped_axis, second_cropped_axis,`

See Also

- https://keras.io/api/layers/reshaping_layers/cropping3d#cropping3d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()

layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()

layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()

layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_cut_mix *CutMix data augmentation technique.*

Description

CutMix is a data augmentation method where patches are cut and pasted between two images in the dataset, while the labels are also mixed proportionally to the area of the patches.

Usage

```
layer_cut_mix(object, factor = 1, seed = NULL, data_format = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A single float or a tuple of two floats between 0 and 1. If a tuple of numbers is passed, a `factor` is sampled between the two values. If a single float is passed, a value between 0 and the passed float is sampled. These values define the range from which the mixing weight is sampled. A higher factor increases the variability in patch sizes, leading to more diverse and larger mixed patches. Defaults to 1.
`seed`	Integer. Used to create a random seed.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`...`	For forward/backward compatability.

References

- CutMix paper.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()

layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()

layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()

layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()

layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_dense *Just your regular densely-connected NN layer.*

Description

Dense implements the operation: output = activation(dot(input, kernel) + bias) where activation is the element-wise activation function passed as the activation argument, kernel is a weights matrix created by the layer, and bias is a bias vector created by the layer (only applicable if use_bias is TRUE).

Usage

```
layer_dense(
  object,
  units,
  activation = NULL,
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  lora_rank = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
units	Positive integer, dimensionality of the output space.
activation	Activation function to use. If you don't specify anything, no activation is applied (ie. "linear" activation: a(x) = x).
use_bias	Boolean, whether the layer uses a bias vector.
kernel_initializer	Initializer for the kernel weights matrix.

bias_initializer
: Initializer for the bias vector.

kernel_regularizer
: Regularizer function applied to the kernel weights matrix.

bias_regularizer
: Regularizer function applied to the bias vector.

activity_regularizer
: Regularizer function applied to the output of the layer (its "activation").

kernel_constraint
: Constraint function applied to the kernel weights matrix.

bias_constraint
: Constraint function applied to the bias vector.

lora_rank
: Optional integer. If set, the layer's forward pass will implement LoRA (Low-Rank Adaptation) with the provided rank. LoRA sets the layer's kernel to non-trainable and replaces it with a delta over the original kernel, obtained via multiplying two lower-rank trainable matrices. This can be useful to reduce the computation cost of fine-tuning large dense layers. You can also enable LoRA on an existing Dense layer by calling layer$enable_lora(rank).

...
: For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Note

If the input to the layer has a rank greater than 2, Dense computes the dot product between the inputs and the kernel along the last axis of the inputs and axis 0 of the kernel (using tf.tensordot). For example, if input has dimensions (batch_size, d0, d1), then we create a kernel with shape (d1, units), and the kernel operates along axis 2 of the input, on every sub-tensor of shape (1, 1, d1) (there are batch_size * d0 such sub-tensors). The output in this case will have shape (batch_size, d0, units).

Input Shape

N-D tensor with shape: (batch_size, ..., input_dim). The most common situation would be a 2D input with shape (batch_size, input_dim).

Output Shape

N-D tensor with shape: (batch_size, ..., units). For instance, for a 2D input with shape (batch_size, input_dim), the output would have shape (batch_size, units).

Methods

- ```
  enable_lora(
    rank,
    a_initializer = 'he_uniform',
    b_initializer = 'zeros'
  )
  ```
- `quantize(mode, type_check = TRUE)`

Readonly properties:

- `kernel`

See Also

- https://keras.io/api/layers/core_layers/dense#dense-class

Other core layers:
`layer_einsum_dense()`
`layer_embedding()`
`layer_identity()`
`layer_lambda()`
`layer_masking()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
  ```

layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
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layer_random_rotation()
layer_random_saturation()
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layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_depthwise_conv_1d

1D depthwise convolution layer.

Description

Depthwise convolution is a type of convolution in which each input channel is convolved with a different kernel (called a depthwise kernel). You can understand depthwise convolution as the first step in a depthwise separable convolution.

It is implemented via the following steps:

- Split the input into individual channels.
- Convolve each channel with an individual depthwise kernel with `depth_multiplier` output channels.
- Concatenate the convolved outputs along the channels axis.

Unlike a regular 1D convolution, depthwise convolution does not mix information across different input channels.

The `depth_multiplier` argument determines how many filters are applied to one input channel. As such, it controls the amount of output channels that are generated per input channel in the depthwise step.

Usage

```
layer_depthwise_conv_1d(
  object,
  kernel_size,
  strides = 1L,
  padding = "valid",
  depth_multiplier = 1L,
  data_format = NULL,
  dilation_rate = 1L,
  activation = NULL,
```

```
  use_bias = TRUE,
  depthwise_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  depthwise_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  depthwise_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`kernel_size` int or list of 1 integer, specifying the size of the depthwise convolution window.

`strides` int or list of 1 integer, specifying the stride length of the convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.

`padding` string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.

`depth_multiplier` The number of depthwise convolution output channels for each input channel. The total number of depthwise convolution output channels will be equal to `input_channel * depth_multiplier`.

`data_format` string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

`dilation_rate` int or list of 1 integers, specifying the dilation rate to use for dilated convolution.

`activation` Activation function. If `NULL`, no activation is applied.

`use_bias` bool, if `TRUE`, bias will be added to the output.

`depthwise_initializer` Initializer for the convolution kernel. If `NULL`, the default initializer (`"glorot_uniform"`) will be used.

`bias_initializer` Initializer for the bias vector. If `NULL`, the default initializer (`"zeros"`) will be used.

`depthwise_regularizer` Optional regularizer for the convolution kernel.

`bias_regularizer` Optional regularizer for the bias vector.

`activity_regularizer` Optional regularizer function for the output.

`depthwise_constraint`
: Optional projection function to be applied to the kernel after being updated by an `Optimizer` (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

`bias_constraint`
: Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...`
: For forward/backward compatability.

Value

A 3D tensor representing `activation(depthwise_conv1d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, steps, channels)`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, channels, steps)`

Output Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, new_steps, channels * depth_multi`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, channels * depth_multiplier, new`

Raises

ValueError: when both `strides > 1` and `dilation_rate > 1`.

Example

```
x <- random_uniform(c(4, 10, 12))
y <- x |> layer_depthwise_conv_1d(
  kernel_size = 3,
  depth_multiplier = 3,
  activation = 'relu'
)
shape(y)
```

```
## shape(4, 8, 36)
```

See Also

Other convolutional layers:
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d()`
`layer_conv_2d_transpose()`

layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_2d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()

layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()

layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_depthwise_conv_2d

2D depthwise convolution layer.

Description

Depthwise convolution is a type of convolution in which each input channel is convolved with a different kernel (called a depthwise kernel). You can understand depthwise convolution as the first step in a depthwise separable convolution.

It is implemented via the following steps:

- Split the input into individual channels.
- Convolve each channel with an individual depthwise kernel with `depth_multiplier` output channels.
- Concatenate the convolved outputs along the channels axis.

Unlike a regular 2D convolution, depthwise convolution does not mix information across different input channels.

The `depth_multiplier` argument determines how many filters are applied to one input channel. As such, it controls the amount of output channels that are generated per input channel in the depthwise step.

Usage

```
layer_depthwise_conv_2d(
  object,
  kernel_size,
  strides = list(1L, 1L),
  padding = "valid",
  depth_multiplier = 1L,
  data_format = NULL,
  dilation_rate = list(1L, 1L),
  activation = NULL,
  use_bias = TRUE,
  depthwise_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  depthwise_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  depthwise_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`kernel_size`	int or list of 2 integer, specifying the size of the depthwise convolution window.
`strides`	int or list of 2 integer, specifying the stride length of the depthwise convolution. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.

depth_multiplier
: The number of depthwise convolution output channels for each input channel. The total number of depthwise convolution output channels will be equal to input_channel * depth_multiplier.

data_format
: string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".

dilation_rate
: int or list of 2 integers, specifying the dilation rate to use for dilated convolution.

activation
: Activation function. If NULL, no activation is applied.

use_bias
: bool, if TRUE, bias will be added to the output.

depthwise_initializer
: Initializer for the convolution kernel. If NULL, the default initializer ("glorot_uniform") will be used.

bias_initializer
: Initializer for the bias vector. If NULL, the default initializer ("zeros") will be used.

depthwise_regularizer
: Optional regularizer for the convolution kernel.

bias_regularizer
: Optional regularizer for the bias vector.

activity_regularizer
: Optional regularizer function for the output.

depthwise_constraint
: Optional projection function to be applied to the kernel after being updated by an Optimizer (e.g. used to implement norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape). Constraints are not safe to use when doing asynchronous distributed training.

bias_constraint
: Optional projection function to be applied to the bias after being updated by an Optimizer.

...
: For forward/backward compatability.

Value

A 4D tensor representing activation(depthwise_conv2d(inputs, kernel) + bias).

Input Shape

- If data_format="channels_last": A 4D tensor with shape: (batch_size, height, width, channels)
- If data_format="channels_first": A 4D tensor with shape: (batch_size, channels, height, width)

Output Shape

- If data_format="channels_last": A 4D tensor with shape: (batch_size, new_height, new_width, channels *
- If data_format="channels_first": A 4D tensor with shape: (batch_size, channels * depth_multiplier, new_

Raises

ValueError: when both strides > 1 and dilation_rate > 1.

Example

```
x <- random_uniform(c(4, 10, 10, 12))
y <- x |> layer_depthwise_conv_2d(kernel_size = 3, activation = 'relu')
shape(y)

## shape(4, 8, 8, 12)
```

See Also

- https://keras.io/api/layers/convolution_layers/depthwise_convolution2d#depthwiseconv2d-class

Other convolutional layers:
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_1d()
layer_separable_conv_1d()
layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()

layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()

layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_discretization *A preprocessing layer which buckets continuous features by ranges.*

Description

This layer will place each element of its input data into one of several contiguous ranges and output an integer index indicating which range each element was placed in.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_discretization(
  object,
  bin_boundaries = NULL,
  num_bins = NULL,
  epsilon = 0.01,
  output_mode = "int",
  sparse = FALSE,
  dtype = NULL,
  name = NULL
)
```

Arguments

- `object` — Object to compose the layer with. A tensor, array, or sequential model.
- `bin_boundaries` — A list of bin boundaries. The leftmost and rightmost bins will always extend to `-Inf` and `Inf`, so `bin_boundaries = c(0, 1, 2)` generates bins `(-Inf, 0)`, `[0, 1)`, `[1, 2)`, and `[2, +Inf)`. If this option is set, `adapt()` should not be called.
- `num_bins` — The integer number of bins to compute. If this option is set, `bin_boundaries` should not be set and `adapt()` should be called to learn the bin boundaries.
- `epsilon` — Error tolerance, typically a small fraction close to zero (e.g. 0.01). Higher values of epsilon increase the quantile approximation, and hence result in more unequal buckets, but could improve performance and resource consumption.
- `output_mode` — Specification for the output of the layer. Values can be `"int"`, `"one_hot"`, `"multi_hot"`, or `"count"` configuring the layer as follows:
  - `"int"`: Return the discretized bin indices directly.
  - `"one_hot"`: Encodes each individual element in the input into an array the same size as `num_bins`, containing a 1 at the input's bin index. If the last dimension is size 1, will encode on that dimension. If the last dimension is not size 1, will append a new dimension for the encoded output.
  - `"multi_hot"`: Encodes each sample in the input into a single array the same size as `num_bins`, containing a 1 for each bin index index present in the sample. Treats the last dimension as the sample dimension, if input shape is `(..., sample_length)`, output shape will be `(..., num_tokens)`.
  - `"count"`: As `"multi_hot"`, but the int array contains a count of the number of times the bin index appeared in the sample. Defaults to `"int"`.
- `sparse` — Boolean. Only applicable to `"one_hot"`, `"multi_hot"`, and `"count"` output modes. Only supported with TensorFlow backend. If `TRUE`, returns a `SparseTensor` instead of a dense `Tensor`. Defaults to `FALSE`.
- `dtype` — datatype (e.g., `"float32"`).
- `name` — String, name for the object

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

Any array of dimension 2 or higher.

Output Shape

Same as input shape.

Examples

Discretize float values based on provided buckets.

```
input <- op_array(rbind(c(-1.5, 1, 3.4, 0.5),
                        c(0, 3, 1.3, 0),
                        c(-.5, 0, .5, 1),
                        c(1.5, 2, 2.5, 3)))
output <- input |> layer_discretization(bin_boundaries = c(0, 1, 2))
output
```

```
## tf.Tensor(
## [[0 2 3 1]
##  [1 3 2 1]
##  [0 1 1 2]
##  [2 3 3 3]], shape=(4, 4), dtype=int64)
```

Discretize float values based on a number of buckets to compute.

```
layer <- layer_discretization(num_bins = 4, epsilon = 0.01)
layer |> adapt(input)
layer(input)
```

```
## tf.Tensor(
## [[0 2 3 1]
##  [1 3 2 1]
##  [0 1 1 2]
##  [2 3 3 3]], shape=(4, 4), dtype=int64)
```

See Also

- https://keras.io/api/layers/preprocessing_layers/numerical/discretization#discretization-class

Other numerical features preprocessing layers:
layer_normalization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()

layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()

layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()

layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_dot *Computes element-wise dot product of two tensors.*

Description

It takes a list of inputs of size 2, and the axes corresponding to each input along with the dot product is to be performed.

Let's say `x` and `y` are the two input tensors with shapes `(2, 3, 5)` and `(2, 10, 3)`. The batch dimension should be of same size for both the inputs, and `axes` should correspond to the dimensions that have the same size in the corresponding inputs. e.g. with `axes = c(1, 2)`, the dot product of `x`, and `y` will result in a tensor with shape `(2, 5, 10)`

Usage

```
layer_dot(inputs, ..., axes, normalize = FALSE)
```

Arguments

inputs	layers to combine
...	Standard layer keyword arguments.
axes	Integer or list of integers, axis or axes along which to take the dot product. If a list, should be two integers corresponding to the desired axis from the first input and the desired axis from the second input, respectively. Note that the size of the two selected axes must match.
normalize	Whether to L2-normalize samples along the dot product axis before taking the dot product. If set to `TRUE`, then the output of the dot product is the cosine proximity between the two samples.

Value

A tensor, the dot product of the samples from the inputs.

Examples

```
x <- op_reshape(0:9,   c(1, 5, 2))
y <- op_reshape(10:19, c(1, 2, 5))
layer_dot(x, y, axes=c(2, 3))

## tf.Tensor(
## [[[260 360]
##   [320 445]]], shape=(1, 2, 2), dtype=int32)
```

Usage in a Keras model:

```
x1 <- op_reshape(0:9, c(5, 2)) |> layer_dense(8)
x2 <- op_reshape(10:19, c(5, 2)) |> layer_dense(8)
shape(x1)

## shape(5, 8)

shape(x2)

## shape(5, 8)

y <- layer_dot(x1, x2, axes=2)
shape(y)

## shape(5, 1)
```

See Also

- https://keras.io/api/layers/merging_layers/dot#dot-class

Other merging layers:
layer_add()
layer_average()
layer_concatenate()
layer_maximum()
layer_minimum()
layer_multiply()
layer_subtract()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()

layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
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layer_random_rotation()
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layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
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layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_dropout *Applies dropout to the input.*

Description

The Dropout layer randomly sets input units to 0 with a frequency of rate at each step during training time, which helps prevent overfitting. Inputs not set to 0 are scaled up by 1 / (1 - rate) such that the sum over all inputs is unchanged.

Note that the `Dropout` layer only applies when `training` is set to `TRUE` in `call()`, such that no values are dropped during inference. When using `model.fit`, `training` will be appropriately set to `TRUE` automatically. In other contexts, you can set the argument explicitly to `TRUE` when calling the layer.

(This is in contrast to setting `trainable=FALSE` for a `Dropout` layer. `trainable` does not affect the layer's behavior, as `Dropout` does not have any variables/weights that can be frozen during training.)

Usage

```
layer_dropout(object, rate, noise_shape = NULL, seed = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`rate`	Float between 0 and 1. Fraction of the input units to drop.
`noise_shape`	1D integer tensor representing the shape of the binary dropout mask that will be multiplied with the input. For instance, if your inputs have shape `(batch_size, timesteps, features)` and you want the dropout mask to be the same for all timesteps, you can use `noise_shape=(batch_size, 1, features)`.
`seed`	An R integer to use as random seed.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor (of any rank).
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (doing nothing).

See Also

- https://keras.io/api/layers/regularization_layers/dropout#dropout-class

Other regularization layers:
`layer_activity_regularization()`
`layer_alpha_dropout()`
`layer_gaussian_dropout()`
`layer_gaussian_noise()`
`layer_spatial_dropout_1d()`

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_einsum_dense *A layer that uses* einsum *as the backing computation.*

Description

This layer can perform einsum calculations of arbitrary dimensionality.

Usage

```
layer_einsum_dense(
  object,
  equation,
  output_shape,
  activation = NULL,
  bias_axes = NULL,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  lora_rank = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`equation`	An equation describing the einsum to perform. This equation must be a valid einsum string of the form `ab,bc->ac`, `...ab,bc->...ac`, or `ab...,bc->ac...` where 'ab', 'bc', and 'ac' can be any valid einsum axis expression sequence.
`output_shape`	The expected shape of the output tensor (excluding the batch dimension and any dimensions represented by ellipses). You can specify `NA` or `NULL` for any dimension that is unknown or can be inferred from the input shape.
`activation`	Activation function to use. If you don't specify anything, no activation is applied (that is, a "linear" activation: `a(x) = x`).
`bias_axes`	A string containing the output dimension(s) to apply a bias to. Each character in the `bias_axes` string should correspond to a character in the output portion of the `equation` string.
`kernel_initializer`	Initializer for the `kernel` weights matrix.
`bias_initializer`	Initializer for the bias vector.
`kernel_regularizer`	Regularizer function applied to the `kernel` weights matrix.
`bias_regularizer`	Regularizer function applied to the bias vector.
`kernel_constraint`	Constraint function applied to the `kernel` weights matrix.
`bias_constraint`	Constraint function applied to the bias vector.
`lora_rank`	Optional integer. If set, the layer's forward pass will implement LoRA (Low-Rank Adaptation) with the provided rank. LoRA sets the layer's kernel to non-trainable and replaces it with a delta over the original kernel, obtained via multiplying two lower-rank trainable matrices (the factorization happens on the last

dimension). This can be useful to reduce the computation cost of fine-tuning large dense layers. You can also enable LoRA on an existing `EinsumDense` layer by calling `layer$enable_lora(rank)`.

`...` Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Biased dense layer with einsums

This example shows how to instantiate a standard Keras dense layer using einsum operations. This example is equivalent to `layer_Dense(64, use_bias=TRUE)`.

```
input <- layer_input(shape = c(32))
output <- input |>
  layer_einsum_dense("ab,bc->ac",
                     output_shape = 64,
                     bias_axes = "c")
output # shape(NA, 64)
```

```
## <KerasTensor shape=(None, 64), dtype=float32, sparse=False, ragged=False, name=keras_tensor_1>
```

Applying a dense layer to a sequence

This example shows how to instantiate a layer that applies the same dense operation to every element in a sequence. Here, the `output_shape` has two values (since there are two non-batch dimensions in the output); the first dimension in the `output_shape` is `NA`, because the sequence dimension `b` has an unknown shape.

```
input <- layer_input(shape = c(32, 128))
output <- input |>
  layer_einsum_dense("abc,cd->abd",
                     output_shape = c(NA, 64),
                     bias_axes = "d")
output  # shape(NA, 32, 64)
```

```
## <KerasTensor shape=(None, None, 64), dtype=float32, sparse=False, ragged=False, name=keras_tensor_3
```

Applying a dense layer to a sequence using ellipses

This example shows how to instantiate a layer that applies the same dense operation to every element in a sequence, but uses the ellipsis notation instead of specifying the batch and sequence dimensions.

Because we are using ellipsis notation and have specified only one axis, the `output_shape` arg is a single value. When instantiated in this way, the layer can handle any number of sequence dimensions - including the case where no sequence dimension exists.

```
input <- layer_input(shape = c(32, 128))
output <- input |>
  layer_einsum_dense("...x,xy->...y",
                     output_shape = 64,
                     bias_axes = "y")

output  # shape(NA, 32, 64)

## <KerasTensor shape=(None, 32, 64), dtype=float32, sparse=False, ragged=False, name=keras_tensor_5>
```

Methods

- ```
  enable_lora(
    rank,
    a_initializer = 'he_uniform',
    b_initializer = 'zeros'
  )
  ```
- `quantize(mode, type_check = TRUE)`

Readonly properties:

- `kernel`

See Also

Other core layers:
`layer_dense()`
`layer_embedding()`
`layer_identity()`
`layer_lambda()`
`layer_masking()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
  ```

layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()

layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()

layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_embedding *Turns nonnegative integers (indexes) into dense vectors of fixed size.*

Description

e.g. `rbind(4L, 20L)` → `rbind(c(0.25, 0.1), c(0.6, -0.2))`

This layer can only be used on nonnegative integer inputs of a fixed range.

Usage

```
layer_embedding(
  object,
  input_dim,
  output_dim,
  embeddings_initializer = "uniform",
  embeddings_regularizer = NULL,
  embeddings_constraint = NULL,
```

```
  mask_zero = FALSE,
  weights = NULL,
  lora_rank = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`input_dim` Integer. Size of the vocabulary, i.e. maximum integer index + 1.

`output_dim` Integer. Dimension of the dense embedding.

`embeddings_initializer` Initializer for the `embeddings` matrix (see `keras3::initializer_*`).

`embeddings_regularizer` Regularizer function applied to the `embeddings` matrix (see `keras3::regularizer_*`).

`embeddings_constraint` Constraint function applied to the `embeddings` matrix (see `keras3::constraint_*`).

`mask_zero` Boolean, whether or not the input value 0 is a special "padding" value that should be masked out. This is useful when using recurrent layers which may take variable length input. If this is `TRUE`, then all subsequent layers in the model need to support masking or an exception will be raised. If `mask_zero` is set to `TRUE`, as a consequence, index 0 cannot be used in the vocabulary (`input_dim` should equal size of vocabulary + 1).

`weights` Optional floating-point matrix of size `(input_dim, output_dim)`. The initial embeddings values to use.

`lora_rank` Optional integer. If set, the layer's forward pass will implement LoRA (Low-Rank Adaptation) with the provided rank. LoRA sets the layer's embeddings matrix to non-trainable and replaces it with a delta over the original matrix, obtained via multiplying two lower-rank trainable matrices. This can be useful to reduce the computation cost of fine-tuning large embedding layers. You can also enable LoRA on an existing `Embedding` layer instance by calling `layer$enable_lora(rank)`.

`...` For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
model <- keras_model_sequential() |>
  layer_embedding(1000, 64)
```

```
# The model will take as input an integer matrix of size (batch,input_length),
# and the largest integer (i.e. word index) in the input
# should be no larger than 999 (vocabulary size).
# Now model$output_shape is (NA, 10, 64), where `NA` is the batch
# dimension.

input_array <- random_integer(shape = c(32, 10), minval = 0, maxval = 1000)
model |> compile('rmsprop', 'mse')
output_array <- model |> predict(input_array, verbose = 0)
dim(output_array)    # (32, 10, 64)

## [1] 32 10 64
```

Input Shape

2D tensor with shape: `(batch_size, input_length)`.

Output Shape

3D tensor with shape: `(batch_size, input_length, output_dim)`.

Methods

- ```
  enable_lora(
    rank,
    a_initializer = 'he_uniform',
    b_initializer = 'zeros'
  )
  ```
- `quantize(mode, type_check = TRUE)`
- `quantized_build(input_shape, mode)`
- `quantized_call(...)`

Readonly properties:

- `embeddings`

See Also

- https://keras.io/api/layers/core_layers/embedding#embedding-class

Other core layers:
`layer_dense()`
`layer_einsum_dense()`
`layer_identity()`
`layer_lambda()`
`layer_masking()`
  ```

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()

layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()

layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_equalization` *Preprocessing layer for histogram equalization on image channels.*

Description

Histogram equalization is a technique to adjust image intensities to enhance contrast by effectively spreading out the most frequent intensity values. This layer applies equalization on a channel-wise basis, which can improve the visibility of details in images.

This layer works with both grayscale and color images, performing equalization independently on each color channel. At inference time, the equalization is consistently applied.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Input Shape:

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape:

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`, or `(..., channels, target_height, target_width)`, in `"channels_first"` format.

Usage

```
layer_equalization(
  object,
  value_range = list(0L, 255L),
  bins = 256L,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`value_range`	Optional list/tuple of 2 floats specifying the lower and upper limits of the input data values. Defaults to `[0, 255]`. If the input image has been scaled, use the appropriate range (e.g., `[0.0, 1.0]`). The equalization will be scaled to this range, and output values will be clipped accordingly.
`bins`	Integer specifying the number of histogram bins to use for equalization. Defaults to 256, which is suitable for 8-bit images. Larger values can provide more granular intensity redistribution.
`data_format`	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
`...`	For forward/backward compatability.

Examples

```
# Create an equalization layer for standard 8-bit images
equalizer <- layer_equalization()

# An image with uneven intensity distribution
image <- np_array(...) # your input image
```

```
# Apply histogram equalization
equalized_image <- equalizer(image)

# For images with custom value range
custom_equalizer <- layer_equalization(
    value_range=c(0.0, 1.0),  # for normalized images
    bins=128  # fewer bins for more subtle equalization
)
custom_equalized <- custom_equalizer(normalized_image)
```

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()

layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()

layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()

layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()

layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_feature_space` *One-stop utility for preprocessing and encoding structured data.*

Description

Available feature types:

Note that all features can be referred to by their string name, e.g. `"integer_categorical"`. When using the string name, the default argument values are used.

```
# Plain float values.
feature_float(name = NULL)

# Float values to be preprocessed via featurewise standardization
# (i.e. via a `layer_normalization()` layer).
feature_float_normalized(name = NULL)

# Float values to be preprocessed via linear rescaling
# (i.e. via a `layer_rescaling` layer).
feature_float_rescaled(scale = 1., offset = 0., name = NULL)

# Float values to be discretized. By default, the discrete
# representation will then be one-hot encoded.
feature_float_discretized(
  num_bins,
  bin_boundaries = NULL,
  output_mode = "one_hot",
```

```
  name = NULL
)

# Integer values to be indexed. By default, the discrete
# representation will then be one-hot encoded.
feature_integer_categorical(
  max_tokens = NULL,
  num_oov_indices = 1,
  output_mode = "one_hot",
  name = NULL
)

# String values to be indexed. By default, the discrete
# representation will then be one-hot encoded.
feature_string_categorical(
  max_tokens = NULL,
  num_oov_indices = 1,
  output_mode = "one_hot",
  name = NULL
)

# Integer values to be hashed into a fixed number of bins.
# By default, the discrete representation will then be one-hot encoded.
feature_integer_hashed(num_bins, output_mode = "one_hot", name = NULL)

# String values to be hashed into a fixed number of bins.
# By default, the discrete representation will then be one-hot encoded.
feature_string_hashed(num_bins, output_mode = "one_hot", name = NULL)
```

Usage

```
layer_feature_space(
  object,
  features,
  output_mode = "concat",
  crosses = NULL,
  crossing_dim = 32L,
  hashing_dim = 32L,
  num_discretization_bins = 32L,
  name = NULL,
  feature_names = NULL
)

feature_cross(feature_names, crossing_dim, output_mode = "one_hot")

feature_custom(dtype, preprocessor, output_mode)

feature_float(name = NULL)
```

```
feature_float_rescaled(scale = 1, offset = 0, name = NULL)

feature_float_normalized(name = NULL)

feature_float_discretized(
  num_bins,
  bin_boundaries = NULL,
  output_mode = "one_hot",
  name = NULL
)

feature_integer_categorical(
  max_tokens = NULL,
  num_oov_indices = 1,
  output_mode = "one_hot",
  name = NULL
)

feature_string_categorical(
  max_tokens = NULL,
  num_oov_indices = 1,
  output_mode = "one_hot",
  name = NULL
)

feature_string_hashed(num_bins, output_mode = "one_hot", name = NULL)

feature_integer_hashed(num_bins, output_mode = "one_hot", name = NULL)
```

Arguments

`object` see description

`features` see description

`output_mode` A string.
- For `layer_feature_space()`, one of `"concat"` or `"dict"`. In concat mode, all features get concatenated together into a single vector. In dict mode, the `FeatureSpace` returns a named list of individually encoded features (with the same names as the input list names).
- For the `feature_*` functions, one of: `"int"` `"one_hot"` or `"float"`.

`crosses` List of features to be crossed together, e.g. `crosses=list(c("feature_1", "feature_2"))`. The features will be "crossed" by hashing their combined value into a fixed-length vector.

`crossing_dim` Default vector size for hashing crossed features. Defaults to `32`.

`hashing_dim` Default vector size for hashing features of type `"integer_hashed"` and `"string_hashed"`. Defaults to `32`.

`num_discretization_bins`
Default number of bins to be used for discretizing features of type `"float_discretized"`. Defaults to `32`.

name	String, name for the object
feature_names	Named list mapping the names of your features to their type specification, e.g. `list(my_feature = "integer_categorical")` or `list(my_feature = feature_integer_categorica` For a complete list of all supported types, see "Available feature types" paragraph below.
dtype	string, the output dtype of the feature. E.g., "float32".
preprocessor	A callable.
scale, offset	Passed on to `layer_rescaling()`
num_bins, bin_boundaries	Passed on to `layer_discretization()`
max_tokens, num_oov_indices	Passed on to `layer_integer_lookup()` by `feature_integer_categorical()` or to `layer_string_lookup()` by `feature_string_categorical()`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Basic usage with a named list of input data:

```
raw_data <- list(
  float_values = c(0.0, 0.1, 0.2, 0.3),
  string_values = c("zero", "one", "two", "three"),
  int_values = as.integer(c(0, 1, 2, 3))
)

dataset <- tfdatasets::tensor_slices_dataset(raw_data)

feature_space <- layer_feature_space(
  features = list(
    float_values = "float_normalized",
    string_values = "string_categorical",
    int_values = "integer_categorical"
  ),
  crosses = list(c("string_values", "int_values")),
  output_mode = "concat"
)

# Before you start using the feature_space(),
# you must `adapt()` it on some data.
```

```
feature_space |> adapt(dataset)

# You can call the feature_space() on a named list of
# data (batched or unbatched).
output_vector <- feature_space(raw_data)
```

Basic usage with `tf.data`:

```
library(tfdatasets)
# Unlabeled data
preprocessed_ds <- unlabeled_dataset |>
  dataset_map(feature_space)

# Labeled data
preprocessed_ds <- labeled_dataset |>
  dataset_map(function(x, y) tuple(feature_space(x), y))
```

Basic usage with the Keras Functional API:

```
# Retrieve a named list of Keras layer_input() objects
(inputs <- feature_space$get_inputs())

## $float_values
## <KerasTensor shape=(None, 1), dtype=float32, sparse=False, ragged=False, name=float_values>
##
## $string_values
## <KerasTensor shape=(None, 1), dtype=string, sparse=False, ragged=False, name=string_values>
##
## $int_values
## <KerasTensor shape=(None, 1), dtype=int32, sparse=False, ragged=False, name=int_values>


# Retrieve the corresponding encoded Keras tensors
(encoded_features <- feature_space$get_encoded_features())

## <KerasTensor shape=(None, 43), dtype=float32, sparse=False, ragged=False, name=keras_tensor_7>


# Build a Functional model
outputs <- encoded_features |> layer_dense(1, activation = "sigmoid")
model <- keras_model(inputs, outputs)
```

Customizing each feature or feature cross:

```
feature_space <- layer_feature_space(
  features = list(
    float_values = feature_float_normalized(),
    string_values = feature_string_categorical(max_tokens = 10),
```

```
    int_values = feature_integer_categorical(max_tokens = 10)
  ),
  crosses = list(
    feature_cross(c("string_values", "int_values"), crossing_dim = 32)
  ),
  output_mode = "concat"
)
```

Returning a dict (a named list) of integer-encoded features:

```
feature_space <- layer_feature_space(
  features = list(
    "string_values" = feature_string_categorical(output_mode = "int"),
    "int_values" = feature_integer_categorical(output_mode = "int")
  ),
  crosses = list(
    feature_cross(
      feature_names = c("string_values", "int_values"),
      crossing_dim = 32,
      output_mode = "int"
    )
  ),
  output_mode = "dict"
)
```

Specifying your own Keras preprocessing layer:

```
# Let's say that one of the features is a short text paragraph that
# we want to encode as a vector (one vector per paragraph) via TF-IDF.
data <- list(text = c("1st string", "2nd string", "3rd string"))

# There's a Keras layer for this: layer_text_vectorization()
custom_layer <- layer_text_vectorization(output_mode = "tf_idf")

# We can use feature_custom() to create a custom feature
# that will use our preprocessing layer.
feature_space <- layer_feature_space(
  features = list(
    text = feature_custom(preprocessor = custom_layer,
                          dtype = "string",
                          output_mode = "float"
    )
  ),
  output_mode = "concat"
)
feature_space |> adapt(tfdatasets::tensor_slices_dataset(data))
output_vector <- feature_space(data)
```

Retrieving the underlying Keras preprocessing layers:

```
# The preprocessing layer of each feature is available in `$preprocessors`.
preprocessing_layer <- feature_space$preprocessors$feature1

# The crossing layer of each feature cross is available in `$crossers`.
# It's an instance of layer_hashed_crossing()
crossing_layer <- feature_space$crossers[["feature1_X_feature2"]]
```

Saving and reloading a FeatureSpace:

```
feature_space$save("featurespace.keras")
reloaded_feature_space <- keras$models$load_model("featurespace.keras")
```

See Also

- https://keras.io/api/utils/feature_space#featurespace-class

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()

layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()

layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
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layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other utils:
audio_dataset_from_directory()

clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

layer_flatten *Flattens the input. Does not affect the batch size.*

Description

Flattens the input. Does not affect the batch size.

Usage

```
layer_flatten(object, data_format = NULL, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
data_format	A string, one of "channels_last" (default) or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, ..., channels) while "channels_first" corresponds to inputs with shape (batch, channels, ...). When unspecified, uses image_data_format value found in your Keras config file at ~/.keras/keras.json (if exists). Defaults to "channels_last".
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Note

If inputs are shaped `(batch)` without a feature axis, then flattening adds an extra channel dimension and output shape is `(batch, 1)`.

Example

```
x <- layer_input(shape=c(10, 64))
y <- x |> layer_flatten()
shape(y)

## shape(NA, 640)
```

See Also

- https://keras.io/api/layers/reshaping_layers/flatten#flatten-class

Other reshaping layers:
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_permute()`
`layer_repeat_vector()`
`layer_reshape()`
`layer_upsampling_1d()`
`layer_upsampling_2d()`
`layer_upsampling_3d()`
`layer_zero_padding_1d()`
`layer_zero_padding_2d()`
`layer_zero_padding_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`

layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
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layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()

layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
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layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
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layer_multiply()
layer_normalization()
layer_permute()
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layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()

layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_flax_module_wrapper

Keras Layer that wraps a R*hrefhttps://flax.readthedocs.ioFlax module.*

Description

This layer enables the use of Flax components in the form of `flax.linen.Module` instances within Keras when using JAX as the backend for Keras.

The module method to use for the forward pass can be specified via the `method` argument and is `__call__` by default. This method must take the following arguments with these exact names:

- `self` if the method is bound to the module, which is the case for the default of `__call__`, and `module` otherwise to pass the module.
- `inputs`: the inputs to the model, a JAX array or a `PyTree` of arrays.
- `training` *(optional)*: an argument specifying if we're in training mode or inference mode, `TRUE` is passed in training mode.

FlaxLayer handles the non-trainable state of your model and required RNGs automatically. Note that the mutable parameter of flax.linen.Module.apply() is set to DenyList(["params"]), therefore making the assumption that all the variables outside of the "params" collection are non-trainable weights.

This example shows how to create a FlaxLayer from a Flax Module with the default __call__ method and no training argument:

```
# keras3::use_backend("jax")
# py_install("flax", "r-keras")

if(config_backend() == "jax" &&
   reticulate::py_module_available("flax")) {

flax <- import("flax")

MyFlaxModule(flax$linen$Module) %py_class% {
  `__call__` <- flax$linen$compact(\(self, inputs) {
    inputs |>
      (flax$linen$Conv(features = 32L, kernel_size = tuple(3L, 3L)))() |>
      flax$linen$relu() |>
      flax$linen$avg_pool(window_shape = tuple(2L, 2L),
                          strides = tuple(2L, 2L)) |>
      # flatten all except batch_size axis
      (\(x) x$reshape(tuple(x$shape[[1]], -1L)))() |>
      (flax$linen$Dense(features = 200L))() |>
      flax$linen$relu() |>
      (flax$linen$Dense(features = 10L))() |>
      flax$linen$softmax()
  })
}

# typical usage:
input <- keras_input(c(28, 28, 3))
output <- input |>
  layer_flax_module_wrapper(MyFlaxModule())

model <- keras_model(input, output)

# to instantiate the layer before composing:
flax_module <- MyFlaxModule()
keras_layer <- layer_flax_module_wrapper(module = flax_module)

input <- keras_input(c(28, 28, 3))
output <- input |>
  keras_layer()

model <- keras_model(input, output)
```

```
}
```

This example shows how to wrap the module method to conform to the required signature. This allows having multiple input arguments and a training argument that has a different name and values. This additionally shows how to use a function that is not bound to the module.

```
flax <- import("flax")

MyFlaxModule(flax$linen$Module) \%py_class\% {
  forward <-
    flax$linen$compact(\(self, inputs1, input2, deterministic) {
      # do work ....
      outputs # return
    })
}

my_flax_module_wrapper <- function(module, inputs, training) {
  c(input1, input2) \%<-\% inputs
  module$forward(input1, input2,!training)
}

flax_module <- MyFlaxModule()
keras_layer <- layer_flax_module_wrapper(module = flax_module,
                                         method = my_flax_module_wrapper)
```

Usage

```
layer_flax_module_wrapper(object, module, method = NULL, variables = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`module`	An instance of `flax.linen.Module` or subclass.
`method`	The method to call the model. This is generally a method in the `Module`. If not provided, the `__call__` method is used. `method` can also be a function not defined in the `Module`, in which case it must take the `Module` as the first argument. It is used for both `Module.init` and `Module.apply`. Details are documented in the `method` argument of `flax.linen.Module.apply()`.
`variables`	A `dict` (named R list) containing all the variables of the module in the same format as what is returned by `flax.linen.Module.init()`. It should contain a `"params"` key and, if applicable, other keys for collections of variables for non-trainable state. This allows passing trained parameters and learned non-trainable state or controlling the initialization. If `NULL` is passed, the module's `init` function is called at build time to initialize the variables of the model.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/layers/FlaxLayer

Other wrapping layers:
`layer_jax_model_wrapper()`
`layer_torch_module_wrapper()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d()`
`layer_conv_2d_transpose()`
`layer_conv_3d()`
`layer_conv_3d_transpose()`
`layer_conv_lstm_1d()`
`layer_conv_lstm_2d()`

layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()

layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
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layer_tfsm()
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layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_gaussian_dropout

Apply multiplicative 1-centered Gaussian noise.

Description

As it is a regularization layer, it is only active at training time.

Usage

```
layer_gaussian_dropout(object, rate, seed = NULL, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
rate	Float, drop probability (as with `Dropout`). The multiplicative noise will have standard deviation `sqrt(rate / (1 - rate))`.
seed	Integer, optional random seed to enable deterministic behavior.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor (of any rank).
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (doing nothing).

See Also

- https://keras.io/api/layers/regularization_layers/gaussian_dropout#gaussiandropout-class

Other regularization layers:
layer_activity_regularization()
layer_alpha_dropout()
layer_dropout()
layer_gaussian_noise()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()

layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()

layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_gaussian_noise *Apply additive zero-centered Gaussian noise.*

Description

This is useful to mitigate overfitting (you could see it as a form of random data augmentation). Gaussian Noise (GS) is a natural choice as corruption process for real valued inputs.

As it is a regularization layer, it is only active at training time.

Usage

```
layer_gaussian_noise(object, stddev, seed = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`stddev`	Float, standard deviation of the noise distribution.
`seed`	Integer, optional random seed to enable deterministic behavior.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor (of any rank).
- `training`: Python boolean indicating whether the layer should behave in training mode (adding noise) or in inference mode (doing nothing).

See Also

- https://keras.io/api/layers/regularization_layers/gaussian_noise#gaussiannoise-class

Other regularization layers:
`layer_activity_regularization()`
`layer_alpha_dropout()`
`layer_dropout()`
`layer_gaussian_dropout()`
`layer_spatial_dropout_1d()`

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()

layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_average_pooling_1d

Global average pooling operation for temporal data.

Description

Global average pooling operation for temporal data.

Usage

```
layer_global_average_pooling_1d(
  object,
  data_format = NULL,
  keepdims = FALSE,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`keepdims`	A boolean, whether to keep the temporal dimension or not. If `keepdims` is `FALSE` (default), the rank of the tensor is reduced for spatial dimensions. If `keepdims` is `TRUE`, the temporal dimension are retained with length 1. The behavior is the same as for `tf$reduce_mean()` or `op_mean()`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 3D tensor.
- `mask`: Binary tensor of shape `(batch_size, steps)` indicating whether a given step should be masked (excluded from the average).

Input Shape

- If `data_format='channels_last'`: 3D tensor with shape: `(batch_size, steps, features)`
- If `data_format='channels_first'`: 3D tensor with shape: `(batch_size, features, steps)`

Output Shape

- If keepdims=FALSE: 2D tensor with shape (batch_size, features).
- If keepdims=TRUE:
  - If data_format="channels_last": 3D tensor with shape (batch_size, 1, features)
  - If data_format="channels_first": 3D tensor with shape (batch_size, features, 1)

Examples

```
x <- random_uniform(c(2, 3, 4))
y <- x |> layer_global_average_pooling_1d()
shape(y)

## shape(2, 4)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_average_pooling1d#globalaveragepooling1d-clas

Other pooling layers:
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()

layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()

layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_average_pooling_2d

Global average pooling operation for 2D data.

Description

Global average pooling operation for 2D data.

Usage

```
layer_global_average_pooling_2d(
  object,
  data_format = NULL,
  keepdims = FALSE,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, features, height, weight). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".

keepdims — A boolean, whether to keep the temporal dimension or not. If `keepdims` is `FALSE` (default), the rank of the tensor is reduced for spatial dimensions. If `keepdims` is `TRUE`, the spatial dimension are retained with length 1. The behavior is the same as for `tf$reduce_mean()` or `op_mean()`.

... — For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format='channels_last'`: 4D tensor with shape: `(batch_size, height, width, channels)`
- If `data_format='channels_first'`: 4D tensor with shape: `(batch_size, channels, height, width)`

Output Shape

- If `keepdims=FALSE`: 2D tensor with shape `(batch_size, channels)`.
- If `keepdims=TRUE`:
  - If `data_format="channels_last"`: 4D tensor with shape `(batch_size, 1, 1, channels)`
  - If `data_format="channels_first"`: 4D tensor with shape `(batch_size, channels, 1, 1)`

Examples

```
x <- random_uniform(c(2, 4, 5, 3))
y <- x |> layer_global_average_pooling_2d()
shape(y)

## shape(2, 3)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_average_pooling2d#globalaveragepooling2d-clas

Other pooling layers:
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_global_average_pooling_1d()`
`layer_global_average_pooling_3d()`
`layer_global_max_pooling_1d()`
`layer_global_max_pooling_2d()`

layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()

layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()

layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_average_pooling_3d

Global average pooling operation for 3D data.

Description

Global average pooling operation for 3D data.

Usage

```
layer_global_average_pooling_3d(
  object,
  data_format = NULL,
  keepdims = FALSE,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, spatial_dim1, spatial_di` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`keepdims`	A boolean, whether to keep the temporal dimension or not. If `keepdims` is `FALSE` (default), the rank of the tensor is reduced for spatial dimensions. If `keepdims` is `TRUE`, the spatial dimension are retained with length 1. The behavior is the same as for `tf$reduce_mean()` or `op_mean()`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format='channels_last'`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format='channels_first'`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `keepdims=FALSE`: 2D tensor with shape `(batch_size, channels)`.
- If `keepdims=TRUE`:
  - If `data_format="channels_last"`: 5D tensor with shape `(batch_size, 1, 1, 1, channels)`
  - If `data_format="channels_first"`: 5D tensor with shape `(batch_size, channels, 1, 1, 1)`

Examples

```
x <- random_uniform(c(2, 4, 5, 4, 3))
y <- x |> layer_global_average_pooling_3d()
shape(y)

## shape(2, 3)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_average_pooling3d#globalaveragepooling3d-clas

Other pooling layers:
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()

layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()

layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()

layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_max_pooling_1d
Global max pooling operation for temporal data.

Description

Global max pooling operation for temporal data.

Usage

```
layer_global_max_pooling_1d(object, data_format = NULL, keepdims = FALSE, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, steps, features) while "channels_first" corresponds to inputs with shape (batch, features, steps). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
keepdims	A boolean, whether to keep the temporal dimension or not. If keepdims is FALSE (default), the rank of the tensor is reduced for spatial dimensions. If keepdims is TRUE, the temporal dimension are retained with length 1. The behavior is the same as for tf$reduce_mean() or op_mean().
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format='channels_last'`: 3D tensor with shape: `(batch_size, steps, features)`
- If `data_format='channels_first'`: 3D tensor with shape: `(batch_size, features, steps)`

Output Shape

- If `keepdims=FALSE`: 2D tensor with shape `(batch_size, features)`.
- If `keepdims=TRUE`:
  - If `data_format="channels_last"`: 3D tensor with shape `(batch_size, 1, features)`
  - If `data_format="channels_first"`: 3D tensor with shape `(batch_size, features, 1)`

Examples

```
x <- random_uniform(c(2, 3, 4))
y <- x |> layer_global_max_pooling_1d()
shape(y)

## shape(2, 4)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_max_pooling1d#globalmaxpooling1d-class

Other pooling layers:
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_global_average_pooling_1d()`
`layer_global_average_pooling_2d()`
`layer_global_average_pooling_3d()`
`layer_global_max_pooling_2d()`
`layer_global_max_pooling_3d()`
`layer_max_pooling_1d()`
`layer_max_pooling_2d()`
`layer_max_pooling_3d()`

Other layers:
`Layer()`

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()

layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_max_pooling_2d

Global max pooling operation for 2D data.

Description

Global max pooling operation for 2D data.

Usage

```
layer_global_max_pooling_2d(object, data_format = NULL, keepdims = FALSE, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, features, height, weight). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
keepdims	A boolean, whether to keep the temporal dimension or not. If keepdims is FALSE (default), the rank of the tensor is reduced for spatial dimensions. If keepdims is TRUE, the spatial dimension are retained with length 1. The behavior is the same as for tf$reduce_mean() or op_mean().
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

- If data_format='channels_last': 4D tensor with shape: (batch_size, height, width, channels)
- If data_format='channels_first': 4D tensor with shape: (batch_size, channels, height, width)

Output Shape

- If keepdims=FALSE: 2D tensor with shape (batch_size, channels).
- If keepdims=TRUE:
  - If data_format="channels_last": 4D tensor with shape (batch_size, 1, 1, channels)
  - If data_format="channels_first": 4D tensor with shape (batch_size, channels, 1, 1)

Examples

```
x <- random_uniform(c(2, 4, 5, 3))
y <- x |> layer_global_max_pooling_2d()
shape(y)

## shape(2, 3)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_max_pooling2d#globalmaxpooling2d-class

Other pooling layers:
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()

layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()

layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_global_max_pooling_3d
Global max pooling operation for 3D data.

Description

Global max pooling operation for 3D data.

Usage

```
layer_global_max_pooling_3d(object, data_format = NULL, keepdims = FALSE, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, spatial_dim1, spatial_di` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`keepdims`	A boolean, whether to keep the temporal dimension or not. If `keepdims` is `FALSE` (default), the rank of the tensor is reduced for spatial dimensions. If `keepdims` is `TRUE`, the spatial dimension are retained with length 1. The behavior is the same as for `tf$reduce_mean()` or `op_mean()`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format='channels_last'`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format='channels_first'`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `keepdims=FALSE`: 2D tensor with shape `(batch_size, channels)`.
- If `keepdims=TRUE`:
  - If `data_format="channels_last"`: 5D tensor with shape `(batch_size, 1, 1, 1, channels)`
  - If `data_format="channels_first"`: 5D tensor with shape `(batch_size, channels, 1, 1, 1)`

Examples

```
x <- random_uniform(c(2, 4, 5, 4, 3))
y <- x |> layer_global_max_pooling_3d()
shape(y)

## shape(2, 3)
```

See Also

- https://keras.io/api/layers/pooling_layers/global_max_pooling3d#globalmaxpooling3d-class

Other pooling layers:
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_global_average_pooling_1d()`
`layer_global_average_pooling_2d()`
`layer_global_average_pooling_3d()`
`layer_global_max_pooling_1d()`
`layer_global_max_pooling_2d()`
`layer_max_pooling_1d()`
`layer_max_pooling_2d()`
`layer_max_pooling_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`

layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()

layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_group_normalization

Group normalization layer.

Description

Group Normalization divides the channels into groups and computes within each group the mean and variance for normalization. Empirically, its accuracy is more stable than batch norm in a wide range of small batch sizes, if learning rate is adjusted linearly with batch sizes.

Relation to Layer Normalization: If the number of groups is set to 1, then this operation becomes nearly identical to Layer Normalization (see Layer Normalization docs for details).

Relation to Instance Normalization: If the number of groups is set to the input dimension (number of groups is equal to number of channels), then this operation becomes identical to Instance Normalization. You can achieve this via groups=-1.

Usage

```
layer_group_normalization(
  object,
  groups = 32L,
  axis = -1L,
  epsilon = 0.001,
  center = TRUE,
  scale = TRUE,
```

```
  beta_initializer = "zeros",
  gamma_initializer = "ones",
  beta_regularizer = NULL,
  gamma_regularizer = NULL,
  beta_constraint = NULL,
  gamma_constraint = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
groups	Integer, the number of groups for Group Normalization. Can be in the range [1, N] where N is the input dimension. The input dimension must be divisible by the number of groups. Defaults to 32.
axis	Integer or List/Tuple. The axis or axes to normalize across. Typically, this is the features axis/axes. The left-out axes are typically the batch axis/axes. -1 is the last dimension in the input. Defaults to -1.
epsilon	Small float added to variance to avoid dividing by zero. Defaults to 1e-3.
center	If TRUE, add offset of beta to normalized tensor. If FALSE, beta is ignored. Defaults to TRUE.
scale	If TRUE, multiply by gamma. If FALSE, gamma is not used. When the next layer is linear (also e.g. relu), this can be disabled since the scaling will be done by the next layer. Defaults to TRUE.
beta_initializer	Initializer for the beta weight. Defaults to zeros.
gamma_initializer	Initializer for the gamma weight. Defaults to ones.
beta_regularizer	Optional regularizer for the beta weight. NULL by default.
gamma_regularizer	Optional regularizer for the gamma weight. NULL by default.
beta_constraint	Optional constraint for the beta weight. NULL by default.
gamma_constraint	Optional constraint for the gamma weight. NULL by default.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

Arbitrary. Use the keyword argument `input_shape` (tuple of integers, does not include the samples axis) when using this layer as the first layer in a model.

Output Shape

Same shape as input. **kwargs: Base layer keyword arguments (e.g. `name` and `dtype`).

Reference

- Yuxin Wu & Kaiming He, 2018

See Also

- `https://keras.io/api/layers/normalization_layers/group_normalization#groupnormalization-class`

Other normalization layers:
`layer_batch_normalization()`
`layer_layer_normalization()`
`layer_rms_normalization()`
`layer_spectral_normalization()`
`layer_unit_normalization()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
`layer_conv_1d_transpose()`

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()

layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_group_query_attention
Grouped Query Attention layer.

Description

This is an implementation of grouped-query attention introduced by Ainslie et al., 2023. Here num_key_value_heads denotes number of groups, setting num_key_value_heads to 1 is equivalent to multi-query attention, and when num_key_value_heads is equal to num_query_heads it is equivalent to multi-head attention.

This layer first projects query, key, and value tensors. Then, key and value are repeated to match the number of heads of query.

Then, the query is scaled and dot-producted with key tensors. These are softmaxed to obtain attention probabilities. The value tensors are then interpolated by these probabilities and concatenated back to a single tensor.

Usage

```
layer_group_query_attention(
  object,
  head_dim,
  num_query_heads,
  num_key_value_heads,
  dropout = 0,
  use_bias = TRUE,
  flash_attention = NULL,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  seed = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`head_dim` Size of each attention head.

`num_query_heads` Number of query attention heads.

`num_key_value_heads` Number of key and value attention heads.

`dropout` Dropout probability.

`use_bias` Boolean, whether the dense layers use bias vectors/matrices.

`flash_attention` If `NULL`, the layer attempts to use flash attention for faster and more memory-efficient attention computations when possible. This behavior can be configured using `config_enable_flash_attention()` or `config_disable_flash_attention()`.

`kernel_initializer` Initializer for dense layer kernels.

`bias_initializer` Initializer for dense layer biases.

`kernel_regularizer` Regularizer for dense layer kernels.

`bias_regularizer` Regularizer for dense layer biases.

`activity_regularizer` Regularizer for dense layer activity.

`kernel_constraint` Constraint for dense layer kernels.

`bias_constraint` Constraint for dense layer kernels.

`seed` Optional integer to seed the dropout layer.

`...` For forward/backward compatability.

Value

attention_output: Result of the computation, of shape `(batch_dim, target_seq_len, feature_dim)`, where `target_seq_len` is for target sequence length and `feature_dim` is the query input last dim.
attention_scores: (Optional) attention coefficients of shape `(batch_dim, num_query_heads, target_seq_len, source_se`

Call Arguments

- `query`: Query tensor of shape `(batch_dim, target_seq_len, feature_dim)`, where `batch_dim` is batch size, `target_seq_len` is the length of target sequence, and `feature_dim` is dimension of feature.
- `value`: Value tensor of shape `(batch_dim, source_seq_len, feature_dim)`, where `batch_dim` is batch size, `source_seq_len` is the length of source sequence, and `feature_dim` is dimension of feature.

- `key`: Optional key tensor of shape `(batch_dim, source_seq_len, feature_dim)`. If not given, will use `value` for both `key` and `value`, which is most common case.
- `attention_mask`: A boolean mask of shape `(batch_dim, target_seq_len, source_seq_len)`, that prevents attention to certain positions. The boolean mask specifies which query elements can attend to which key elements, where 1 indicates attention and 0 indicates no attention. Broadcasting can happen for the missing batch dimensions and the head dimension.
- `return_attention_scores`: A boolean to indicate whether the output should be `(attention_output, attention_sc` if `TRUE`, or `attention_output` if `FALSE`. Defaults to `FALSE`.
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (no dropout). Will go with either using the training mode of the parent layer/model or `FALSE` (inference) if there is no parent layer.
- `use_causal_mask`: A boolean to indicate whether to apply a causal mask to prevent tokens from attending to future tokens (e.g., used in a decoder Transformer).

See Also

Other attention layers:
`layer_additive_attention()`
`layer_attention()`
`layer_multi_head_attention()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
`layer_conv_1d_transpose()`

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()

layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_gru *Gated Recurrent Unit - Cho et al. 2014.*

Description

Based on available runtime hardware and constraints, this layer will choose different implementations (cuDNN-based or backend-native) to maximize the performance. If a GPU is available and all the arguments to the layer meet the requirement of the cuDNN kernel (see below for details), the layer will use a fast cuDNN implementation when using the TensorFlow backend.

The requirements to use the cuDNN implementation are:

1. `activation` == `tanh`
2. `recurrent_activation` == `sigmoid`
3. `recurrent_dropout` == 0
4. `unroll` is `FALSE`
5. `use_bias` is `TRUE`
6. `reset_after` is `TRUE`
7. Inputs, if use masking, are strictly right-padded.
8. Eager execution is enabled in the outermost context.

There are two variants of the GRU implementation. The default one is based on v3 and has reset gate applied to hidden state before matrix multiplication. The other one is based on original and has the order reversed.

The second variant is compatible with CuDNNGRU (GPU-only) and allows inference on CPU. Thus it has separate biases for `kernel` and `recurrent_kernel`. To use this variant, set `reset_after=TRUE` and `recurrent_activation='sigmoid'`.

For example:

```
inputs <- random_uniform(c(32, 10, 8))
outputs <- inputs |> layer_gru(4)
shape(outputs)
```

```
## shape(32, 4)
```

```
# (32, 4)
gru <- layer_gru(, 4, return_sequences = TRUE, return_state = TRUE)
c(whole_sequence_output, final_state) %<-% gru(inputs)
shape(whole_sequence_output)
```

```
## shape(32, 10, 4)
```

```
shape(final_state)
```

```
## shape(32, 4)
```

Usage

```
layer_gru(
  object,
  units,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  unroll = FALSE,
  reset_after = TRUE,
  use_cudnn = "auto",
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`units`	Positive integer, dimensionality of the output space.
`activation`	Activation function to use. Default: hyperbolic tangent (`tanh`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).
`recurrent_activation`	Activation function to use for the recurrent step. Default: sigmoid (`sigmoid`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).
`use_bias`	Boolean, (default `TRUE`), whether the layer should use a bias vector.
`kernel_initializer`	Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs. Default: `"glorot_uniform"`.
`recurrent_initializer`	Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state. Default: `"orthogonal"`.
`bias_initializer`	Initializer for the bias vector. Default: `"zeros"`.
`kernel_regularizer`	Regularizer function applied to the `kernel` weights matrix. Default: `NULL`.
`recurrent_regularizer`	Regularizer function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.
`bias_regularizer`	Regularizer function applied to the bias vector. Default: `NULL`.
`activity_regularizer`	Regularizer function applied to the output of the layer (its "activation"). Default: `NULL`.
`kernel_constraint`	Constraint function applied to the `kernel` weights matrix. Default: `NULL`.
`recurrent_constraint`	Constraint function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.
`bias_constraint`	Constraint function applied to the bias vector. Default: `NULL`.
`dropout`	Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.
`recurrent_dropout`	Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.
`seed`	Random seed for dropout.
`return_sequences`	Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: `FALSE`.
`return_state`	Boolean. Whether to return the last state in addition to the output. Default: `FALSE`.

go_backwards	Boolean (default FALSE). If TRUE, process the input sequence backwards and return the reversed sequence.
stateful	Boolean (default: FALSE). If TRUE, the last state for each sample at index i in a batch will be used as initial state for the sample of index i in the following batch.
unroll	Boolean (default: FALSE). If TRUE, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.
reset_after	GRU convention (whether to apply reset gate after or before matrix multiplication). FALSE is "before", TRUE is "after" (default and cuDNN compatible).
use_cudnn	Whether to use a cuDNN-backed implementation. "auto" will attempt to use cuDNN when feasible, and will fallback to the default implementation if not.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Call Arguments

- inputs: A 3D tensor, with shape (batch, timesteps, feature).
- mask: Binary tensor of shape (samples, timesteps) indicating whether a given timestep should be masked (optional). An individual TRUE entry indicates that the corresponding timestep should be utilized, while a FALSE entry indicates that the corresponding timestep should be ignored. Defaults to NULL.
- training: Python boolean indicating whether the layer should behave in training mode or in inference mode. This argument is passed to the cell when calling it. This is only relevant if dropout or recurrent_dropout is used (optional). Defaults to NULL.
- initial_state: List of initial state tensors to be passed to the first call of the cell (optional, NULL causes creation of zero-filled initial state tensors). Defaults to NULL.

See Also

- https://keras.io/api/layers/recurrent_layers/gru#gru-class

Other gru rnn layers:
rnn_cell_gru()

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()

layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()

layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()

layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_hashed_crossing` *A preprocessing layer which crosses features using the "hashing trick".*

Description

This layer performs crosses of categorical features using the "hashing trick". Conceptually, the transformation can be thought of as: `hash(concatenate(features)) %% num_bins`.

This layer currently only performs crosses of scalar inputs and batches of scalar inputs. Valid input shapes are `(batch_size, 1)`, `(batch_size)` and `()`.

Note: This layer wraps `tf.keras.layers.HashedCrossing`. It cannot be used as part of the compiled computation graph of a model with any backend other than TensorFlow. It can however be used with any backend when running eagerly. It can also always be used as part of an input preprocessing pipeline with any backend (outside the model itself), which is how we recommend to use this layer.

Note: This layer is safe to use inside a `tfdatasets` pipeline (independently of which backend you're using).

Usage

```
layer_hashed_crossing(
  object,
  num_bins,
  output_mode = "int",
  sparse = FALSE,
  name = NULL,
  dtype = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`num_bins`	Number of hash bins.
`output_mode`	Specification for the output of the layer. Values can be `"int"`, or `"one_hot"` configuring the layer as follows: • `"int"`: Return the integer bin indices directly. • `"one_hot"`: Encodes each individual element in the input into an array the same size as `num_bins`, containing a 1 at the input's bin index. Defaults to `"int"`.
`sparse`	Boolean. Only applicable to `"one_hot"` mode and only valid when using the TensorFlow backend. If `TRUE`, returns a `SparseTensor` instead of a dense `Tensor`. Defaults to `FALSE`.
`name`	String, name for the object
`dtype`	datatype (e.g., `"float32"`).
`...`	Keyword arguments to construct a layer.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
feat1 <- c('A', 'B', 'A', 'B', 'A') |> as.array()
feat2 <- c(101, 101, 101, 102, 102) |> as.integer() |> as.array()
```

Crossing two scalar features.

```
layer <- layer_hashed_crossing(num_bins = 5)
layer(list(feat1, feat2))

## tf.Tensor([1 4 1 1 3], shape=(5), dtype=int64)
```

Crossing and one-hotting two scalar features.

```
layer <- layer_hashed_crossing(num_bins = 5, output_mode = 'one_hot')
layer(list(feat1, feat2))

## tf.Tensor(
## [[0. 1. 0. 0. 0.]
##  [0. 0. 0. 0. 1.]
##  [0. 1. 0. 0. 0.]
##  [0. 1. 0. 0. 0.]
##  [0. 0. 0. 1. 0.]], shape=(5, 5), dtype=float32)
```

See Also

- https://keras.io/api/layers/preprocessing_layers/categorical/hashed_crossing#hashedcrossing-class

Other categorical features preprocessing layers:
`layer_category_encoding()`
`layer_hashing()`
`layer_integer_lookup()`
`layer_string_lookup()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`

layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()

layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()

layer_group_query_attention()
layer_gru()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()

layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_hashing *A preprocessing layer which hashes and bins categorical features.*

Description

This layer transforms categorical inputs to hashed output. It element-wise converts a ints or strings to ints in a fixed range. The stable hash function uses `tensorflow::ops::Fingerprint` to produce the same output consistently across all platforms.

This layer uses FarmHash64 by default, which provides a consistent hashed output across different platforms and is stable across invocations, regardless of device and context, by mixing the input bits thoroughly.

If you want to obfuscate the hashed output, you can also pass a random `salt` argument in the constructor. In that case, the layer will use the SipHash64 hash function, with the `salt` value serving as additional input to the hash function.

Note: This layer internally uses TensorFlow. It cannot be used as part of the compiled computation graph of a model with any backend other than TensorFlow. It can however be used with any backend when running eagerly. It can also always be used as part of an input preprocessing pipeline with any backend (outside the model itself), which is how we recommend to use this layer.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Example (FarmHash64)

```
layer <- layer_hashing(num_bins = 3)
inp <- c('A', 'B', 'C', 'D', 'E') |> array(dim = c(5, 1))
layer(inp)
```

```
## tf.Tensor(
## [[1]
##  [0]
##  [1]
##  [1]
##  [2]], shape=(5, 1), dtype=int64)
```

Example (FarmHash64) with a mask value

```
layer <- layer_hashing(num_bins=3, mask_value='')
inp <- c('A', 'B', '', 'C', 'D') |> array(dim = c(5, 1))
layer(inp)
```

```
## tf.Tensor(
## [[1]
##  [1]
##  [0]
##  [2]
##  [2]], shape=(5, 1), dtype=int64)
```

Example (SipHash64)

```
layer <- layer_hashing(num_bins=3, salt=c(133, 137))
inp <- c('A', 'B', 'C', 'D', 'E') |> array(dim = c(5, 1))
layer(inp)
```

```
## tf.Tensor(
## [[1]
##  [2]
##  [1]
##  [0]
##  [2]], shape=(5, 1), dtype=int64)
```

Example (Siphash64 with a single integer, same as `salt=[133, 133]`)

```
layer <- layer_hashing(num_bins=3, salt=133)
inp <- c('A', 'B', 'C', 'D', 'E') |> array(dim = c(5, 1))
layer(inp)
```

```
## tf.Tensor(
## [[0]
##  [0]
##  [2]
##  [1]
##  [0]], shape=(5, 1), dtype=int64)
```

Usage

```
layer_hashing(
  object,
  num_bins,
  mask_value = NULL,
  salt = NULL,
  output_mode = "int",
  sparse = FALSE,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
num_bins	Number of hash bins. Note that this includes the mask_value bin, so the effective number of bins is (num_bins - 1) if mask_value is set.
mask_value	A value that represents masked inputs, which are mapped to index 0. NULL means no mask term will be added and the hashing will start at index 0. Defaults to NULL.
salt	A single unsigned integer or NULL. If passed, the hash function used will be SipHash64, with these values used as an additional input (known as a "salt" in cryptography). These should be non-zero. If NULL, uses the FarmHash64 hash function. It also supports list of 2 unsigned integer numbers, see reference paper for details. Defaults to NULL.
output_mode	Specification for the output of the layer. Values can be "int", "one_hot", "multi_hot", or "count" configuring the layer as follows: • "int": Return the integer bin indices directly. • "one_hot": Encodes each individual element in the input into an array the same size as num_bins, containing a 1 at the input's bin index. If the last dimension is size 1, will encode on that dimension. If the last dimension is not size 1, will append a new dimension for the encoded output. • "multi_hot": Encodes each sample in the input into a single array the same size as num_bins, containing a 1 for each bin index index present in the sample. Treats the last dimension as the sample dimension, if input shape is (..., sample_length), output shape will be (..., num_tokens). • "count": As "multi_hot", but the int array contains a count of the number of times the bin index appeared in the sample. Defaults to "int".

sparse	Boolean. Only applicable to "one_hot", "multi_hot", and "count" output modes. Only supported with TensorFlow backend. If TRUE, returns a SparseTensor instead of a dense Tensor. Defaults to FALSE.
...	Keyword arguments to construct a layer.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

A single string, a list of strings, or an int32 or int64 tensor of shape (batch_size, ...,).

Output Shape

An int32 tensor of shape (batch_size, ...).

Reference

- SipHash with salt

See Also

- https://keras.io/api/layers/preprocessing_layers/categorical/hashing#hashing-class

Other categorical features preprocessing layers:
layer_category_encoding()
layer_hashed_crossing()
layer_integer_lookup()
layer_string_lookup()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()

layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()

layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()

layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()

layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_identity *Identity layer.*

Description

This layer should be used as a placeholder when no operation is to be performed. The layer just returns its `inputs` argument as output.

Usage

```
layer_identity(object, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

See Also

Other core layers:
layer_dense()
layer_einsum_dense()
layer_embedding()
layer_lambda()
layer_masking()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()

layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()

layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_integer_lookup` *A preprocessing layer that maps integers to (possibly encoded) indices.*

Description

This layer maps a set of arbitrary integer input tokens into indexed integer output via a table-based vocabulary lookup. The layer's output indices will be contiguously arranged up to the maximum vocab size, even if the input tokens are non-continguous or unbounded. The layer supports multiple options for encoding the output via `output_mode`, and has optional support for out-of-vocabulary (OOV) tokens and masking.

The vocabulary for the layer must be either supplied on construction or learned via `adapt()`. During `adapt()`, the layer will analyze a data set, determine the frequency of individual integer tokens, and create a vocabulary from them. If the vocabulary is capped in size, the most frequent tokens will be used to create the vocabulary and all others will be treated as OOV.

There are two possible output modes for the layer. When `output_mode` is `"int"`, input integers are converted to their index in the vocabulary (an integer). When `output_mode` is `"multi_hot"`, `"count"`, or `"tf_idf"`, input integers are encoded into an array where each dimension corresponds to an element in the vocabulary.

The vocabulary can optionally contain a mask token as well as an OOV token (which can optionally occupy multiple indices in the vocabulary, as set by `num_oov_indices`). The position of these tokens in the vocabulary is fixed. When `output_mode` is `"int"`, the vocabulary will begin with the mask token at index 0, followed by OOV indices, followed by the rest of the vocabulary. When `output_mode` is `"multi_hot"`, `"count"`, or `"tf_idf"` the vocabulary will begin with OOV indices and instances of the mask token will be dropped.

Note: This layer uses TensorFlow internally. It cannot be used as part of the compiled computation graph of a model with any backend other than TensorFlow. It can however be used with any backend when running eagerly. It can also always be used as part of an input preprocessing pipeline with any backend (outside the model itself), which is how we recommend to use this layer.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Note: If working with layer outputs directly (e.g., not passing outputs to another layer, but using them in lower-level operations like `[` and `op_*`): the returned indices are 0-based. However, with default settings, the first (`0`) index is the OOV token, so the returned indices are offset by `1` and may appear to be 1-based.

Usage

```
layer_integer_lookup(
  object,
  max_tokens = NULL,
  num_oov_indices = 1L,
  mask_token = NULL,
  oov_token = -1L,
  vocabulary = NULL,
  vocabulary_dtype = "int64",
```

```
  idf_weights = NULL,
  invert = FALSE,
  output_mode = "int",
  sparse = FALSE,
  pad_to_max_tokens = FALSE,
  name = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`max_tokens` Maximum size of the vocabulary for this layer. This should only be specified when adapting the vocabulary or when setting `pad_to_max_tokens=TRUE`. If NULL, there is no cap on the size of the vocabulary. Note that this size includes the OOV and mask tokens. Defaults to `NULL`.

`num_oov_indices` The number of out-of-vocabulary tokens to use. If this value is more than 1, OOV inputs are modulated to determine their OOV value. If this value is 0, OOV inputs will cause an error when calling the layer. Defaults to `1`.

`mask_token` An integer token that represents masked inputs. When `output_mode` is `"int"`, the token is included in vocabulary and mapped to index 0. In other output modes, the token will not appear in the vocabulary and instances of the mask token in the input will be dropped. If set to NULL, no mask term will be added. Defaults to `NULL`.

`oov_token` Only used when `invert` is `TRUE`. The token to return for OOV indices. Defaults to `-1`.

`vocabulary` Optional. Either an array of integers or a string path to a text file. If passing an array, can pass a list, list, 1D NumPy array, or 1D tensor containing the integer vocabulary terms. If passing a file path, the file should contain one line per term in the vocabulary. If this argument is set, there is no need to `adapt()` the layer.

`vocabulary_dtype` The dtype of the vocabulary terms, for example `"int64"` or `"int32"`. Defaults to `"int64"`.

`idf_weights` Only valid when `output_mode` is `"tf_idf"`. A list, list, 1D NumPy array, or 1D tensor or the same length as the vocabulary, containing the floating point inverse document frequency weights, which will be multiplied by per sample term counts for the final TF-IDF weight. If the `vocabulary` argument is set, and `output_mode` is `"tf_idf"`, this argument must be supplied.

`invert` Only valid when `output_mode` is `"int"`. If `TRUE`, this layer will map indices to vocabulary items instead of mapping vocabulary items to indices. Defaults to `FALSE`.

`output_mode` Specification for the output of the layer. Values can be `"int"`, `"one_hot"`, `"multi_hot"`, `"count"`, or `"tf_idf"` configuring the layer as follows:

- `"int"`: Return the vocabulary indices of the input tokens.

- "one_hot": Encodes each individual element in the input into an array the same size as the vocabulary, containing a 1 at the element index. If the last dimension is size 1, will encode on that dimension. If the last dimension is not size 1, will append a new dimension for the encoded output.
- "multi_hot": Encodes each sample in the input into a single array the same size as the vocabulary, containing a 1 for each vocabulary term present in the sample. Treats the last dimension as the sample dimension, if input shape is (..., sample_length), output shape will be (..., num_tokens).
- "count": As "multi_hot", but the int array contains a count of the number of times the token at that index appeared in the sample.
- "tf_idf": As "multi_hot", but the TF-IDF algorithm is applied to find the value in each token slot. For "int" output, any shape of input and output is supported. For all other output modes, currently only output up to rank 2 is supported. Defaults to "int".

sparse — Boolean. Only applicable to "multi_hot", "count", and "tf_idf" output modes. Only supported with TensorFlow backend. If TRUE, returns a SparseTensor instead of a dense Tensor. Defaults to FALSE.

pad_to_max_tokens — Only applicable when output_mode is "multi_hot", "count", or "tf_idf". If TRUE, the output will have its feature axis padded to max_tokens even if the number of unique tokens in the vocabulary is less than max_tokens, resulting in a tensor of shape (batch_size, max_tokens) regardless of vocabulary size. Defaults to FALSE.

name — String, name for the object

... — For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Examples

Creating a lookup layer with a known vocabulary

This example creates a lookup layer with a pre-existing vocabulary.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(rbind(c(12, 1138, 42),
                       c(42, 1000, 36)))  # Note OOV tokens
out <- data |> layer_integer_lookup(vocabulary = vocab)
out
```

```
## tf.Tensor(
## [[1 3 4]
##  [4 0 2]], shape=(2, 3), dtype=int64)
```

Creating a lookup layer with an adapted vocabulary

This example creates a lookup layer and generates the vocabulary by analyzing the dataset.

```
data <- op_array(rbind(c(12, 1138, 42),
                       c(42, 1000, 36)))  # Note OOV tokens
layer <- layer_integer_lookup()
layer |> adapt(data)
layer |> get_vocabulary() |> str()
```

```
## List of 6
##  $ : int -1
##  $ : num 42
##  $ : num 1138
##  $ : num 1000
##  $ : num 36
##  $ : num 12
```

Note that the OOV token -1 have been added to the vocabulary. The remaining tokens are sorted by frequency (42, which has 2 occurrences, is first) then by inverse sort order.

```
layer(data)
```

```
## tf.Tensor(
## [[5 2 1]
##  [1 3 4]], shape=(2, 3), dtype=int64)
```

Lookups with multiple OOV indices

This example demonstrates how to use a lookup layer with multiple OOV indices. When a layer is created with more than one OOV index, any OOV tokens are hashed into the number of OOV buckets, distributing OOV tokens in a deterministic fashion across the set.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(rbind(c(12, 1138, 42),
                       c(37, 1000, 36)))  # Note OOV tokens
out <- data |>
  layer_integer_lookup(vocabulary = vocab,
                       num_oov_indices = 2)
out
```

```
## tf.Tensor(
## [[2 4 5]
##  [1 0 3]], shape=(2, 3), dtype=int64)
```

Note that the output for OOV token 37 is 1, while the output for OOV token 1000 is 0. The in-vocab terms have their output index increased by 1 from earlier examples (12 maps to 2, etc) in order to make space for the extra OOV token.

One-hot output

Configure the layer with `output_mode='one_hot'`. Note that the first `num_oov_indices` dimensions in the ont_hot encoding represent OOV values.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(c(12, 36, 1138, 42, 7), 'int32')  # Note OOV tokens
layer <- layer_integer_lookup(vocabulary = vocab,
                              output_mode = 'one_hot')
layer(data)
```

```
## tf.Tensor(
## [[0 1 0 0 0]
##  [0 0 1 0 0]
##  [0 0 0 1 0]
##  [0 0 0 0 1]
##  [1 0 0 0 0]], shape=(5, 5), dtype=int64)
```

Multi-hot output

Configure the layer with `output_mode = 'multi_hot'`. Note that the first `num_oov_indices` dimensions in the multi_hot encoding represent OOV tokens

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(rbind(c(12, 1138, 42, 42),
                       c(42,    7, 36,  7)), "int64")  # Note OOV tokens
layer <- layer_integer_lookup(vocabulary = vocab,
                              output_mode = 'multi_hot')
layer(data)
```

```
## tf.Tensor(
## [[0 1 0 1 1]
##  [1 0 1 0 1]], shape=(2, 5), dtype=int64)
```

Token count output

Configure the layer with `output_mode='count'`. As with multi_hot output, the first `num_oov_indices` dimensions in the output represent OOV tokens.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- rbind(c(12, 1138, 42, 42),
              c(42,    7, 36,  7)) |> op_array("int64")
layer <- layer_integer_lookup(vocabulary = vocab,
                              output_mode = 'count')
layer(data)
```

```
## tf.Tensor(
## [[0 1 0 1 2]
##  [2 0 1 0 1]], shape=(2, 5), dtype=int64)
```

TF-IDF output

Configure the layer with `output_mode='tf_idf'`. As with multi_hot output, the first `num_oov_indices` dimensions in the output represent OOV tokens.

Each token bin will output `token_count * idf_weight`, where the idf weights are the inverse document frequency weights per token. These should be provided along with the vocabulary. Note that the `idf_weight` for OOV tokens will default to the average of all idf weights passed in.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
idf_weights <- c(0.25, 0.75, 0.6, 0.4)
data <- rbind(c(12, 1138, 42, 42),
              c(42,    7, 36,  7)) |> op_array("int64")
layer <- layer_integer_lookup(output_mode = 'tf_idf',
                              vocabulary = vocab,
                              idf_weights = idf_weights)
layer(data)
```

```
## tf.Tensor(
## [[0.   0.25 0.   0.6  0.8 ]
##  [1.   0.   0.75 0.   0.4 ]], shape=(2, 5), dtype=float32)
```

To specify the idf weights for oov tokens, you will need to pass the entire vocabulary including the leading oov token.

```
vocab <- c(-1, 12, 36, 1138, 42) |> as.integer()
idf_weights <- c(0.9, 0.25, 0.75, 0.6, 0.4)
data <- rbind(c(12, 1138, 42, 42),
              c(42,    7, 36,  7)) |> op_array("int64")
layer <- layer_integer_lookup(output_mode = 'tf_idf',
                              vocabulary = vocab,
                              idf_weights = idf_weights)
layer(data)
```

```
## tf.Tensor(
## [[0.   0.25 0.   0.6  0.8 ]
##  [1.8  0.   0.75 0.   0.4 ]], shape=(2, 5), dtype=float32)
```

When adapting the layer in `"tf_idf"` mode, each input sample will be considered a document, and IDF weight per token will be calculated as: `log(1 + num_documents / (1 + token_document_count))`.

Inverse lookup

This example demonstrates how to map indices to tokens using this layer. (You can also use `adapt()` with `inverse = TRUE`, but for simplicity we'll pass the vocab in this example.)

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(c(1, 3, 4,
                   4, 0, 2)) |> op_reshape(c(2,-1)) |> op_cast("int32")
layer <- layer_integer_lookup(vocabulary = vocab, invert = TRUE)
layer(data)
```

```
## tf.Tensor(
## [[  12 1138   42]
##  [  42   -1   36]], shape=(2, 3), dtype=int64)
```

Note that the first index correspond to the oov token by default.

Forward and inverse lookup pairs

This example demonstrates how to use the vocabulary of a standard lookup layer to create an inverse lookup layer.

```
vocab <- c(12, 36, 1138, 42) |> as.integer()
data <- op_array(rbind(c(12, 1138, 42), c(42, 1000, 36)), "int32")
layer <- layer_integer_lookup(vocabulary = vocab)
i_layer <- layer_integer_lookup(vocabulary = get_vocabulary(layer),
                                invert = TRUE)
int_data <- layer(data)
i_layer(int_data)
```

```
## tf.Tensor(
## [[  12 1138   42]
##  [  42   -1   36]], shape=(2, 3), dtype=int64)
```

In this example, the input token 1000 resulted in an output of -1, since 1000 was not in the vocabulary - it got represented as an OOV, and all OOV tokens are returned as -1 in the inverse layer. Also, note that for the inverse to work, you must have already set the forward layer vocabulary either directly or via `adapt()` before calling `get_vocabulary()`.

See Also

- https://keras.io/api/layers/preprocessing_layers/categorical/integer_lookup#integerlookup-class

Other categorical features preprocessing layers:
`layer_category_encoding()`

layer_hashed_crossing()
layer_hashing()
layer_string_lookup()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()

layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_jax_model_wrapper

Keras Layer that wraps a JAX model.

Description

This layer enables the use of JAX components within Keras when using JAX as the backend for Keras.

Usage

```
layer_jax_model_wrapper(
  object,
  call_fn,
  init_fn = NULL,
  params = NULL,
  state = NULL,
  seed = NULL,
  ...,
  dtype = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`call_fn`	The function to call the model. See description above for the list of arguments it takes and the outputs it returns.
`init_fn`	the function to call to initialize the model. See description above for the list of arguments it takes and the outputs it returns. If `NULL`, then `params` and/or `state` must be provided.
`params`	A `PyTree` containing all the model trainable parameters. This allows passing trained parameters or controlling the initialization. If both `params` and `state` are `NULL`, `init_fn()` is called at build time to initialize the trainable parameters of the model.
`state`	A `PyTree` containing all the model non-trainable state. This allows passing learned state or controlling the initialization. If both `params` and `state` are `NULL`, and `call_fn()` takes a `state` argument, then `init_fn()` is called at build time to initialize the non-trainable state of the model.
`seed`	Seed for random number generator. Optional.
`...`	For forward/backward compatability.
`dtype`	The dtype of the layer's computations and weights. Can also be a `keras.DTypePolicy`. Optional. Defaults to the default policy.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Model function

This layer accepts JAX models in the form of a function, `call_fn()`, which must take the following arguments with these exact names:

- `params`: trainable parameters of the model.
- `state` (*optional*): non-trainable state of the model. Can be omitted if the model has no non-trainable state.
- `rng` (*optional*): a `jax.random.PRNGKey` instance. Can be omitted if the model does not need RNGs, neither during training nor during inference.
- `inputs`: inputs to the model, a JAX array or a `PyTree` of arrays.
- `training` (*optional*): an argument specifying if we're in training mode or inference mode, `TRUE` is passed in training mode. Can be omitted if the model behaves the same in training mode and inference mode.

The `inputs` argument is mandatory. Inputs to the model must be provided via a single argument. If the JAX model takes multiple inputs as separate arguments, they must be combined into a single structure, for instance in a `tuple()` or a `dict()`.

Model weights initialization:

The initialization of the `params` and `state` of the model can be handled by this layer, in which case the `init_fn()` argument must be provided. This allows the model to be initialized dynamically with the right shape. Alternatively, and if the shape is known, the `params` argument and optionally the `state` argument can be used to create an already initialized model.

The `init_fn()` function, if provided, must take the following arguments with these exact names:

- `rng`: a `jax.random.PRNGKey` instance.
- `inputs`: a JAX array or a `PyTree` of arrays with placeholder values to provide the shape of the inputs.
- `training` (*optional*): an argument specifying if we're in training mode or inference mode. `True` is always passed to `init_fn`. Can be omitted regardless of whether `call_fn` has a `training` argument.

Models with non-trainable state:

For JAX models that have non-trainable state:

- `call_fn()` must have a `state` argument
- `call_fn()` must return a `tuple()` containing the outputs of the model and the new non-trainable state of the model
- `init_fn()` must return a `tuple()` containing the initial trainable params of the model and the initial non-trainable state of the model.

This code shows a possible combination of `call_fn()` and `init_fn()` signatures for a model with non-trainable state. In this example, the model has a `training` argument and an `rng` argument in `call_fn()`.

```
stateful_call <- function(params, state, rng, inputs, training) {
  outputs <- ....
  new_state <- ....
  tuple(outputs, new_state)
}

stateful_init <- function(rng, inputs) {
  initial_params <- ....
```

```
  initial_state <- ....
  tuple(initial_params, initial_state)
}
```

Models without non-trainable state:

For JAX models with no non-trainable state:

- `call_fn()` must not have a `state` argument
- `call_fn()` must return only the outputs of the model
- `init_fn()` must return only the initial trainable params of the model.

This code shows a possible combination of `call_fn()` and `init_fn()` signatures for a model without non-trainable state. In this example, the model does not have a `training` argument and does not have an `rng` argument in `call_fn()`.

```
stateful_call <- function(pparams, inputs) {
  outputs <- ....
  outputs
}

stateful_init <- function(rng, inputs) {
  initial_params <- ....
  initial_params
}
```

Conforming to the required signature:

If a model has a different signature than the one required by `JaxLayer`, one can easily write a wrapper method to adapt the arguments. This example shows a model that has multiple inputs as separate arguments, expects multiple RNGs in a `dict`, and has a `deterministic` argument with the opposite meaning of `training`. To conform, the inputs are combined in a single structure using a `tuple`, the RNG is split and used the populate the expected `dict`, and the Boolean flag is negated:

```
jax <- import("jax")
my_model_fn <- function(params, rngs, input1, input2, deterministic) {
  ....
  if (!deterministic) {
    dropout_rng <- rngs$dropout
    keep <- jax$random$bernoulli(dropout_rng, dropout_rate, x$shape)
    x <- jax$numpy$where(keep, x / dropout_rate, 0)
    ....
  }
  ....
  return(outputs)
}

my_model_wrapper_fn <- function(params, rng, inputs, training) {
  c(input1, input2) %<-% inputs
  c(rng1, rng2) %<-% jax$random$split(rng)
  rngs <-  list(dropout = rng1, preprocessing = rng2)
```

```
  deterministic <-  !training
  my_model_fn(params, rngs, input1, input2, deterministic)
}

keras_layer <- layer_jax_model_wrapper(call_fn = my_model_wrapper_fn,
                                       params = initial_params)
```

Usage with Haiku modules:

JaxLayer enables the use of Haiku components in the form of haiku.Module. This is achieved by transforming the module per the Haiku pattern and then passing module.apply in the call_fn parameter and module.init in the init_fn parameter if needed.

If the model has non-trainable state, it should be transformed with haiku.transform_with_state. If the model has no non-trainable state, it should be transformed with haiku.transform. Additionally, and optionally, if the module does not use RNGs in "apply", it can be transformed with haiku.without_apply_rng.

The following example shows how to create a JaxLayer from a Haiku module that uses random number generators via hk.next_rng_key() and takes a training positional argument:

```
# reticulate::py_install("haiku", "r-keras")
hk <- import("haiku")
MyHaikuModule(hk$Module) \%py_class\% {

  `__call__` <- \(self, x, training) {
    x <- hk$Conv2D(32L, tuple(3L, 3L))(x)
    x <- jax$nn$relu(x)
    x <- hk$AvgPool(tuple(1L, 2L, 2L, 1L),
                    tuple(1L, 2L, 2L, 1L), "VALID")(x)
    x <- hk$Flatten()(x)
    x <- hk$Linear(200L)(x)
    if (training)
      x <- hk$dropout(rng = hk$next_rng_key(), rate = 0.3, x = x)
    x <- jax$nn$relu(x)
    x <- hk$Linear(10L)(x)
    x <- jax$nn$softmax(x)
    x
  }

}

my_haiku_module_fn <- function(inputs, training) {
  module <- MyHaikuModule()
  module(inputs, training)
}

transformed_module <- hk$transform(my_haiku_module_fn)

keras_layer <-
  layer_jax_model_wrapper(call_fn = transformed_module$apply,
                          init_fn = transformed_module$init)
```

See Also

Other wrapping layers:
layer_flax_module_wrapper()
layer_torch_module_wrapper()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()

layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()

layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_lambda` *Wraps arbitrary expressions as a* `Layer` *object.*

Description

The `layer_lambda()` layer exists so that arbitrary expressions can be used as a `Layer` when constructing Sequential and Functional API models. `Lambda` layers are best suited for simple operations or quick experimentation. For more advanced use cases, prefer writing new subclasses of `Layer` using `new_layer_class()`.

Usage

```
layer_lambda(
  object,
  f,
  output_shape = NULL,
  mask = NULL,
  arguments = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`f`	The function to be evaluated. Takes input tensor as first argument.
`output_shape`	Expected output shape from function. This argument can usually be inferred if not explicitly provided. Can be a list or function. If a list, it only specifies the first dimension onward; sample dimension is assumed either the same as the input: `output_shape = c(input_shape[1], output_shape)` or, the input is `NULL` and the sample dimension is also `NULL`: `output_shape = c(NA, output_shape)`. If a function, it specifies the entire shape as a function of the input shape: `output_shape = f(input_shape)`.
`mask`	Either `NULL` (indicating no masking) or a callable with the same signature as the `compute_mask` layer method, or a tensor that will be returned as output mask regardless of what the input is.
`arguments`	Optional named list of arguments to be passed to the function.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
# add a x -> x^2 layer
model <- keras_model_sequential()
model |> layer_lambda(\(x) x^2)
```

See Also

- https://keras.io/api/layers/core_layers/lambda#lambda-class

Other core layers:
layer_dense()
layer_einsum_dense()
layer_embedding()
layer_identity()
layer_masking()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()

layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()

layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_layer_normalization

Layer normalization layer (Ba et al., 2016).

Description

Normalize the activations of the previous layer for each given example in a batch independently, rather than across a batch like Batch Normalization. i.e. applies a transformation that maintains the mean activation within each example close to 0 and the activation standard deviation close to 1.

If `scale` or `center` are enabled, the layer will scale the normalized outputs by broadcasting them with a trainable variable `gamma`, and center the outputs by broadcasting with a trainable variable `beta`. `gamma` will default to a ones tensor and `beta` will default to a zeros tensor, so that centering and scaling are no-ops before training has begun.

So, with scaling and centering enabled the normalization equations are as follows:

Let the intermediate activations for a mini-batch to be the `inputs`.

For each sample `x` in a batch of `inputs`, we compute the mean and variance of the sample, normalize each value in the sample (including a small factor `epsilon` for numerical stability), and finally, transform the normalized output by `gamma` and `beta`, which are learned parameters:

```
outputs <- inputs |> apply(1, function(x) {
  x_normalized <- (x - mean(x)) /
                  sqrt(var(x) + epsilon)
  x_normalized * gamma + beta
})
```

`gamma` and `beta` will span the axes of `inputs` specified in `axis`, and this part of the inputs' shape must be fully defined.

For example:

```
layer <- layer_layer_normalization(axis = c(2, 3, 4))

layer(op_ones(c(5, 20, 30, 40))) |> invisible() # build()
shape(layer$beta)
```

```
## shape(20, 30, 40)
```

```
shape(layer$gamma)
```

```
## shape(20, 30, 40)
```

Note that other implementations of layer normalization may choose to define `gamma` and `beta` over a separate set of axes from the axes being normalized across. For example, Group Normalization (Wu et al. 2018) with group size of 1 corresponds to a `layer_layer_normalization()` that normalizes across height, width, and channel and has `gamma` and `beta` span only the channel dimension. So, this `layer_layer_normalization()` implementation will not match a `layer_group_normalization()` layer with group size set to 1.

Usage

```
layer_layer_normalization(
  object,
  axis = -1L,
  epsilon = 0.001,
  center = TRUE,
  scale = TRUE,
  rms_scaling = FALSE,
  beta_initializer = "zeros",
  gamma_initializer = "ones",
  beta_regularizer = NULL,
  gamma_regularizer = NULL,
  beta_constraint = NULL,
  gamma_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`axis`	Integer or list. The axis or axes to normalize across. Typically, this is the features axis/axes. The left-out axes are typically the batch axis/axes. `-1` is the last dimension in the input. Defaults to `-1`.
`epsilon`	Small float added to variance to avoid dividing by zero. Defaults to 1e-3.
`center`	If `TRUE`, add offset of `beta` to normalized tensor. If `FALSE`, `beta` is ignored. Defaults to `TRUE`.
`scale`	If `TRUE`, multiply by `gamma`. If `FALSE`, `gamma` is not used. When the next layer is linear (also e.g. `layer_activation_relu()`), this can be disabled since the scaling will be done by the next layer. Defaults to `TRUE`.
`rms_scaling`	If `TRUE`, `center` and `scale` are ignored, and the inputs are scaled by `gamma` and the inverse square root of the square of all inputs. This is an approximate and faster approach that avoids ever computing the mean of the input. Note that this *isn't* equivalent to the computation that the `layer_rms_normalization` layer performs.
`beta_initializer`	Initializer for the beta weight. Defaults to zeros.
`gamma_initializer`	Initializer for the gamma weight. Defaults to ones.
`beta_regularizer`	Optional regularizer for the beta weight. `NULL` by default.
`gamma_regularizer`	Optional regularizer for the gamma weight. `NULL` by default.
`beta_constraint`	Optional constraint for the beta weight. `NULL` by default.
`gamma_constraint`	Optional constraint for the gamma weight. `NULL` by default.
`...`	Base layer keyword arguments (e.g. `name` and `dtype`).

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Reference

- Lei Ba et al., 2016.

See Also

- https://keras.io/api/layers/normalization_layers/layer_normalization#layernormalization-class

Other normalization layers:
`layer_batch_normalization()`
`layer_group_normalization()`
`layer_rms_normalization()`
`layer_spectral_normalization()`
`layer_unit_normalization()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`

layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_lstm *Long Short-Term Memory layer - Hochreiter 1997.*

Description

Based on available runtime hardware and constraints, this layer will choose different implementations (cuDNN-based or backend-native) to maximize the performance. If a GPU is available and all the arguments to the layer meet the requirement of the cuDNN kernel (see below for details), the layer will use a fast cuDNN implementation when using the TensorFlow backend. The requirements to use the cuDNN implementation are:

1. activation == tanh
2. recurrent_activation == sigmoid
3. recurrent_dropout == 0
4. unroll is FALSE
5. use_bias is TRUE
6. Inputs, if use masking, are strictly right-padded.
7. Eager execution is enabled in the outermost context.

For example:

```
input <- random_uniform(c(32, 10, 8))
output <- input |> layer_lstm(4)
shape(output)

## shape(32, 4)


lstm <- layer_lstm(units = 4, return_sequences = TRUE, return_state = TRUE)
c(whole_seq_output, final_memory_state, final_carry_state) %<-% lstm(input)
shape(whole_seq_output)
```

```
## shape(32, 10, 4)


shape(final_memory_state)

## shape(32, 4)


shape(final_carry_state)

## shape(32, 4)
```

Usage

```
layer_lstm(
  object,
  units,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  unit_forget_bias = TRUE,
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  unroll = FALSE,
  use_cudnn = "auto",
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`units`	Positive integer, dimensionality of the output space.

activation
: Activation function to use. Default: hyperbolic tangent (`tanh`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).

recurrent_activation
: Activation function to use for the recurrent step. Default: sigmoid (`sigmoid`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).

use_bias
: Boolean, (default `TRUE`), whether the layer should use a bias vector.

kernel_initializer
: Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs. Default: `"glorot_uniform"`.

recurrent_initializer
: Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state. Default: `"orthogonal"`.

bias_initializer
: Initializer for the bias vector. Default: `"zeros"`.

unit_forget_bias
: Boolean (default `TRUE`). If `TRUE`, add 1 to the bias of the forget gate at initialization. Setting it to `TRUE` will also force `bias_initializer="zeros"`. This is recommended in Jozefowicz et al.

kernel_regularizer
: Regularizer function applied to the `kernel` weights matrix. Default: `NULL`.

recurrent_regularizer
: Regularizer function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.

bias_regularizer
: Regularizer function applied to the bias vector. Default: `NULL`.

activity_regularizer
: Regularizer function applied to the output of the layer (its "activation"). Default: `NULL`.

kernel_constraint
: Constraint function applied to the `kernel` weights matrix. Default: `NULL`.

recurrent_constraint
: Constraint function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.

bias_constraint
: Constraint function applied to the bias vector. Default: `NULL`.

dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.

recurrent_dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.

seed
: Random seed for dropout.

return_sequences
: Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: `FALSE`.

return_state
: Boolean. Whether to return the last state in addition to the output. Default: `FALSE`.

go_backwards	Boolean (default: FALSE). If TRUE, process the input sequence backwards and return the reversed sequence.
stateful	Boolean (default: FALSE). If TRUE, the last state for each sample at index i in a batch will be used as initial state for the sample of index i in the following batch.
unroll	Boolean (default FALSE). If TRUE, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.
use_cudnn	Whether to use a cuDNN-backed implementation. "auto" will attempt to use cuDNN when feasible, and will fallback to the default implementation if not.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 3D tensor, with shape `(batch, timesteps, feature)`.
- `mask`: Binary tensor of shape `(samples, timesteps)` indicating whether a given timestep should be masked (optional). An individual `TRUE` entry indicates that the corresponding timestep should be utilized, while a `FALSE` entry indicates that the corresponding timestep should be ignored. Defaults to `NULL`.
- `training`: Boolean indicating whether the layer should behave in training mode or in inference mode. This argument is passed to the cell when calling it. This is only relevant if `dropout` or `recurrent_dropout` is used (optional). Defaults to `NULL`.
- `initial_state`: List of initial state tensors to be passed to the first call of the cell (optional, `NULL` causes creation of zero-filled initial state tensors). Defaults to `NULL`.

See Also

- https://keras.io/api/layers/recurrent_layers/lstm#lstm-class

Other lstm rnn layers:
`rnn_cell_lstm()`

Other rnn layers:
`layer_bidirectional()`
`layer_conv_lstm_1d()`
`layer_conv_lstm_2d()`
`layer_conv_lstm_3d()`
`layer_gru()`
`layer_rnn()`

layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()

layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_masking()
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layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()

layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
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layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_masking` *Masks a sequence by using a mask value to skip timesteps.*

Description

For each timestep in the input tensor (the second dimension in the tensor), if all values in the input tensor at that timestep are equal to `mask_value`, then the timestep will be masked (skipped) in all downstream layers (as long as they support masking).

If any downstream layer does not support masking yet receives such an input mask, an exception will be raised.

Usage

```
layer_masking(object, mask_value = 0, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`mask_value`	see description
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Consider an array `x` of shape `c(samples, timesteps, features)`, to be fed to an LSTM layer. You want to mask timestep #3 and #5 because you lack data for these timesteps. You can:

- Set `x[, 3, ] <- 0.` and `x[, 5, ] <- 0.`
- Insert a `layer_masking()` layer with `mask_value = 0.` before the LSTM layer:

```
c(samples, timesteps, features) %<-% c(32, 10, 8)
inputs <- c(samples, timesteps, features) %>% { array(runif(prod(.)), dim = .) }
inputs[, 3, ] <- 0
inputs[, 5, ] <- 0

model <- keras_model_sequential() %>%
  layer_masking(mask_value = 0) %>%
  layer_lstm(32)

output <- model(inputs)
# The time step 3 and 5 will be skipped from LSTM calculation.
```

Note

in the Keras masking convention, a masked timestep is denoted by a mask value of FALSE, while a non-masked (i.e. usable) timestep is denoted by a mask value of TRUE.

See Also

- https://keras.io/api/layers/core_layers/masking#masking-class

Other core layers:
layer_dense()
layer_einsum_dense()
layer_embedding()
layer_identity()
layer_lambda()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()

layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()

layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()

rnn_cell_simple()
rnn_cells_stack()

---

layer_maximum *Computes element-wise maximum on a list of inputs.*

Description

It takes as input a list of tensors, all of the same shape, and returns a single tensor (also of the same shape).

Usage

```
layer_maximum(inputs, ...)
```

Arguments

inputs	layers to combine
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(2, 3, 4)
x1 <- random_uniform(input_shape)
x2 <- random_uniform(input_shape)
y <- layer_maximum(x1, x2)
```

Usage in a Keras model:

```
input1 <- layer_input(shape = c(16))
x1 <- input1 |> layer_dense(8, activation = 'relu')
input2 <- layer_input(shape = c(32))
x2 <- input2 |> layer_dense(8, activation = 'relu')
# equivalent to `y <- layer_maximum(x1, x2)`
y <- layer_maximum(x1, x2)
out <- y |> layer_dense(4)
model <- keras_model(inputs = c(input1, input2), outputs = out)
```

See Also

- https://keras.io/api/layers/merging_layers/maximum#maximum-class

Other merging layers:
layer_add()
layer_average()
layer_concatenate()
layer_dot()
layer_minimum()
layer_multiply()
layer_subtract()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()

layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()

layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_max_num_bounding_boxes
Ensure the maximum number of bounding boxes.

Description

Ensure the maximum number of bounding boxes.

Usage

```
layer_max_num_bounding_boxes(object, max_number, fill_value = -1L, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
max_number	Desired output number of bounding boxes.
fill_value	The fill value of the boxes and labels in bounding_boxes. Defaults to -1.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()

layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()

layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()

layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()

layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_max_pooling_1d *Max pooling operation for 1D temporal data.*

Description

Downsamples the input representation by taking the maximum value over a spatial window of size `pool_size`. The window is shifted by `strides`.

The resulting output when using the `"valid"` padding option has a shape of: `output_shape = (input_shape - pool_size`

The resulting output shape when using the `"same"` padding option is: `output_shape = input_shape / strides`

Usage

```
layer_max_pooling_1d(
  object,
  pool_size = 2L,
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`pool_size`	int, size of the max pooling window.
`strides`	int or `NULL`. Specifies how much the pooling window moves for each pooling step. If `NULL`, it will default to `pool_size`.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format="channels_last"`: 3D tensor with shape `(batch_size, steps, features)`.
- If `data_format="channels_first"`: 3D tensor with shape `(batch_size, features, steps)`.

Output Shape

- If `data_format="channels_last"`: 3D tensor with shape `(batch_size, downsampled_steps, features)`.
- If `data_format="channels_first"`: 3D tensor with shape `(batch_size, features, downsampled_steps)`.

Examples

`strides=1` and `padding="valid"`:

```
x <- op_reshape(c(1, 2, 3, 4, 5),
               c(1, 5, 1))
max_pool_1d <- layer_max_pooling_1d(pool_size = 2,
                                    strides = 1,
                                    padding = "valid")
max_pool_1d(x)

## tf.Tensor(
## [[[2.]
##   [3.]
##   [4.]
##   [5.]]], shape=(1, 4, 1), dtype=float32)
```

`strides=2` and `padding="valid"`:

```
x <- op_reshape(c(1, 2, 3, 4, 5),
               c(1, 5, 1))
max_pool_1d <- layer_max_pooling_1d(pool_size = 2,
                                    strides = 2,
                                    padding = "valid")
max_pool_1d(x)

## tf.Tensor(
## [[[2.]
##   [4.]]], shape=(1, 2, 1), dtype=float32)
```

`strides=1` and `padding="same"`:

```
x <- op_reshape(c(1, 2, 3, 4, 5),
               c(1, 5, 1))
max_pool_1d <- layer_max_pooling_1d(pool_size = 2,
                                    strides = 1,
                                    padding = "same")
max_pool_1d(x)
```

```
## tf.Tensor(
## [[[2.]
##   [3.]
##   [4.]
##   [5.]
##   [5.]]], shape=(1, 5, 1), dtype=float32)
```

See Also

- https://keras.io/api/layers/pooling_layers/max_pooling1d#maxpooling1d-class

Other pooling layers:
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_2d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()

layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_2d()
layer_max_pooling_3d()

layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()

layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_max_pooling_2d *Max pooling operation for 2D spatial data.*

Description

Downsamples the input along its spatial dimensions (height and width) by taking the maximum value over an input window (of size defined by `pool_size`) for each channel of the input. The window is shifted by `strides` along each dimension.

The resulting output when using the "valid" padding option has a spatial shape (number of rows or columns) of: `output_shape = floor((input_shape - pool_size) / strides) + 1` (when `input_shape >= pool_size`)

The resulting output shape when using the "same" padding option is: `output_shape = floor((input_shape - 1) / strides) + 1`

Usage

```
layer_max_pooling_2d(
  object,
  pool_size = list(2L, 2L),
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
pool_size	int or list of 2 integers, factors by which to downscale (dim1, dim2). If only one integer is specified, the same window length will be used for all dimensions.

strides	int or list of 2 integers, or NULL. Strides values. If NULL, it will default to pool_size. If only one int is specified, the same stride size will be used for all dimensions.
padding	string, either "valid" or "same" (case-insensitive). "valid" means no padding. "same" results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
name	String, name for the object
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

- If data_format="channels_last": 4D tensor with shape (batch_size, height, width, channels).
- If data_format="channels_first": 4D tensor with shape (batch_size, channels, height, width).

Output Shape

- If data_format="channels_last": 4D tensor with shape (batch_size, pooled_height, pooled_width, channel
- If data_format="channels_first": 4D tensor with shape (batch_size, channels, pooled_height, pooled_wid

Examples

strides = (1, 1) and padding = "valid":

```
x <- rbind(c(1., 2., 3.),
           c(4., 5., 6.),
           c(7., 8., 9.)) |> op_reshape(c(1, 3, 3, 1))
max_pool_2d <- layer_max_pooling_2d(pool_size = c(2, 2),
                                    strides = c(1, 1),
                                    padding = "valid")
max_pool_2d(x)
```

```
## tf.Tensor(
## [[[[5.]
##    [6.]]
##
##   [[8.]
##    [9.]]]], shape=(1, 2, 2, 1), dtype=float32)
```

strides = c(2, 2) and padding = "valid":

```
x <- rbind(c(1., 2., 3., 4.),
           c(5., 6., 7., 8.),
           c(9., 10., 11., 12.)) |> op_reshape(c(1, 3, 4, 1))
max_pool_2d <- layer_max_pooling_2d(pool_size = c(2, 2),
                                    strides = c(2, 2),
                                    padding = "valid")
max_pool_2d(x)
```

```
## tf.Tensor(
## [[[[6.]
##    [8.]]]], shape=(1, 1, 2, 1), dtype=float32)
```

stride = (1, 1) and padding = "same":

```
x <- rbind(c(1., 2., 3.),
           c(4., 5., 6.),
           c(7., 8., 9.)) |> op_reshape(c(1, 3, 3, 1))
max_pool_2d <- layer_max_pooling_2d(pool_size = c(2, 2),
                                    strides = c(1, 1),
                                    padding = "same")
max_pool_2d(x)
```

```
## tf.Tensor(
## [[[[5.]
##    [6.]
##    [6.]]
##
##   [[8.]
##    [9.]
##    [9.]]
##
##   [[8.]
##    [9.]
##    [9.]]]], shape=(1, 3, 3, 1), dtype=float32)
```

See Also

- https://keras.io/api/layers/pooling_layers/max_pooling2d#maxpooling2d-class

Other pooling layers:
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_max_pooling_1d()
layer_max_pooling_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()

layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()

layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_max_pooling_3d *Max pooling operation for 3D data (spatial or spatio-temporal).*

Description

Downsamples the input along its spatial dimensions (depth, height, and width) by taking the maximum value over an input window (of size defined by `pool_size`) for each channel of the input. The window is shifted by `strides` along each dimension.

Usage

```
layer_max_pooling_3d(
  object,
  pool_size = list(2L, 2L, 2L),
  strides = NULL,
  padding = "valid",
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`pool_size`	int or list of 3 integers, factors by which to downscale (dim1, dim2, dim3). If only one integer is specified, the same window length will be used for all dimensions.
`strides`	int or list of 3 integers, or `NULL`. Strides values. If `NULL`, it will default to `pool_size`. If only one int is specified, the same stride size will be used for all dimensions.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, spatial_dim1, spatial_di` It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, spatial_dim1, spatial_dim2, spatial_`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, spatial_dim1, spatial_di`

Output Shape

- If `data_format="channels_last"`: 5D tensor with shape: `(batch_size, pooled_dim1, pooled_dim2, pooled_di`
- If `data_format="channels_first"`: 5D tensor with shape: `(batch_size, channels, pooled_dim1, pooled_dim2`

Examples

```
depth <- 30
height <- 30
width <- 30
channels <- 3

inputs <- layer_input(shape=c(depth, height, width, channels))
layer <- layer_max_pooling_3d(pool_size=3)
outputs <- inputs |> layer()
outputs

## <KerasTensor shape=(None, 10, 10, 10, 3), dtype=float32, sparse=False, ragged=False, name=keras_tens
```

See Also

- https://keras.io/api/layers/pooling_layers/max_pooling3d#maxpooling3d-class

Other pooling layers:
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_global_average_pooling_1d()`
`layer_global_average_pooling_2d()`
`layer_global_average_pooling_3d()`
`layer_global_max_pooling_1d()`
`layer_global_max_pooling_2d()`
`layer_global_max_pooling_3d()`
`layer_max_pooling_1d()`

layer_max_pooling_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()

layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_mel_spectrogram` *A preprocessing layer to convert raw audio signals to Mel spectrograms.*

Description

This layer takes `float32`/`float64` single or batched audio signal as inputs and computes the Mel spectrogram using Short-Time Fourier Transform and Mel scaling. The input should be a 1D (unbatched) or 2D (batched) tensor representing audio signals. The output will be a 2D or 3D tensor representing Mel spectrograms.

A spectrogram is an image-like representation that shows the frequency spectrum of a signal over time. It uses x-axis to represent time, y-axis to represent frequency, and each pixel to represent intensity. Mel spectrograms are a special type of spectrogram that use the mel scale, which approximates how humans perceive sound. They are commonly used in speech and music processing tasks like speech recognition, speaker identification, and music genre classification.

Usage

```
layer_mel_spectrogram(
  object,
  fft_length = 2048L,
  sequence_stride = 512L,
  sequence_length = NULL,
  window = "hann",
  sampling_rate = 16000L,
  num_mel_bins = 128L,
  min_freq = 20,
  max_freq = NULL,
  power_to_db = TRUE,
  top_db = 80,
  mag_exp = 2,
  min_power = 1e-10,
  ref_power = 1,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`fft_length`	Integer, size of the FFT window.
`sequence_stride`	Integer, number of samples between successive STFT columns.
`sequence_length`	Integer, size of the window used for applying `window` to each audio frame. If `NULL`, defaults to `fft_length`.
`window`	String, name of the window function to use. Available values are `"hann"` and `"hamming"`. If `window` is a tensor, it will be used directly as the window and its length must be `sequence_length`. If `window` is `NULL`, no windowing is used. Defaults to `"hann"`.
`sampling_rate`	Integer, sample rate of the input signal.
`num_mel_bins`	Integer, number of mel bins to generate.
`min_freq`	Float, minimum frequency of the mel bins.
`max_freq`	Float, maximum frequency of the mel bins. If `NULL`, defaults to `sampling_rate / 2`.

power_to_db	If TRUE, convert the power spectrogram to decibels.
top_db	Float, minimum negative cut-off `max(10 * log10(S)) - top_db`.
mag_exp	Float, exponent for the magnitude spectrogram. 1 for magnitude, 2 for power, etc. Default is 2.
min_power	Float, minimum value for power and `ref_power`.
ref_power	Float, the power is scaled relative to it `10 * log10(S / ref_power)`.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

References

- Spectrogram,
- Mel scale.

Examples

Unbatched audio signal

```
layer <- layer_mel_spectrogram(
  num_mel_bins = 64,
  sampling_rate = 8000,
  sequence_stride = 256,
  fft_length = 2048
)
layer(random_uniform(shape = c(16000))) |> shape()
```

Batched audio signal

```
layer <- layer_mel_spectrogram(
  num_mel_bins = 80,
  sampling_rate = 8000,
  sequence_stride = 128,
  fft_length = 2048
)
layer(random_uniform(shape = c(2, 16000))) |> shape()
```

Input Shape

1D (unbatched) or 2D (batched) tensor with shape:`(..., samples)`.

Output Shape

2D (unbatched) or 3D (batched) tensor with shape:`(..., num_mel_bins, time)`.

See Also

Other audio preprocessing layers:
`layer_stft_spectrogram()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`
`layer_hashed_crossing()`
`layer_hashing()`
`layer_integer_lookup()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_normalization()`
`layer_rand_augment()`
`layer_random_brightness()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_contrast()`
`layer_random_crop()`
`layer_random_erasing()`
`layer_random_flip()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_rotation()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_random_shear()`
`layer_random_translation()`
`layer_random_zoom()`
`layer_rescaling()`
`layer_resizing()`
`layer_solarization()`
`layer_stft_spectrogram()`
`layer_string_lookup()`

layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()

layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_minimum` *Computes elementwise minimum on a list of inputs.*

Description

It takes as input a list of tensors, all of the same shape, and returns a single tensor (also of the same shape).

Usage

```
layer_minimum(inputs, ...)
```

Arguments

`inputs`	layers to combine
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(2, 3, 4)
x1 <- random_uniform(input_shape)
x2 <- random_uniform(input_shape)
y <- layer_minimum(x1, x2)
```

Usage in a Keras model:

```
input1 <- layer_input(shape = c(16))
x1 <- input1 |> layer_dense(8, activation = 'relu')
input2 <- layer_input(shape = c(32))
x2 <- input2 |> layer_dense(8, activation = 'relu')
# equivalent to `y <- layer_minimum(x1, x2)`
y <- layer_minimum(x1, x2)
out <- y |> layer_dense(4)
model <- keras_model(inputs = c(input1, input2), outputs = out)
```

See Also

- https://keras.io/api/layers/merging_layers/minimum#minimum-class

Other merging layers:
`layer_add()`
`layer_average()`
`layer_concatenate()`
`layer_dot()`
`layer_maximum()`
`layer_multiply()`
`layer_subtract()`

Other layers:
`Layer()`

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()

layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_mix_up *MixUp implements the MixUp data augmentation technique.*

Description

MixUp implements the MixUp data augmentation technique.

Usage

```
layer_mix_up(object, alpha = 0.2, data_format = NULL, seed = NULL, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
alpha	Float between 0 and 1. Controls the blending strength. Smaller values mean less mixing, while larger values allow for more blending between images. Defaults to 0.2, recommended for ImageNet1k classification.
data_format	String, one of "channels_last" (default) or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width).
seed	Integer. Used to create a random seed.
...	For forward/backward compatability.

References

- MixUp paper.
- MixUp for Object Detection paper.

Examples

```
c(c(images, labels), .) %<-% dataset_cifar10()
c(images, labels) %<-% list(images[1:8,,,], labels[1:8,])
labels <- labels |> op_one_hot(10) |> op_cast("float32")
mix_up <- layer_mix_up(alpha=0.2)
output <- mix_up(list(images = images, labels = labels))
```

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()

layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_multiply` *Performs elementwise multiplication.*

Description

It takes as input a list of tensors, all of the same shape, and returns a single tensor (also of the same shape).

Usage

```
layer_multiply(inputs, ...)
```

Arguments

`inputs`	layers to combine
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(2, 3, 4)
x1 <- random_uniform(input_shape)
x2 <- random_uniform(input_shape)
y <- layer_multiply(x1, x2)
```

Usage in a Keras model:

```
input1 <- layer_input(shape = c(16))
x1 <- input1 |> layer_dense(8, activation = 'relu')
input2 <- layer_input(shape = c(32))
x2 <- input2 |> layer_dense(8, activation = 'relu')
# equivalent to `y <- layer_multiply(x1, x2)`
y <- layer_multiply(x1, x2)
out <- y |> layer_dense(4)
model <- keras_model(inputs = c(input1, input2), outputs = out)
```

See Also

- https://keras.io/api/layers/merging_layers/multiply#multiply-class

Other merging layers:
`layer_add()`
`layer_average()`
`layer_concatenate()`
`layer_dot()`
`layer_maximum()`
`layer_minimum()`
`layer_subtract()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`

layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()

layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()

layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_multi_head_attention

Multi Head Attention layer.

Description

This is an implementation of multi-headed attention as described in the paper "Attention is all you Need" Vaswani et al., 2017. If query, key, value are the same, then this is self-attention. Each timestep in query attends to the corresponding sequence in key, and returns a fixed-width vector.

This layer first projects query, key and value. These are (effectively) a list of tensors of length num_attention_heads, where the corresponding shapes are (batch_size, <query dimensions>, key_dim), (batch_size, <key/value dimensions>, key_dim), (batch_size, <key/value dimensions>, value_dim).

Then, the query and key tensors are dot-producted and scaled. These are softmaxed to obtain attention probabilities. The value tensors are then interpolated by these probabilities, then concatenated back to a single tensor.

Finally, the result tensor with the last dimension as `value_dim` can take a linear projection and return.

Usage

```
layer_multi_head_attention(
  inputs,
  num_heads,
  key_dim,
  value_dim = NULL,
  dropout = 0,
  use_bias = TRUE,
  output_shape = NULL,
  attention_axes = NULL,
  flash_attention = NULL,
  kernel_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  bias_constraint = NULL,
  seed = NULL,
  ...
)
```

Arguments

`inputs`	see description
`num_heads`	Number of attention heads.
`key_dim`	Size of each attention head for query and key.
`value_dim`	Size of each attention head for value.
`dropout`	Dropout probability.
`use_bias`	Boolean, whether the dense layers use bias vectors/matrices.
`output_shape`	The expected shape of an output tensor, besides the batch and sequence dims. If not specified, projects back to the query feature dim (the query input's last dimension).
`attention_axes`	axes over which the attention is applied. `NULL` means attention over all axes, but batch, heads, and features.
`flash_attention`	If `NULL`, the layer attempts to use flash attention for faster and more memory-efficient attention computations when possible. This behavior can be configured using `config_enable_flash_attention()` or `config_disable_flash_attention()`.

`kernel_initializer`
: Initializer for dense layer kernels.

`bias_initializer`
: Initializer for dense layer biases.

`kernel_regularizer`
: Regularizer for dense layer kernels.

`bias_regularizer`
: Regularizer for dense layer biases.

`activity_regularizer`
: Regularizer for dense layer activity.

`kernel_constraint`
: Constraint for dense layer kernels.

`bias_constraint`
: Constraint for dense layer kernels.

`seed` Optional integer to seed the dropout layer.

`...` For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `query`: Query tensor of shape `(B, T, dim)`, where `B` is the batch size, `T` is the target sequence length, and dim is the feature dimension.
- `value`: Value tensor of shape `(B, S, dim)`, where `B` is the batch size, `S` is the source sequence length, and dim is the feature dimension.
- `key`: Optional key tensor of shape `(B, S, dim)`. If not given, will use `value` for both `key` and `value`, which is the most common case.
- `attention_mask`: a boolean mask of shape `(B, T, S)`, that prevents attention to certain positions. The boolean mask specifies which query elements can attend to which key elements, 1 indicates attention and 0 indicates no attention. Broadcasting can happen for the missing batch dimensions and the head dimension.
- `return_attention_scores`: A boolean to indicate whether the output should be `(attention_output, attention_sc` if `TRUE`, or `attention_output` if `FALSE`. Defaults to `FALSE`.
- `training`: Python boolean indicating whether the layer should behave in training mode (adding dropout) or in inference mode (no dropout). Will go with either using the training mode of the parent layer/model, or `FALSE` (inference) if there is no parent layer.
- `use_causal_mask`: A boolean to indicate whether to apply a causal mask to prevent tokens from attending to future tokens (e.g., used in a decoder Transformer).

Call return

- attention_output: The result of the computation, of shape `(B, T, E)`, where `T` is for target sequence shapes and `E` is the query input last dimension if `output_shape` is `NULL`. Otherwise, the multi-head outputs are projected to the shape specified by `output_shape`.
- attention_scores: (Optional) multi-head attention coefficients over attention axes.

Properties

A `MultiHeadAttention Layer` instance has the following additional read-only properties:

- `attention_axes`
- `dropout`
- `key_dense`
- `key_dim`
- `num_heads`
- `output_dense`
- `output_shape`
- `query_dense`
- `use_bias`
- `value_dense`
- `value_dim`

See Also

- https://keras.io/api/layers/attention_layers/multi_head_attention#multiheadattention-class

Other attention layers:
`layer_additive_attention()`
`layer_attention()`
`layer_group_query_attention()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`

layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()

layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_normalization *A preprocessing layer that normalizes continuous features.*

Description

This layer will shift and scale inputs into a distribution centered around 0 with standard deviation 1. It accomplishes this by precomputing the mean and variance of the data, and calling `(input - mean) / sqrt(var)` at runtime.

The mean and variance values for the layer must be either supplied on construction or learned via `adapt()`. `adapt()` will compute the mean and variance of the data and store them as the layer's weights. `adapt()` should be called before `fit()`, `evaluate()`, or `predict()`.

Usage

```
layer_normalization(
  object,
  axis = -1L,
  mean = NULL,
  variance = NULL,
  invert = FALSE,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`axis`	Integer, list of integers, or NULL. The axis or axes that should have a separate mean and variance for each index in the shape. For example, if shape is `(NULL, 5)` and `axis=1`, the layer will track 5 separate mean and variance values for the last axis. If `axis` is set to `NULL`, the layer will normalize all elements in the input by a scalar mean and variance. When `-1`, the last axis of the input is assumed to be a feature dimension and is normalized per index. Note that in the specific case of batched scalar inputs where the only axis is the batch axis, the default will normalize each index in the batch separately. In this case, consider passing `axis=NULL`. Defaults to `-1`.
`mean`	The mean value(s) to use during normalization. The passed value(s) will be broadcast to the shape of the kept axes above; if the value(s) cannot be broadcast, an error will be raised when this layer's `build()` method is called.
`variance`	The variance value(s) to use during normalization. The passed value(s) will be broadcast to the shape of the kept axes above; if the value(s) cannot be broadcast, an error will be raised when this layer's `build()` method is called.
`invert`	If `TRUE`, this layer will apply the inverse transformation to its inputs: it would turn a normalized input back into its original form.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Calculate a global mean and variance by analyzing the dataset in `adapt()`.

```
adapt_data <- op_array(c(1., 2., 3., 4., 5.), dtype='float32')
input_data <- op_array(c(1., 2., 3.), dtype='float32')
layer <- layer_normalization(axis = NULL)
layer %>% adapt(adapt_data)
layer(input_data)
```

```
## tf.Tensor([-1.4142135  -0.70710677  0.        ], shape=(3), dtype=float32)
```

Calculate a mean and variance for each index on the last axis.

```
adapt_data <- op_array(rbind(c(0., 7., 4.),
                       c(2., 9., 6.),
                       c(0., 7., 4.),
                       c(2., 9., 6.)), dtype='float32')
input_data <- op_array(matrix(c(0., 7., 4.), nrow = 1), dtype='float32')
layer <- layer_normalization(axis=-1)
layer %>% adapt(adapt_data)
layer(input_data)

## tf.Tensor([[-1. -1. -1.]], shape=(1, 3), dtype=float32)
```

Pass the mean and variance directly.

```
input_data <- op_array(rbind(1, 2, 3), dtype='float32')
layer <- layer_normalization(mean=3., variance=2.)
layer(input_data)

## tf.Tensor(
## [[-1.4142135 ]
##  [-0.70710677]
##  [ 0.        ]], shape=(3, 1), dtype=float32)
```

Use the layer to de-normalize inputs (after adapting the layer).

```
adapt_data <- op_array(rbind(c(0., 7., 4.),
                       c(2., 9., 6.),
                       c(0., 7., 4.),
                       c(2., 9., 6.)), dtype='float32')
input_data <- op_array(c(1., 2., 3.), dtype='float32')
layer <- layer_normalization(axis=-1, invert=TRUE)
layer %>% adapt(adapt_data)
layer(input_data)

## tf.Tensor([[ 2. 10.  8.]], shape=(1, 3), dtype=float32)
```

See Also

- https://keras.io/api/layers/preprocessing_layers/numerical/normalization#normalization-class

Other numerical features preprocessing layers:
layer_discretization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()

layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()

layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()

layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()

layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_permute *Permutes the dimensions of the input according to a given pattern.*

Description

Useful e.g. connecting RNNs and convnets.

Usage

```
layer_permute(object, dims, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
dims	List of integers. Permutation pattern does not include the batch dimension. Indexing starts at 1. For instance, (1, 3, 2) permutes the second and third dimensions of the input.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

Arbitrary.

Output Shape

Same as the input shape, but with the dimensions re-ordered according to the specified pattern.

Example

```
x <- layer_input(shape=c(10, 64))
y <- layer_permute(x, c(2, 1))
shape(y)

## shape(NA, 64, 10)
```

See Also

- https://keras.io/api/layers/reshaping_layers/permute#permute-class

Other reshaping layers:
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_flatten()`
`layer_repeat_vector()`
`layer_reshape()`
`layer_upsampling_1d()`
`layer_upsampling_2d()`
`layer_upsampling_3d()`
`layer_zero_padding_1d()`
`layer_zero_padding_2d()`
`layer_zero_padding_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`

layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
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layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()

layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
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layer_max_pooling_3d()
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layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
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layer_random_shear()
layer_random_translation()
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layer_reshape()
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layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_pipeline *Applies a series of layers to an input.*

Description

This class is useful to build a preprocessing pipeline, in particular an image data augmentation pipeline. Compared to a `Sequential` model, `Pipeline` features a few important differences:

- It's not a `Model`, just a plain layer.
- When the layers in the pipeline are compatible with `tf.data`, the pipeline will also remain `tf.data` compatible. That is to say, the pipeline will not attempt to convert its inputs to backend-native tensors when in a tf.data context (unlike a `Sequential` model).

Usage

```
layer_pipeline(layers, name = NULL)
```

Arguments

layers	A list of layers.
name	String, name for the object

Examples

```
preprocessing_pipeline <- layer_pipeline(c(
  layer_auto_contrast(, ),
  layer_random_zoom(, 0.2),
  layer_random_rotation(, 0.2)
))

# `ds` is a tf.data.Dataset of images
ds <- tfdatasets::tensor_slices_dataset(1:100) |>
  tfdatasets::dataset_map(\(.x) {
    random_normal(c(28, 28))
  }) |>
  tfdatasets::dataset_batch(32)
  #|>
  # tfdatasets::dataset_take(4) |>
  # iterate() |> str()

preprocessed_ds <- ds |>
  tfdatasets::dataset_map(preprocessing_pipeline, num_parallel_calls = 4)
```

---

layer_random_brightness

A preprocessing layer which randomly adjusts brightness during training.

Description

This layer will randomly increase/reduce the brightness for the input RGB images. At inference time, the output will be identical to the input. Call the layer with `training=TRUE` to adjust the brightness of the input.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_random_brightness(
  object,
  factor,
  value_range = list(0L, 255L),
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	Float or a list of 2 floats between -1.0 and 1.0. The factor is used to determine the lower bound and upper bound of the brightness adjustment. A float value will be chosen randomly between the limits. When -1.0 is chosen, the output image will be black, and when 1.0 is chosen, the image will be fully white. When only one float is provided, eg, 0.2, then -0.2 will be used for lower bound and 0.2 will be used for upper bound.
`value_range`	Optional list of 2 floats for the lower and upper limit of the values of the input data. To make no change, use `c(0.0, 1.0)`, e.g., if the image input has been scaled before this layer. Defaults to `c(0.0, 255.0)`. The brightness adjustment will be scaled to this range, and the output values will be clipped to this range.
`seed`	optional integer, for fixed RNG behavior.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Inputs

3D (HWC) or 4D (NHWC) tensor, with float or int dtype. Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`)

Output

3D (HWC) or 4D (NHWC) tensor with brightness adjusted based on the `factor`. By default, the layer will output floats. The output value will be clipped to the range `[0, 255]`, the valid range of RGB colors, and rescaled based on the `value_range` if needed.

Example

```
random_bright <- layer_random_brightness(factor=0.2, seed = 1)

# An image with shape [2, 2, 3]
image <- array(1:12, dim=c(2, 2, 3))

# Assume we randomly select the factor to be 0.1, then it will apply
# 0.1 * 255 to all the channel
output <- random_bright(image, training=TRUE)
output
```

```
## tf.Tensor(
## [[[39 43 47]
##   [41 45 49]]
##
##  [[40 44 48]
##   [42 46 50]]], shape=(2, 2, 3), dtype=int32)
```

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_brightness#randombrightness-class

Other image augmentation layers:
layer_random_contrast()
layer_random_crop()
layer_random_flip()
layer_random_rotation()
layer_random_translation()
layer_random_zoom()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()

layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()

layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()

rnn_cell_simple()
rnn_cells_stack()

---

layer_random_color_degeneration
Randomly performs the color degeneration operation on given images.

Description

The sharpness operation first converts an image to gray scale, then back to color. It then takes a weighted average between original image and the degenerated image. This makes colors appear more dull.

Usage

```
layer_random_color_degeneration(
  object,
  factor,
  value_range = list(0L, 255L),
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A tuple of two floats or a single float. `factor` controls the extent to which the image sharpness is impacted. `factor=0.0` makes this layer perform a no-op operation, while a value of 1.0 uses the degenerated result entirely. Values between 0 and 1 result in linear interpolation between the original image and the sharpened image. Values should be between `0.0` and `1.0`. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. In order to ensure the value is always the same, please pass a tuple with two identical floats: `(0.5, 0.5)`.
`value_range`	The range of values the input image can take. Default is `(0, 255)`. Typically, this would be `(0, 1)` for normalized images or `(0, 255)` for raw images.
`data_format`	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
`seed`	Integer. Used to create a random seed.
`...`	For forward/backward compatability.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()

layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()

layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()

layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()

layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_color_jitter

Randomly apply brightness, contrast, saturation

Description

and hue image processing operation sequentially and randomly on the input.

Usage

```
layer_random_color_jitter(
  object,
  value_range = list(0L, 255L),
  brightness_factor = NULL,
  contrast_factor = NULL,
  saturation_factor = NULL,
  hue_factor = NULL,
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`value_range` the range of values the incoming images will have. Represented as a two number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.

`brightness_factor`
Float or a list/tuple of 2 floats between -1.0 and 1.0. The factor is used to determine the lower bound and upper bound of the brightness adjustment. A float value will be chosen randomly between the limits. When -1.0 is chosen, the output image will be black, and when 1.0 is chosen, the image will be fully white. When only one float is provided, eg, 0.2, then -0.2 will be used for lower bound and 0.2 will be used for upper bound.

contrast_factor
: a positive float represented as fraction of value, or a tuple of size 2 representing lower and upper bound. When represented as a single float, lower = upper. The contrast factor will be randomly picked between `[1.0 - lower, 1.0 + upper]`. For any pixel x in the channel, the output will be `(x - mean) * factor + mean` where `mean` is the mean value of the channel.

saturation_factor
: A tuple of two floats or a single float. `factor` controls the extent to which the image saturation is impacted. `factor=0.5` makes this layer perform a no-op operation. `factor=0.0` makes the image fully grayscale. `factor=1.0` makes the image fully saturated. Values should be between `0.0` and `1.0`. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. To ensure the value is always the same, pass a tuple with two identical floats: `(0.5, 0.5)`.

hue_factor
: A single float or a tuple of two floats. `factor` controls the extent to which the image hue is impacted. `factor=0.0` makes this layer perform a no-op operation, while a value of `1.0` performs the most aggressive contrast adjustment available. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. In order to ensure the value is always the same, please pass a tuple with two identical floats: `(0.5, 0.5)`.

seed
: Integer. Used to create a random seed.

data_format
: String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.

...
: For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()

layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_random_contrast` *A preprocessing layer which randomly adjusts contrast during training.*

Description

This layer will randomly adjust the contrast of an image or images by a random factor. Contrast is adjusted independently for each channel of each image during training.

For each channel, this layer computes the mean of the image pixels in the channel and then adjusts each component `x` of each pixel to `(x - mean) * contrast_factor + mean`.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`) and in integer or floating point dtype. By default, the layer will output floats.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_random_contrast(
  object,
  factor,
  value_range = c(0L, 255L),
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	a positive float represented as fraction of value, or a tuple of size 2 representing lower and upper bound. When represented as a single float, lower = upper. The contrast factor will be randomly picked between `[1.0 - lower, 1.0 + upper]`. For any pixel x in the channel, the output will be `(x - mean) * factor + mean` where `mean` is the mean value of the channel.
`value_range`	The range of values the incoming images will have. Represented as a two-number tuple written `tuple(low, high)`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
`seed`	Integer. Used to create a random seed.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format.

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_contrast#randomcontrast-class

Other image augmentation layers:
layer_random_brightness()
layer_random_crop()
layer_random_flip()
layer_random_rotation()
layer_random_translation()
layer_random_zoom()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()

layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()

layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()

layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_random_crop` *A preprocessing layer which randomly crops images during training.*

Description

During training, this layer will randomly choose a location to crop images down to a target size. The layer will crop all the images in the same batch to the same cropping location.

At inference time, and during training if an input image is smaller than the target size, the input will be resized and cropped so as to return the largest possible window in the image that matches the target aspect ratio. If you need to apply random cropping at inference time, set `training` to TRUE when calling the layer.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`) and of integer or floating point dtype. By default, the layer will output floats.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_random_crop(
  object,
  height,
  width,
  seed = NULL,
  data_format = NULL,
  name = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`height`	Integer, the height of the output shape.
`width`	Integer, the width of the output shape.
`seed`	Integer. Used to create a random seed.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`name`	String, name for the object
`...`	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`.

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_crop#randomcrop-class

Other image augmentation layers:
layer_random_brightness()
layer_random_contrast()
layer_random_flip()
layer_random_rotation()
layer_random_translation()
layer_random_zoom()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()

layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()

layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()

rnn_cell_simple()
rnn_cells_stack()

---

layer_random_erasing   *Random Erasing data augmentation technique.*

Description

Random Erasing is a data augmentation method where random patches of an image are erased (replaced by a constant value or noise) during training to improve generalization.

Usage

```
layer_random_erasing(
  object,
  factor = 1,
  scale = list(0.02, 0.33),
  fill_value = NULL,
  value_range = list(0L, 255L),
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A single float or a tuple of two floats. `factor` controls the probability of applying the transformation. • `factor=0.0` ensures no erasing is applied. • `factor=1.0` means erasing is always applied. • If a tuple `(min, max)` is provided, a probability value is sampled between `min` and `max` for each image. • If a single float is provided, a probability is sampled between `0.0` and the given float. Default is 1.0.
`scale`	A tuple of two floats representing the aspect ratio range of the erased patch. This defines the width-to-height ratio of the patch to be erased. It can help control the rw shape of the erased region. Default is (0.02, 0.33).
`fill_value`	A value to fill the erased region with. This can be set to a constant value or `None` to sample a random value from a normal distribution. Default is `None`.
`value_range`	the range of values the incoming images will have. Represented as a two-number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
`seed`	Integer. Used to create a random seed.

data_format — string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".

... — For forward/backward compatability.

References

- Random Erasing paper.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()

layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()

layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()

layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
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layer_rnn()
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layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_flip *A preprocessing layer which randomly flips images during training.*

Description

This layer will flip the images horizontally and or vertically based on the mode attribute. During inference time, the output will be identical to input. Call the layer with training=TRUE to flip the input. Input pixel values can be of any range (e.g. [0., 1.) or [0, 255]) and of integer or floating point dtype. By default, the layer will output floats.

Note: This layer is safe to use inside a tf.data pipeline (independently of which backend you're using).

Usage

```
layer_random_flip(
  object,
  mode = "horizontal_and_vertical",
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
mode	String indicating which flip mode to use. Can be "horizontal", "vertical", or "horizontal_and_vertical". "horizontal" is a left-right flip and "vertical" is a top-bottom flip. Defaults to "horizontal_and_vertical"
seed	Integer. Used to create a random seed.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
...	Base layer keyword arguments, such as name and dtype.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: (..., height, width, channels), in "channels_last" format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: (..., height, width, channels), in "channels_last" format.

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_flip#randomflip-class

Other image augmentation layers:
layer_random_brightness()
layer_random_contrast()
layer_random_crop()
layer_random_rotation()
layer_random_translation()
layer_random_zoom()

Other preprocessing layers:
layer_aug_mix()

layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()

layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()

layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
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layer_random_posterization()
layer_random_rotation()
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layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()

layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_gaussian_blur

Applies random Gaussian blur to images for data augmentation.

Description

This layer performs a Gaussian blur operation on input images with a randomly selected degree of blurring, controlled by the `factor` and `sigma` arguments.

Usage

```
layer_random_gaussian_blur(
  object,
  factor = 1,
  kernel_size = 3L,
  sigma = 1,
  value_range = list(0L, 255L),
```

```
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
factor	A single float or a tuple of two floats. `factor` controls the extent to which the image hue is impacted. `factor=0.0` makes this layer perform a no-op operation, while a value of `1.0` performs the most aggressive blurring available. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. Default is 1.0.
kernel_size	Integer. Size of the Gaussian kernel used for blurring. Must be an odd integer. Default is 3.
sigma	Float or tuple of two floats. Standard deviation of the Gaussian kernel. Controls the intensity of the blur. If a tuple is provided, a value is sampled between the two for each image. Default is 1.0.
value_range	the range of values the incoming images will have. Represented as a two-number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
data_format	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
seed	Integer. Used to create a random seed.
...	For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_grayscale()`
`layer_random_hue()`

layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()

layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()

layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
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layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()

layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
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layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_random_grayscale` *Preprocessing layer for random conversion of RGB images to grayscale.*

Description

This layer randomly converts input images to grayscale with a specified factor. When applied, it maintains the original number of channels but sets all channels to the same grayscale value. This can be useful for data augmentation and training models to be robust to color variations.

The conversion preserves the perceived luminance of the original color image using standard RGB to grayscale conversion coefficients. Images that are not selected for conversion remain unchanged.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_random_grayscale(
  object,
  factor = 0.5,
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	Float between 0 and 1, specifying the factor of converting each image to grayscale. Defaults to 0.5. A value of 1.0 means all images will be converted, while 0.0 means no images will be converted.
`data_format`	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
`seed`	Initial seed for the random number generator
`...`	For forward/backward compatability.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape

Same as input shape. The output maintains the same number of channels as the input, even for grayscale-converted images where all channels will have the same value.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()

layer_random_flip()
layer_random_gaussian_blur()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()

layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()

layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()

layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_hue *Randomly adjusts the hue on given images.*

Description

This layer will randomly increase/reduce the hue for the input RGB images.

The image hue is adjusted by converting the image(s) to HSV and rotating the hue channel (H) by delta. The image is then converted back to RGB.

Usage

```
layer_random_hue(
  object,
  factor,
  value_range = list(0L, 255L),
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
factor	A single float or a tuple of two floats. `factor` controls the extent to which the image hue is impacted. `factor=0.0` makes this layer perform a no-op operation, while a value of `1.0` performs the most aggressive contrast adjustment available. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. In order to ensure the value is always the same, please pass a tuple with two identical floats: `(0.5, 0.5)`.
value_range	the range of values the incoming images will have. Represented as a two-number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
data_format	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.

seed	Integer. Used to create a random seed.
...	For forward/backward compatability.

Examples

```
c(c(images, labels), .) %<-% dataset_cifar10()
random_hue <- layer_random_hue(factor=0.5, value_range=c(0, 1))
images <- op_cast(images[1:8,,,], "float32")
augmented_images_batch = random_hue(images)
```

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()

layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()

layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()

layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()

layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_invert *Preprocessing layer for random inversion of image colors.*

Description

This layer randomly inverts the colors of input images with a specified probability range. When applied, each image has a chance of having its colors inverted, where the pixel values are transformed to their complementary values. Images that are not selected for inversion remain unchanged.

Usage

```
layer_random_invert(
  object,
  factor = 1,
  value_range = list(0L, 255L),
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A single float or a tuple of two floats. `factor` controls the probability of inverting the image colors. If a tuple is provided, the value is sampled between the two values for each image, where `factor[0]` is the minimum and `factor[1]` is the maximum probability. If a single float is provided, a value between `0.0` and the provided float is sampled. Defaults to `(0, 1)`.

value_range	a tuple or a list of two elements. The first value represents the lower bound for values in passed images, the second represents the upper bound. Images passed to the layer should have values within value_range. Defaults to (0, 255).
seed	Integer. Used to create a random seed.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
...	For forward/backward compatability.

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()

layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()

layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()

layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_perspective

A preprocessing layer that applies random perspective transformations.

Description

This layer distorts the perspective of input images by shifting their corner points, simulating a 3D-like transformation. The amount of distortion is controlled by the `factor` and `scale` parameters.

Usage

```
layer_random_perspective(
  object,
  factor = 1,
  scale = 1,
  interpolation = "bilinear",
  fill_value = 0,
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A float or a tuple of two floats. Represents the probability of applying the perspective transformation to each image in the batch. • `factor=0.0` ensures no transformation is applied. • `factor=1.0` means the transformation is always applied. • If a tuple `(min, max)` is provided, a probability is randomly sampled between `min` and `max` for each image. • If a single float is given, the probability is sampled between `0.0` and the provided float. Default is 1.0.
`scale`	A float defining the relative amount of perspective shift. Determines how much the image corners are displaced, affecting the intensity of the perspective effect.
`interpolation`	Interpolation mode. Supported values: `"nearest"`, `"bilinear"`.
`fill_value`	a float represents the value to be filled outside the boundaries when `fill_mode="constant"`.
`seed`	Integer. Used to create a random seed.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`...`	For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_posterization()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_random_shear()`

layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()

layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()

layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
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layer_masking()
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layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
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layer_random_grayscale()
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layer_random_invert()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()

layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_posterization

Reduces the number of bits for each color channel.

Description

Reduces the number of bits for each color channel.

Usage

```
layer_random_posterization(
```

```
  object,
  factor,
  value_range = list(0L, 255L),
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
factor	integer, the number of bits to keep for each channel. Must be a value between 1-8.
value_range	a tuple or a list of two elements. The first value represents the lower bound for values in passed images, the second represents the upper bound. Images passed to the layer should have values within value_range. Defaults to (0, 255).
data_format	String, one of "channels_last" (default) or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width).
seed	Initial seed for the random number generator
...	For forward/backward compatability.

References

- AutoAugment: Learning Augmentation Policies from Data
- RandAugment: Practical automated data augmentation with a reduced search space

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()

layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
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layer_random_translation()
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layer_reshape()
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layer_tfsm()
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layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_rotation *A preprocessing layer which randomly rotates images during training.*

Description

This layer will apply random rotations to each image, filling empty space according to `fill_mode`.

By default, random rotations are only applied during training. At inference time, the layer does nothing. If you need to apply random rotations at inference time, pass `training = TRUE` when calling the layer.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`) and of integer or floating point dtype. By default, the layer will output floats.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_random_rotation(
  object,
  factor,
  fill_mode = "reflect",
  interpolation = "bilinear",
  seed = NULL,
  fill_value = 0,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	a float represented as fraction of 2 Pi, or a tuple of size 2 representing lower and upper bound for rotating clockwise and counter-clockwise. A positive values means rotating counter clock-wise, while a negative value means clock-wise. When represented as a single float, this value is used for both the upper and lower bound. For instance, `factor=c(-0.2, 0.3)` results in an output rotation by a random amount in the range `[-20% * 360, 30% * 360]`. `factor=0.2` results in an output rotating by a random amount in the range `[-20% * 360, 20% * 360]`.
`fill_mode`	Points outside the boundaries of the input are filled according to the given mode (one of `{"constant", "reflect", "wrap", "nearest"}`). • *reflect*: `(d c b a | a b c d | d c b a)` The input is extended by reflecting about the edge of the last pixel. • *constant*: `(k k k k | a b c d | k k k k)` The input is extended by filling all values beyond the edge with the same constant value k = 0. • *wrap*: `(a b c d | a b c d | a b c d)` The input is extended by wrapping around to the opposite edge. • *nearest*: `(a a a a | a b c d | d d d d)` The input is extended by the nearest pixel.
`interpolation`	Interpolation mode. Supported values: `"nearest"`, `"bilinear"`.
`seed`	Integer. Used to create a random seed.
`fill_value`	a float represents the value to be filled outside the boundaries when `fill_mode="constant"`.

data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: (..., height, width, channels), in "channels_last" format

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: (..., height, width, channels), in "channels_last" format

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_rotation#randomrotation-class

Other image augmentation layers:
layer_random_brightness()
layer_random_contrast()
layer_random_crop()
layer_random_flip()
layer_random_translation()
layer_random_zoom()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()

layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()

layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()

layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_saturation *Randomly adjusts the saturation on given images.*

Description

This layer will randomly increase/reduce the saturation for the input RGB images.

Usage

```
layer_random_saturation(
  object,
  factor,
  value_range = list(0L, 255L),
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.

`factor`	A tuple of two floats or a single float. `factor` controls the extent to which the image saturation is impacted. `factor=0.5` makes this layer perform a no-op operation. `factor=0.0` makes the image fully grayscale. `factor=1.0` makes the image fully saturated. Values should be between `0.0` and `1.0`. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. To ensure the value is always the same, pass a tuple with two identical floats: `(0.5, 0.5)`.
`value_range`	the range of values the incoming images will have. Represented as a two-number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
`data_format`	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
`seed`	Integer. Used to create a random seed.
`...`	For forward/backward compatability.

Examples

```
c(c(images, labels), .) %<-% dataset_cifar10()
images <- images[1:8, , , ] |> op_cast("float32")
random_saturation <- layer_random_saturation(factor = 0.2)
augmented_images <- random_saturation(images)
```

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_sharpness()`
`layer_random_shear()`
`layer_rescaling()`

layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()

layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()

layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
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layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
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layer_random_hue()
layer_random_invert()
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layer_random_posterization()
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layer_random_shear()
layer_random_translation()

layer_random_zoom()
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layer_solarization()
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layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_random_sharpness` *Randomly performs the sharpness operation on given images.*

Description

The sharpness operation first performs a blur, then blends between the original image and the processed image. This operation adjusts the clarity of the edges in an image, ranging from blurred to enhanced sharpness.

Usage

```
layer_random_sharpness(
  object,
  factor,
  value_range = list(0L, 255L),
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`factor`	A tuple of two floats or a single float. `factor` controls the extent to which the image sharpness is impacted. `factor=0.0` results in a fully blurred image, `factor=0.5` applies no operation (preserving the original image), and `factor=1.0` enhances the sharpness beyond the original. Values should be between `0.0` and `1.0`. If a tuple is used, a `factor` is sampled between the two values for every image augmented. If a single float is used, a value between `0.0` and the passed float is sampled. To ensure the value is always the same, pass a tuple with two identical floats: `(0.5, 0.5)`.
`value_range`	the range of values the incoming images will have. Represented as a two-number tuple written `[low, high]`. This is typically either `[0, 1]` or `[0, 255]` depending on how your preprocessing pipeline is set up.
`data_format`	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
`seed`	Integer. Used to create a random seed.
`...`	For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`

layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()

layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()

layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()

layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_random_shear *A preprocessing layer that randomly applies shear transformations*

Description

images.

This layer shears the input images along the x-axis and/or y-axis by a randomly selected factor within the specified range. The shear transformation is applied to each image independently in a batch. Empty regions created during the transformation are filled according to the `fill_mode` and `fill_value` parameters.

Usage

```
layer_random_shear(
  object,
  x_factor = 0,
  y_factor = 0,
  interpolation = "bilinear",
  fill_mode = "reflect",
  fill_value = 0,
  data_format = NULL,
  seed = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`x_factor`	A tuple of two floats. For each augmented image, a value is sampled from the provided range. If a float is passed, the range is interpreted as `(0, x_factor)`. Values represent a percentage of the image to shear over. For example, 0.3 shears pixels up to 30% of the way across the image. All provided values should be positive.
`y_factor`	A tuple of two floats. For each augmented image, a value is sampled from the provided range. If a float is passed, the range is interpreted as `(0, y_factor)`. Values represent a percentage of the image to shear over. For example, 0.3 shears pixels up to 30% of the way across the image. All provided values should be positive.
`interpolation`	Interpolation mode. Supported values: `"nearest"`, `"bilinear"`.
`fill_mode`	Points outside the boundaries of the input are filled according to the given mode. Available methods are `"constant"`, `"nearest"`, `"wrap"` and `"reflect"`. Defaults to `"reflect"`. • `"reflect"`: `(d c b a | a b c d | d c b a)` The input is extended by reflecting about the edge of the last pixel. • `"constant"`: `(k k k k | a b c d | k k k k)` The input is extended by filling all values beyond the edge with the same constant value `k` specified by `fill_value`. • `"wrap"`: `(a b c d | a b c d | a b c d)` The input is extended by wrapping around to the opposite edge.

- `"nearest"`: `(a a a a | a b c d | d d d d)` The input is extended by the nearest pixel. Note that when using torch backend, `"reflect"` is redirected to `"mirror"` `(c d c b | a b c d | c b a b)` because torch does not support `"reflect"`. Note that torch backend does not support `"wrap"`.

`fill_value` A float representing the value to be filled outside the boundaries when `fill_mode="constant"`.

`data_format` String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.

`seed` Integer. Used to create a random seed.

`...` For forward/backward compatability.

See Also

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_rescaling()`
`layer_resizing()`
`layer_solarization()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`

layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()

layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()

layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_translation

A preprocessing layer which randomly translates images during training.

Description

This layer will apply random translations to each image during training, filling empty space according to `fill_mode`.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`) and of integer or floating point dtype. By default, the layer will output floats.

Usage

```
layer_random_translation(
  object,
  height_factor,
  width_factor,
  fill_mode = "reflect",
  interpolation = "bilinear",
  seed = NULL,
  fill_value = 0,
  data_format = NULL,
  ...
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`height_factor` a float represented as fraction of value, or a tuple of size 2 representing lower and upper bound for shifting vertically. A negative value means shifting image up, while a positive value means shifting image down. When represented as a single positive float, this value is used for both the upper and lower bound. For instance, `height_factor=(-0.2, 0.3)` results in an output shifted by a random amount in the range `[-20%, +30%]`. `height_factor=0.2` results in an output height shifted by a random amount in the range `[-20%, +20%]`.

`width_factor` a float represented as fraction of value, or a tuple of size 2 representing lower and upper bound for shifting horizontally. A negative value means shifting image left, while a positive value means shifting image right. When represented as a single positive float, this value is used for both the upper and lower bound. For instance, `width_factor=(-0.2, 0.3)` results in an output shifted left by 20%, and shifted right by 30%. `width_factor=0.2` results in an output height shifted left or right by 20%.

`fill_mode` Points outside the boundaries of the input are filled according to the given mode. Available methods are `"constant"`, `"nearest"`, `"wrap"` and `"reflect"`. Defaults to `"reflect"`.

- `"reflect"`: `(d c b a | a b c d | d c b a)` The input is extended by reflecting about the edge of the last pixel.
- `"constant"`: `(k k k k | a b c d | k k k k)` The input is extended by filling all values beyond the edge with the same constant value k specified by `fill_value`.
- `"wrap"`: `(a b c d | a b c d | a b c d)` The input is extended by wrapping around to the opposite edge.
- `"nearest"`: `(a a a a | a b c d | d d d d)` The input is extended by the nearest pixel. Note that when using torch backend, `"reflect"` is redirected to `"mirror"` `(c d c b | a b c d | c b a b)` because torch does not support `"reflect"`. Note that torch backend does not support `"wrap"`.

`interpolation` Interpolation mode. Supported values: `"nearest"`, `"bilinear"`.

`seed` Integer. Used to create a random seed.

`fill_value` a float represents the value to be filled outside the boundaries when `fill_mode="constant"`.

`data_format` string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

`...` Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`, or `(..., channels, target_height, target_width)`, in `"channels_first"` format.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_translation#randomtranslation-class

Other image augmentation layers:
`layer_random_brightness()`
`layer_random_contrast()`
`layer_random_crop()`
`layer_random_flip()`
`layer_random_rotation()`
`layer_random_zoom()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`
`layer_hashed_crossing()`
`layer_hashing()`
`layer_integer_lookup()`
`layer_max_num_bounding_boxes()`
`layer_mel_spectrogram()`
`layer_mix_up()`
`layer_normalization()`
`layer_rand_augment()`
`layer_random_brightness()`

layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
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layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()

layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
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layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()

layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
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layer_random_shear()
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layer_reshape()
layer_resizing()
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layer_solarization()
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layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()

layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_random_zoom *A preprocessing layer which randomly zooms images during training.*

Description

This layer will randomly zoom in or out on each axis of an image independently, filling empty space according to `fill_mode`.

Input pixel values can be of any range (e.g. `[0., 1.)` or `[0, 255]`) and of integer or floating point dtype. By default, the layer will output floats.

Usage

```
layer_random_zoom(
  object,
  height_factor,
  width_factor = NULL,
  fill_mode = "reflect",
  interpolation = "bilinear",
  seed = NULL,
  fill_value = 0,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`height_factor`	a float represented as fraction of value, or a list of size 2 representing lower and upper bound for zooming vertically. When represented as a single float, this value is used for both the upper and lower bound. A positive value means zooming out, while a negative value means zooming in. For instance, `height_factor=c(0.2, 0.3)` result in an output zoomed out by a random amount in the range `[+20%, +30%]`. `height_factor=c(-0.3, -0.2)` result in an output zoomed in by a random amount in the range `[+20%, +30%]`.

width_factor a float represented as fraction of value, or a list of size 2 representing lower and upper bound for zooming horizontally. When represented as a single float, this value is used for both the upper and lower bound. For instance, `width_factor=c(0.2, 0.3)` result in an output zooming out between 20% to 30%. `width_factor=c(-0.3, -0.2)` result in an output zooming in between 20% to 30%. `NULL` means i.e., zooming vertical and horizontal directions by preserving the aspect ratio. Defaults to `NULL`.

fill_mode Points outside the boundaries of the input are filled according to the given mode. Available methods are `"constant"`, `"nearest"`, `"wrap"` and `"reflect"`. Defaults to `"reflect"`.

- `"reflect"`: `(d c b a | a b c d | d c b a)` The input is extended by reflecting about the edge of the last pixel.
- `"constant"`: `(k k k k | a b c d | k k k k)` The input is extended by filling all values beyond the edge with the same constant value k specified by `fill_value`.
- `"wrap"`: `(a b c d | a b c d | a b c d)` The input is extended by wrapping around to the opposite edge.
- `"nearest"`: `(a a a a | a b c d | d d d d)` The input is extended by the nearest pixel. Note that when using torch backend, `"reflect"` is redirected to `"mirror"` `(c d c b | a b c d | c b a b)` because torch does not support `"reflect"`. Note that torch backend does not support `"wrap"`.

interpolation Interpolation mode. Supported values: `"nearest"`, `"bilinear"`.

seed Integer. Used to create a random seed.

fill_value a float that represents the value to be filled outside the boundaries when `fill_mode="constant"`.

data_format string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

... Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`, or `(..., channels, target_height, target_width)`, in `"channels_first"` format.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Examples

```
input_img <- random_uniform(c(32, 224, 224, 3))
layer <- layer_random_zoom(height_factor = .5, width_factor = .2)
out_img <- layer(input_img)
```

See Also

- https://keras.io/api/layers/preprocessing_layers/image_augmentation/random_zoom#randomzoom-class

Other image augmentation layers:
`layer_random_brightness()`
`layer_random_contrast()`
`layer_random_crop()`
`layer_random_flip()`
`layer_random_rotation()`
`layer_random_translation()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`
`layer_hashed_crossing()`
`layer_hashing()`
`layer_integer_lookup()`
`layer_max_num_bounding_boxes()`
`layer_mel_spectrogram()`
`layer_mix_up()`
`layer_normalization()`
`layer_rand_augment()`
`layer_random_brightness()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_contrast()`
`layer_random_crop()`
`layer_random_erasing()`

layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()

layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()

layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()

layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_rand_augment *RandAugment performs the Rand Augment operation on input images.*

Description

This layer can be thought of as an all-in-one image augmentation layer. The policy implemented by this layer has been benchmarked extensively and is effective on a wide variety of datasets.

Usage

```
layer_rand_augment(
  object,
  value_range = list(0L, 255L),
  num_ops = 2L,
  factor = 0.5,
  interpolation = "bilinear",
  seed = NULL,
  data_format = NULL,
  ...
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
value_range	The range of values the input image can take. Default is `(0, 255)`. Typically, this would be `(0, 1)` for normalized images or `(0, 255)` for raw images.
num_ops	The number of augmentation operations to apply sequentially to each image. Default is 2.
factor	The strength of the augmentation as a normalized value between 0 and 1. Default is 0.5.
interpolation	The interpolation method to use for resizing operations. Options include `nearest`, `bilinear`. Default is `bilinear`.
seed	Integer. Used to create a random seed.
data_format	String, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.
...	For forward/backward compatability.

References

- RandAugment

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()
layer_solarization()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()

layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()

layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()

layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

`layer_repeat_vector` *Repeats the input n times.*

Description

Repeats the input n times.

Usage

```
layer_repeat_vector(object, n, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
n	Integer, repetition factor.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
x <- layer_input(shape = 32)
y <- layer_repeat_vector(x, n = 3)
shape(y)

## shape(NA, 3, 32)
```

Input Shape

2D tensor with shape (batch_size, features).

Output Shape

3D tensor with shape (batch_size, n, features).

See Also

- https://keras.io/api/layers/reshaping_layers/repeat_vector#repeatvector-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()

layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()

layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()

layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_rescaling — *A preprocessing layer which rescales input values to a new range.*

Description

This layer rescales every value of an input (often an image) by multiplying by `scale` and adding `offset`.

For instance:

1. To rescale an input in the `[0, 255]` range to be in the `[0, 1]` range, you would pass `scale=1./255`.
2. To rescale an input in the `[0, 255]` range to be in the `[-1, 1]` range, you would pass `scale=1./127.5, offset=-1`.

The rescaling is applied both during training and inference. Inputs can be of integer or floating point dtype, and by default the layer will output floats.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_rescaling(object, scale, offset = 0, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`scale`	Float, the scale to apply to the inputs.
`offset`	Float, the offset to apply to the inputs.
`...`	Base layer keyword arguments, such as `name` and `dtype`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

See Also

- https://keras.io/api/layers/preprocessing_layers/image_preprocessing/rescaling#rescaling-class

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_random_shear()`
`layer_resizing()`
`layer_solarization()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`
`layer_hashed_crossing()`
`layer_hashing()`

layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()

layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
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layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()

layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
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layer_random_erasing()
layer_random_flip()
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layer_random_invert()
layer_random_perspective()
layer_random_posterization()
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layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_reshape *Layer that reshapes inputs into the given shape.*

Description

Layer that reshapes inputs into the given shape.

Usage

```
layer_reshape(object, target_shape, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
target_shape	Target shape. List of integers, does not include the samples dimension (batch size).
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Input Shape

Arbitrary, although all dimensions in the input shape must be known/fixed. Use the keyword argument `input_shape` (list of integers, does not include the samples/batch size axis) when using this layer as the first layer in a model.

Output Shape

`(batch_size, *target_shape)`

Examples

```
x <- layer_input(shape = 12)
y <- layer_reshape(x, c(3, 4))
shape(y)

## shape(NA, 3, 4)


# also supports shape inference using `-1` as dimension
y <- layer_reshape(x, c(-1, 2, 2))
shape(y)

## shape(NA, 3, 2, 2)
```

See Also

- https://keras.io/api/layers/reshaping_layers/reshape#reshape-class

Other reshaping layers:
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_flatten()`
`layer_permute()`
`layer_repeat_vector()`
`layer_upsampling_1d()`
`layer_upsampling_2d()`
`layer_upsampling_3d()`
`layer_zero_padding_1d()`
`layer_zero_padding_2d()`
`layer_zero_padding_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`

layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()

layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()

layer_rescaling()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_resizing *A preprocessing layer which resizes images.*

Description

This layer resizes an image input to a target height and width. The input should be a 4D (batched) or 3D (unbatched) tensor in "channels_last" format. Input pixel values can be of any range (e.g. [0., 1.) or [0, 255]).

Usage

```
layer_resizing(
  object,
  height,
  width,
```

```
  interpolation = "bilinear",
  crop_to_aspect_ratio = FALSE,
  pad_to_aspect_ratio = FALSE,
  fill_mode = "constant",
  fill_value = 0,
  data_format = NULL,
  ...,
  antialias = FALSE
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
height	Integer, the height of the output shape.
width	Integer, the width of the output shape.
interpolation	String, the interpolation method. Supports "bilinear", "nearest", "bicubic", "lanczos3", "lanczos5". Defaults to "bilinear".
crop_to_aspect_ratio	If TRUE, resize the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be cropped so as to return the largest possible window in the image (of size (height, width)) that matches the target aspect ratio. By default (crop_to_aspect_ratio=FALSE), aspect ratio may not be preserved.
pad_to_aspect_ratio	If TRUE, pad the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be evenly padded on the short side.
fill_mode	When using pad_to_aspect_ratio=TRUE, padded areas are filled according to the given mode. Only "constant" is supported at this time (fill with constant value, equal to fill_value).
fill_value	Float. Padding value to use when pad_to_aspect_ratio=TRUE.
data_format	string, either "channels_last" or "channels_first". The ordering of the dimensions in the inputs. "channels_last" corresponds to inputs with shape (batch, height, width, channels) while "channels_first" corresponds to inputs with shape (batch, channels, height, width). It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
...	Base layer keyword arguments, such as name and dtype.
antialias	bool

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Input Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., height, width, channels)`, in `"channels_last"` format, or `(..., channels, height, width)`, in `"channels_first"` format.

Output Shape

3D (unbatched) or 4D (batched) tensor with shape: `(..., target_height, target_width, channels)`, or `(..., channels, target_height, target_width)`, in `"channels_first"` format.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

See Also

- https://keras.io/api/layers/preprocessing_layers/image_preprocessing/resizing#resizing-class

Other image preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_equalization()`
`layer_max_num_bounding_boxes()`
`layer_mix_up()`
`layer_rand_augment()`
`layer_random_color_degeneration()`
`layer_random_color_jitter()`
`layer_random_erasing()`
`layer_random_gaussian_blur()`
`layer_random_grayscale()`
`layer_random_hue()`
`layer_random_invert()`
`layer_random_perspective()`
`layer_random_posterization()`
`layer_random_saturation()`
`layer_random_sharpness()`
`layer_random_shear()`
`layer_rescaling()`
`layer_solarization()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`

layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()

layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()

layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()

layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_rms_normalization

Root Mean Square (RMS) Normalization layer.

Description

This layer normalizes the input tensor based on its RMS value.

The Keras layer performs the operation as described in Root Mean Square Layer Normalization by Biao Zhang et al.

If scale is enabled, the layer will scale the normalized outputs via a learnable scaling factor.

So, with scaling enabled, the normalization equations are as follows:

Let the intermediate activations for a mini-batch to be the inputs.

```
rms_normalization(x) = x * rsqrt(mean(square(x))) * scale
```

For example:

```
layer <- layer_rms_normalization()
layer$build(shape(5, 20, 30, 10))
op_shape(layer$scale$shape)
```

```
## shape(1)

op_shape(layer(op_array(runif(10))))
## shape(10)
```

Usage

```
layer_rms_normalization(object, axis = -1L, epsilon = 1e-06, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
axis	int. The axis on which to perform the normalization.
epsilon	float. A small number to add to avoid division by zero.
...	For forward/backward compatability.

See Also

Other normalization layers:
layer_batch_normalization()
layer_group_normalization()
layer_layer_normalization()
layer_spectral_normalization()
layer_unit_normalization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()

layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()

layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()

layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_rnn *Base class for recurrent layers*

Description

Base class for recurrent layers

Usage

```
layer_rnn(
  object,
  cell,
  return_sequences = FALSE,
  return_state = FALSE,
  go_backwards = FALSE,
  stateful = FALSE,
  unroll = FALSE,
  zero_output_for_mask = FALSE,
  ...
)
```

Arguments

object
: Object to compose the layer with. A tensor, array, or sequential model.

cell
: A RNN cell instance or a list of RNN cell instances. A RNN cell is a class that has:

  - A `call(input_at_t, states_at_t)` method, returning `(output_at_t, states_at_t_plus_1)`. The call method of the cell can also take the optional argument `constants`, see section "Note on passing external constants" below.

- A `state_size` attribute. This can be a single integer (single state) in which case it is the size of the recurrent state. This can also be a list of integers (one size per state).
- A `output_size` attribute, a single integer.
- A `get_initial_state(batch_size=NULL)` method that creates a tensor meant to be fed to `call()` as the initial state, if the user didn't specify any initial state via other means. The returned initial state should have shape `(batch_size, cell.state_size)`. The cell might choose to create a tensor full of zeros, or other values based on the cell's implementation. `inputs` is the input tensor to the RNN layer, with shape `(batch_size, timesteps, features)`. If this method is not implemented by the cell, the RNN layer will create a zero filled tensor with shape `(batch_size, cell$state_size)`. In the case that `cell` is a list of RNN cell instances, the cells will be stacked on top of each other in the RNN, resulting in an efficient stacked RNN.

`return_sequences`
: Boolean (default `FALSE`). Whether to return the last output in the output sequence, or the full sequence.

`return_state`
: Boolean (default `FALSE`). Whether to return the last state in addition to the output.

`go_backwards`
: Boolean (default `FALSE`). If `TRUE`, process the input sequence backwards and return the reversed sequence.

`stateful`
: Boolean (default `FALSE`). If TRUE, the last state for each sample at index `i` in a batch will be used as initial state for the sample of index `i` in the following batch.

`unroll`
: Boolean (default `FALSE`). If TRUE, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up a RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.

`zero_output_for_mask`
: Boolean (default `FALSE`). Whether the output should use zeros for the masked timesteps. Note that this field is only used when `return_sequences` is `TRUE` and `mask` is provided. It can useful if you want to reuse the raw output sequence of the RNN without interference from the masked timesteps, e.g., merging bidirectional RNNs.

`...`
: For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `sequences`: A 3-D tensor with shape `(batch_size, timesteps, features)`.
- `initial_state`: List of initial state tensors to be passed to the first call of the cell.
- `mask`: Binary tensor of shape `[batch_size, timesteps]` indicating whether a given timestep should be masked. An individual `TRUE` entry indicates that the corresponding timestep should be utilized, while a `FALSE` entry indicates that the corresponding timestep should be ignored.
- `training`: Python boolean indicating whether the layer should behave in training mode or in inference mode. This argument is passed to the cell when calling it. This is for use with cells that use dropout.

Input Shape

3-D tensor with shape `(batch_size, timesteps, features)`.

Output Shape

- If `return_state`: a list of tensors. The first tensor is the output. The remaining tensors are the last states, each with shape `(batch_size, state_size)`, where `state_size` could be a high dimension tensor shape.
- If `return_sequences`: 3D tensor with shape `(batch_size, timesteps, output_size)`.

Masking:

This layer supports masking for input data with a variable number of timesteps. To introduce masks to your data, use a `layer_embedding()` layer with the `mask_zero` parameter set to `TRUE`.

Note on using statefulness in RNNs:

You can set RNN layers to be 'stateful', which means that the states computed for the samples in one batch will be reused as initial states for the samples in the next batch. This assumes a one-to-one mapping between samples in different successive batches.

To enable statefulness:

- Specify `stateful=TRUE` in the layer constructor.
- Specify a fixed batch size for your model, by passing `batch_size=...` to the `layer_input()` layer(s) of your model. Remember to also specify the same `batch_size=...` when calling `fit()`, or otherwise use a generator-like data source like `tf.data.Dataset`.
- Specify `shuffle=FALSE` when calling `fit()`, since your batches are expected to be temporally ordered.

To reset the states of your model, call `reset_state()` on either a specific layer, or on your entire model.

Note on specifying the initial state of RNNs:

You can specify the initial state of RNN layers symbolically by passing a named argument `initial_state` to the layer or to `reset_state()`. The value of `initial_state` should be a tensor or list of tensors representing the initial state of the RNN layer.

Examples

First, let's define a RNN Cell, as a layer subclass.

```
rnn_cell_minimal <- Layer(
  "MinimalRNNCell",

  initialize = function(units, ...) {
    super$initialize(...)
    self$units <- as.integer(units)
    self$state_size <- as.integer(units)
  },

  build = function(input_shape) {
    self$kernel <- self$add_weight(
      shape = shape(tail(input_shape, 1), self$units),
      initializer = 'uniform',
      name = 'kernel'
    )
    self$recurrent_kernel <- self$add_weight(
      shape = shape(self$units, self$units),
      initializer = 'uniform',
      name = 'recurrent_kernel'
    )
    self$built <- TRUE
  },

  call = function(inputs, states) {
    prev_output <- states[[1]]
    h <- op_matmul(inputs, self$kernel)
    output <- h + op_matmul(prev_output, self$recurrent_kernel)
    list(output, list(output))
  }
)
```

Let's use this cell in a RNN layer:

```
cell <- rnn_cell_minimal(units = 32)
x <- layer_input(shape = shape(NULL, 5))
layer <- layer_rnn(cell = cell)
y <- layer(x)
```

```
cells <- list(rnn_cell_minimal(units = 32), rnn_cell_minimal(units = 4))
x <- layer_input(shape = shape(NULL, 5))
layer <- layer_rnn(cell = cells)
y <- layer(x)
```

See Also

- https://keras.io/api/layers/recurrent_layers/rnn#rnn-class

Other rnn cells:
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_separable_conv_1d

1D separable convolution layer.

Description

This layer performs a depthwise convolution that acts separately on channels, followed by a pointwise convolution that mixes channels. If `use_bias` is TRUE and a bias initializer is provided, it adds a bias vector to the output. It then optionally applies an activation function to produce the final output.

Usage

```
layer_separable_conv_1d(
  object,
  filters,
  kernel_size,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L,
  depth_multiplier = 1L,
  activation = NULL,
  use_bias = TRUE,
  depthwise_initializer = "glorot_uniform",
  pointwise_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  depthwise_regularizer = NULL,
  pointwise_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  depthwise_constraint = NULL,
  pointwise_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

- `object` Object to compose the layer with. A tensor, array, or sequential model.
- `filters` int, the dimensionality of the output space (i.e. the number of filters in the pointwise convolution).
- `kernel_size` int or list of 1 integers, specifying the size of the depthwise convolution window.
- `strides` int or list of 1 integers, specifying the stride length of the depthwise convolution. If only one int is specified, the same stride size will be used for all dimensions. `strides` > 1 is incompatible with `dilation_rate` > 1.
- `padding` string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.
- `data_format` string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, steps, features)` while `"channels_first"` corresponds to inputs with shape `(batch, features, steps)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
- `dilation_rate` int or list of 1 integers, specifying the dilation rate to use for dilated convolution. If only one int is specified, the same dilation rate will be used for all dimensions.
- `depth_multiplier` The number of depthwise convolution output channels for each input channel. The total number of depthwise convolution output channels will be equal to `input_channel * depth_multiplier`.
- `activation` Activation function. If `NULL`, no activation is applied.
- `use_bias` bool, if `TRUE`, bias will be added to the output.
- `depthwise_initializer` An initializer for the depthwise convolution kernel. If NULL, then the default initializer (`"glorot_uniform"`) will be used.
- `pointwise_initializer` An initializer for the pointwise convolution kernel. If NULL, then the default initializer (`"glorot_uniform"`) will be used.
- `bias_initializer` An initializer for the bias vector. If NULL, the default initializer ('"zeros"') will be used.
- `depthwise_regularizer` Optional regularizer for the depthwise convolution kernel.
- `pointwise_regularizer` Optional regularizer for the pointwise convolution kernel.
- `bias_regularizer` Optional regularizer for the bias vector.
- `activity_regularizer` Optional regularizer function for the output.

`depthwise_constraint`
: Optional projection function to be applied to the depthwise kernel after being updated by an `Optimizer` (e.g. used for norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape).

`pointwise_constraint`
: Optional projection function to be applied to the pointwise kernel after being updated by an `Optimizer`.

`bias_constraint`
: Optional projection function to be applied to the bias after being updated by an `Optimizer`.

`...`
: For forward/backward compatability.

Value

A 3D tensor representing `activation(separable_conv1d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, steps, channels)`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, channels, steps)`

Output Shape

- If `data_format="channels_last"`: A 3D tensor with shape: `(batch_shape, new_steps, filters)`
- If `data_format="channels_first"`: A 3D tensor with shape: `(batch_shape, filters, new_steps)`

Example

```
x <- random_uniform(c(4, 10, 12))
y <- layer_separable_conv_1d(x, 3, 2, 2, activation='relu')
shape(y)

## shape(4, 5, 3)
```

See Also

- https://keras.io/api/layers/convolution_layers/separable_convolution1d#separableconv1d-class

Other convolutional layers:
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d()`
`layer_conv_2d_transpose()`
`layer_conv_3d()`
`layer_conv_3d_transpose()`
`layer_depthwise_conv_1d()`
`layer_depthwise_conv_2d()`

layer_separable_conv_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_separable_conv_2d

2D separable convolution layer.

Description

This layer performs a depthwise convolution that acts separately on channels, followed by a pointwise convolution that mixes channels. If use_bias is TRUE and a bias initializer is provided, it adds a bias vector to the output. It then optionally applies an activation function to produce the final output.

Usage

```
layer_separable_conv_2d(
  object,
  filters,
  kernel_size,
  strides = list(1L, 1L),
  padding = "valid",
  data_format = NULL,
  dilation_rate = list(1L, 1L),
  depth_multiplier = 1L,
  activation = NULL,
  use_bias = TRUE,
  depthwise_initializer = "glorot_uniform",
  pointwise_initializer = "glorot_uniform",
  bias_initializer = "zeros",
  depthwise_regularizer = NULL,
  pointwise_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  depthwise_constraint = NULL,
  pointwise_constraint = NULL,
  bias_constraint = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filters`	int, the dimensionality of the output space (i.e. the number of filters in the pointwise convolution).
`kernel_size`	int or list of 2 integers, specifying the size of the depthwise convolution window.
`strides`	int or list of 2 integers, specifying the stride length of the depthwise convolution. If only one int is specified, the same stride size will be used for all dimensions. `strides` > 1 is incompatible with `dilation_rate` > 1.
`padding`	string, either `"valid"` or `"same"` (case-insensitive). `"valid"` means no padding. `"same"` results in padding evenly to the left/right or up/down of the input. When `padding="same"` and `strides=1`, the output has the same size as the input.
`data_format`	string, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.

dilation_rate — int or list of 2 integers, specifying the dilation rate to use for dilated convolution. If only one int is specified, the same dilation rate will be used for all dimensions.

depth_multiplier — The number of depthwise convolution output channels for each input channel. The total number of depthwise convolution output channels will be equal to `input_channel * depth_multiplier`.

activation — Activation function. If `NULL`, no activation is applied.

use_bias — bool, if `TRUE`, bias will be added to the output.

depthwise_initializer — An initializer for the depthwise convolution kernel. If NULL, then the default initializer (`"glorot_uniform"`) will be used.

pointwise_initializer — An initializer for the pointwise convolution kernel. If NULL, then the default initializer (`"glorot_uniform"`) will be used.

bias_initializer — An initializer for the bias vector. If NULL, the default initializer ('"zeros"') will be used.

depthwise_regularizer — Optional regularizer for the depthwise convolution kernel.

pointwise_regularizer — Optional regularizer for the pointwise convolution kernel.

bias_regularizer — Optional regularizer for the bias vector.

activity_regularizer — Optional regularizer function for the output.

depthwise_constraint — Optional projection function to be applied to the depthwise kernel after being updated by an `Optimizer` (e.g. used for norm constraints or value constraints for layer weights). The function must take as input the unprojected variable and must return the projected variable (which must have the same shape).

pointwise_constraint — Optional projection function to be applied to the pointwise kernel after being updated by an `Optimizer`.

bias_constraint — Optional projection function to be applied to the bias after being updated by an `Optimizer`.

... — For forward/backward compatability.

Value

A 4D tensor representing `activation(separable_conv2d(inputs, kernel) + bias)`.

Input Shape

- If `data_format="channels_last"`: A 4D tensor with shape: `(batch_size, height, width, channels)`
- If `data_format="channels_first"`: A 4D tensor with shape: `(batch_size, channels, height, width)`

Output Shape

- If data_format="channels_last": A 4D tensor with shape: (batch_size, new_height, new_width, filters)
- If data_format="channels_first": A 4D tensor with shape: (batch_size, filters, new_height, new_width)

Example

```
x <- random_uniform(c(4, 10, 10, 12))
y <- layer_separable_conv_2d(x, 3, c(4, 3), 2, activation='relu')
shape(y)

## shape(4, 4, 4, 3)
```

See Also

- https://keras.io/api/layers/convolution_layers/separable_convolution2d#separableconv2d-class

Other convolutional layers:
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_separable_conv_1d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()

layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()

layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()

layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_simple_rnn *Fully-connected RNN where the output is to be fed back as the new input.*

Description

Fully-connected RNN where the output is to be fed back as the new input.

Usage

```
layer_simple_rnn(
  object,
  units,
  activation = "tanh",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  activity_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  return_sequences = FALSE,
  return_state = FALSE,
```

```
  go_backwards = FALSE,
  stateful = FALSE,
  unroll = FALSE,
  seed = NULL,
  ...
)
```

Arguments

- `object` Object to compose the layer with. A tensor, array, or sequential model.
- `units` Positive integer, dimensionality of the output space.
- `activation` Activation function to use. Default: hyperbolic tangent (`tanh`). If you pass NULL, no activation is applied (ie. "linear" activation: `a(x) = x`).
- `use_bias` Boolean, (default `TRUE`), whether the layer uses a bias vector.
- `kernel_initializer` Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs. Default: `"glorot_uniform"`.
- `recurrent_initializer` Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state. Default: `"orthogonal"`.
- `bias_initializer` Initializer for the bias vector. Default: `"zeros"`.
- `kernel_regularizer` Regularizer function applied to the `kernel` weights matrix. Default: `NULL`.
- `recurrent_regularizer` Regularizer function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.
- `bias_regularizer` Regularizer function applied to the bias vector. Default: `NULL`.
- `activity_regularizer` Regularizer function applied to the output of the layer (its "activation"). Default: `NULL`.
- `kernel_constraint` Constraint function applied to the `kernel` weights matrix. Default: `NULL`.
- `recurrent_constraint` Constraint function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.
- `bias_constraint` Constraint function applied to the bias vector. Default: `NULL`.
- `dropout` Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.
- `recurrent_dropout` Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.
- `return_sequences` Boolean. Whether to return the last output in the output sequence, or the full sequence. Default: `FALSE`.

return_state	Boolean. Whether to return the last state in addition to the output. Default: FALSE.
go_backwards	Boolean (default: FALSE). If TRUE, process the input sequence backwards and return the reversed sequence.
stateful	Boolean (default: FALSE). If TRUE, the last state for each sample at index i in a batch will be used as the initial state for the sample of index i in the following batch.
unroll	Boolean (default: FALSE). If TRUE, the network will be unrolled, else a symbolic loop will be used. Unrolling can speed-up an RNN, although it tends to be more memory-intensive. Unrolling is only suitable for short sequences.
seed	Initial seed for the random number generator
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `sequence`: A 3D tensor, with shape `[batch, timesteps, feature]`.
- `mask`: Binary tensor of shape `[batch, timesteps]` indicating whether a given timestep should be masked. An individual `TRUE` entry indicates that the corresponding timestep should be utilized, while a `FALSE` entry indicates that the corresponding timestep should be ignored.
- `training`: Python boolean indicating whether the layer should behave in training mode or in inference mode. This argument is passed to the cell when calling it. This is only relevant if `dropout` or `recurrent_dropout` is used.
- `initial_state`: List of initial state tensors to be passed to the first call of the cell.

Examples

```
inputs <- random_uniform(c(32, 10, 8))
simple_rnn <- layer_simple_rnn(units = 4)
output <- simple_rnn(inputs)  # The output has shape `(32, 4)`.
simple_rnn <- layer_simple_rnn(
    units = 4, return_sequences=TRUE, return_state=TRUE
)
# whole_sequence_output has shape `(32, 10, 4)`.
# final_state has shape `(32, 4)`.
c(whole_sequence_output, final_state) %<-% simple_rnn(inputs)
```

See Also

- https://keras.io/api/layers/recurrent_layers/simple_rnn#simplernn-class

Other simple rnn layers:
rnn_cell_simple()

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()

layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()

layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()

layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_solarization *Applies* (max_value - pixel + min_value) *for each pixel in the image.*

Description

When created without threshold parameter, the layer performs solarization to all values. When created with specified threshold the layer only augments pixels that are above the threshold value.

Usage

```
layer_solarization(
  object,
  addition_factor = 0,
  threshold_factor = 0,
  value_range = tuple(0L, 255L),
  seed = NULL,
  ...
)
```

Arguments

object Object to compose the layer with. A tensor, array, or sequential model.

addition_factor (Optional) A tuple of two floats or a single float, between 0 and 1. For each augmented image a value is sampled from the provided range. If a float is passed, the range is interpreted as (0, addition_factor). If specified, this value (times the value range of input images, e.g. 255), is added to each pixel before solarization and thresholding. Defaults to 0.0.

threshold_factor (Optional) A tuple of two floats or a single float. For each augmented image a value is sampled from the provided range. If a float is passed, the range is interpreted as (0, threshold_factor). If specified, only pixel values above this threshold will be solarized.

value_range	a tuple or a list of two elements. The first value represents the lower bound for values in input images, the second represents the upper bound. Images passed to the layer should have values within value_range. Typical values to pass are (0, 255) (RGB image) or (0., 1.) (scaled image).
seed	Integer. Used to create a random seed.
...	Base layer keyword arguments, such as name and dtype.

Examples

```
c(c(images, labels), .) %<-% dataset_cifar10()
str(images)

## int [1:50000, 1:32, 1:32, 1:3] 59 154 255 28 170 159 164 28 134 125 ...


str(images[1, 1, 1, ])

## int [1:3] 59 62 63


# Note that images are Tensor with values in the range [0, 255]
solarization <- layer_solarization(value_range = c(0, 255))
images <- solarization(images) |> as.array()
str(images[1, 1, 1, ])

## num [1:3] 196 193 192
```

See Also

Other image preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_center_crop()
layer_cut_mix()
layer_equalization()
layer_max_num_bounding_boxes()
layer_mix_up()
layer_rand_augment()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_erasing()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_rescaling()
layer_resizing()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_stft_spectrogram()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()

layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
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layer_random_crop()
layer_random_erasing()
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layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_spatial_dropout_1d

Spatial 1D version of Dropout.

Description

This layer performs the same function as Dropout, however, it drops entire 1D feature maps instead of individual elements. If adjacent frames within feature maps are strongly correlated (as is normally the case in early convolution layers) then regular dropout will not regularize the activations and will otherwise just result in an effective learning rate decrease. In this case, `SpatialDropout1D` will help promote independence between feature maps and should be used instead.

Usage

```
layer_spatial_dropout_1d(object, rate, seed = NULL, name = NULL, dtype = NULL)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`rate`	Float between 0 and 1. Fraction of the input units to drop.
`seed`	Initial seed for the random number generator
`name`	String, name for the object
`dtype`	datatype (e.g., `"float32"`).

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 3D tensor.
- `training`: Python boolean indicating whether the layer should behave in training mode (applying dropout) or in inference mode (pass-through).

Input Shape

3D tensor with shape: `(samples, timesteps, channels)`

Output Shape

Same as input.

Reference

- Tompson et al., 2014

See Also

- https://keras.io/api/layers/regularization_layers/spatial_dropout1d#spatialdropout1d-class

Other spatial dropout regularization layers:
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

Other regularization layers:
layer_activity_regularization()
layer_alpha_dropout()
layer_dropout()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()

layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()

layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_spatial_dropout_2d

Spatial 2D version of Dropout.

Description

This version performs the same function as Dropout, however, it drops entire 2D feature maps instead of individual elements. If adjacent pixels within feature maps are strongly correlated (as is normally the case in early convolution layers) then regular dropout will not regularize the activations and will otherwise just result in an effective learning rate decrease. In this case, `SpatialDropout2D` will help promote independence between feature maps and should be used instead.

Usage

```
layer_spatial_dropout_2d(
  object,
  rate,
  data_format = NULL,
  seed = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`rate`	Float between 0 and 1. Fraction of the input units to drop.
`data_format`	`"channels_first"` or `"channels_last"`. In `"channels_first"` mode, the channels dimension (the depth) is at index 1, in `"channels_last"` mode is it at index 3. It defaults to the `image_data_format` value found in your Keras config file at `~/.keras/keras.json`. If you never set it, then it will be `"channels_last"`.
`seed`	Initial seed for the random number generator
`name`	String, name for the object
`dtype`	datatype (e.g., `"float32"`).

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: A 4D tensor.
- `training`: Python boolean indicating whether the layer should behave in training mode (applying dropout) or in inference mode (pass-through).

Input Shape

4D tensor with shape: `(samples, channels, rows, cols)` if data_format='channels_first' or 4D tensor with shape: `(samples, rows, cols, channels)` if data_format='channels_last'.

Output Shape

Same as input.

Reference

- Tompson et al., 2014

See Also

- https://keras.io/api/layers/regularization_layers/spatial_dropout2d#spatialdropout2d-class

Other spatial dropout regularization layers:
`layer_spatial_dropout_1d()`
`layer_spatial_dropout_3d()`

Other regularization layers:
`layer_activity_regularization()`
`layer_alpha_dropout()`
`layer_dropout()`
`layer_gaussian_dropout()`
`layer_gaussian_noise()`
`layer_spatial_dropout_1d()`
`layer_spatial_dropout_3d()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`

layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()

layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()

layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_spatial_dropout_3d

Spatial 3D version of Dropout.

Description

This version performs the same function as Dropout, however, it drops entire 3D feature maps instead of individual elements. If adjacent voxels within feature maps are strongly correlated (as is normally the case in early convolution layers) then regular dropout will not regularize the activations and will otherwise just result in an effective learning rate decrease. In this case, SpatialDropout3D will help promote independence between feature maps and should be used instead.

Usage

```
layer_spatial_dropout_3d(
  object,
  rate,
  data_format = NULL,
  seed = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
rate	Float between 0 and 1. Fraction of the input units to drop.
data_format	"channels_first" or "channels_last". In "channels_first" mode, the channels dimension (the depth) is at index 1, in "channels_last" mode is it at index 4. It defaults to the image_data_format value found in your Keras config file at ~/.keras/keras.json. If you never set it, then it will be "channels_last".
seed	Initial seed for the random number generator
name	String, name for the object
dtype	datatype (e.g., "float32").

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Call Arguments

- inputs: A 5D tensor.
- training: Python boolean indicating whether the layer should behave in training mode (applying dropout) or in inference mode (pass-through).

Input Shape

5D tensor with shape: (samples, channels, dim1, dim2, dim3) if data_format='channels_first' or 5D tensor with shape: (samples, dim1, dim2, dim3, channels) if data_format='channels_last'.

Output Shape

Same as input.

Reference

- Tompson et al., 2014

See Also

- https://keras.io/api/layers/regularization_layers/spatial_dropout3d#spatialdropout3d-class

Other spatial dropout regularization layers:
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

Other regularization layers:
layer_activity_regularization()
layer_alpha_dropout()
layer_dropout()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()

layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()

layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()

layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_spectral_normalization
Performs spectral normalization on the weights of a target layer.

Description

This wrapper controls the Lipschitz constant of the weights of a layer by constraining their spectral norm, which can stabilize the training of GANs.

Usage

```
layer_spectral_normalization(object, layer, power_iterations = 1L, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`layer`	A `Layer` instance that has either a `kernel` (e.g. `layer_conv_2d`, `layer_dense`...) or an `embeddings` attribute (`layer_embedding` layer).
`power_iterations`	int, the number of iterations during normalization.
`...`	Base wrapper keyword arguments.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Wrap layer_conv_2d:

```
x <- random_uniform(c(1, 10, 10, 1))
conv2d <- layer_spectral_normalization(
  layer = layer_conv_2d(filters = 2, kernel_size = 2)
)
y <- conv2d(x)
shape(y)

## shape(1, 9, 9, 2)
```

Wrap layer_dense:

```
x <- random_uniform(c(1, 10, 10, 1))
dense <- layer_spectral_normalization(layer = layer_dense(units = 10))
y <- dense(x)
shape(y)

## shape(1, 10, 10, 10)
```

Reference

- Spectral Normalization for GAN.

See Also

Other normalization layers:
layer_batch_normalization()
layer_group_normalization()
layer_layer_normalization()
layer_rms_normalization()
layer_unit_normalization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()

layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
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layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
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layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
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layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()

layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
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layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()

layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
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layer_tfsm()
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layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_stft_spectrogram   *Layer to compute the Short-Time Fourier Transform (STFT) on a 1D signal.*

Description

A layer that computes Spectrograms of the input signal to produce a spectrogram. This layers by The layer computes Spectrograms based on Short-Time Fourier Transform (STFT) by utilizing convolution kernels, which allows parallelization on GPUs and trainable kernels for fine-tuning support. This layer allows different modes of output (e.g., log-scaled magnitude, phase, power spectral density, etc.) and provides flexibility in windowing, padding, and scaling options for the STFT calculation.

Usage

```
layer_stft_spectrogram(
  object,
  mode = "log",
  frame_length = 256L,
  frame_step = NULL,
```

```
  fft_length = NULL,
  window = "hann",
  periodic = FALSE,
  scaling = "density",
  padding = "valid",
  expand_dims = FALSE,
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`mode`	String, the output type of the spectrogram. Can be one of `"log"`, `"magnitude"`, `"psd"`, `"real"`, `"imag"`, `"angle"`, `"stft"`. Defaults to `"log"`.
`frame_length`	Integer, The length of each frame (window) for STFT in samples. Defaults to `256`.
`frame_step`	Integer, the step size (hop length) between consecutive frames. If not provided, defaults to half the frame_length. Defaults to `frame_length %/% 2`.
`fft_length`	Integer, the size of frequency bins used in the Fast-Fourier Transform (FFT) to apply to each frame. Should be greater than or equal to `frame_length`. Recommended to be a power of two. Defaults to the smallest power of two that is greater than or equal to `frame_length`.
`window`	(String or array_like), the windowing function to apply to each frame. Can be `"hann"` (default), `"hamming"`, or a custom window provided as an array_like.
`periodic`	Boolean, if `TRUE`, the window function will be treated as periodic. Defaults to `FALSE`.
`scaling`	String, type of scaling applied to the window. Can be `"density"`, `"spectrum"`, or None. Default is `"density"`.
`padding`	String, padding strategy. Can be `"valid"` or `"same"`. Defaults to `"valid"`.
`expand_dims`	Boolean, if `TRUE`, will expand the output into spectrograms into two dimensions to be compatible with image models. Defaults to `FALSE`.
`data_format`	String, either `"channels_last"` or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, weight)`. Defaults to `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Apply it as a non-trainable preprocessing layer on 3 audio tracks of 1 channel, 10 seconds and sampled at 16 kHz.

```
layer <- layer_stft_spectrogram(
  mode = 'log',
  frame_length = 256,
  frame_step = 128, # 50% overlap
  fft_length = 512,
  window = "hann",
  padding = "valid",
  trainable = FALSE # non-trainable, preprocessing only)
)
random_uniform(shape=c(3, 160000, 1)) |> layer() |> op_shape()

## shape(3, 1249, 257)
```

Apply it as a trainable processing layer on 3 stereo audio tracks of 2 channels, 10 seconds and sampled at 16 kHz. This is initialized as the non-trainable layer, but then can be trained jointly within a model.

```
layer <- layer_stft_spectrogram(
  mode = 'log',
  frame_length = 256,
  frame_step = 128,   # 50% overlap
  fft_length = 512,
  window = "hamming", # hamming windowing function
  padding = "same",   # padding to preserve the time dimension
  trainable = TRUE,   # trainable, this is the default in keras
)
random_uniform(shape=c(3, 160000, 2)) |> layer() |> op_shape()

## shape(3, 1250, 514)
```

Similar to the last example, but add an extra dimension so the output is an image to be used with image models. We apply this here on a signal of 3 input channels to output an image tensor, hence is directly applicable with an image model.

```
layer <- layer_stft_spectrogram(
  mode = 'log',
  frame_length = 256,
  frame_step = 128,
  fft_length = 512,
  padding = "same",
  expand_dims = TRUE  # this adds the extra dimension
)
random_uniform(shape=c(3, 160000, 3)) |> layer() |> op_shape()
```

```
## shape(3, 1250, 257, 3)
```

Raises

ValueError: If an invalid value is provided for "mode", "scaling", "padding", or other input arguments. TypeError: If the input data type is not one of "float16", "float32", or "float64".

Input Shape

A 3D tensor of shape (batch_size, time_length, input_channels), if data_format=="channels_last", and of shape (batch_size, input_channels, time_length) if data_format=="channels_first", where time_length is the length of the input signal, and input_channels is the number of input channels. The same kernels are applied to each channel independently.

Output Shape

If data_format=="channels_first" && !expand_dims, a 3D tensor: (batch_size, input_channels * freq_channels,
If data_format=="channels_last" && !expand_dims, a 3D tensor: (batch_size, new_time_length, input_channels
If data_format=="channels_first" && expand_dims, a 4D tensor: (batch_size, input_channels, new_time_length
If data_format=="channels_last" && expand_dims, a 4D tensor: (batch_size, new_time_length, freq_channels, i

where new_time_length depends on the padding, and freq_channels is the number of FFT bins (fft_length %/% 2 + 1).

See Also

Other audio preprocessing layers:
layer_mel_spectrogram()

Other preprocessing layers:
layer_aug_mix()
layer_auto_contrast()
layer_category_encoding()
layer_center_crop()
layer_cut_mix()
layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()

layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_string_lookup()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_string_lookup *A preprocessing layer that maps strings to (possibly encoded) indices.*

Description

This layer translates a set of arbitrary strings into integer output via a table-based vocabulary lookup. This layer will perform no splitting or transformation of input strings. For a layer that can split and tokenize natural language, see `layer_text_vectorization`.

The vocabulary for the layer must be either supplied on construction or learned via `adapt()`. During `adapt()`, the layer will analyze a data set, determine the frequency of individual strings tokens, and create a vocabulary from them. If the vocabulary is capped in size, the most frequent tokens will be used to create the vocabulary and all others will be treated as out-of-vocabulary (OOV).

There are two possible output modes for the layer. When `output_mode` is `"int"`, input strings are converted to their (0-based) index in the vocabulary (an integer). When `output_mode` is `"multi_hot"`, `"count"`, or `"tf_idf"`, input strings are encoded into an array where each dimension corresponds to an element in the vocabulary.

The vocabulary can optionally contain a mask token as well as an OOV token (which can optionally occupy multiple indices in the vocabulary, as set by `num_oov_indices`). The position of these tokens in the vocabulary is fixed. When `output_mode` is `"int"`, the vocabulary will begin with the mask token (if set), followed by OOV indices, followed by the rest of the vocabulary. When `output_mode` is `"multi_hot"`, `"count"`, or `"tf_idf"` the vocabulary will begin with OOV indices and instances of the mask token will be dropped.

Note: This layer uses TensorFlow internally. It cannot be used as part of the compiled computation graph of a model with any backend other than TensorFlow. It can however be used with any backend when running eagerly. It can also always be used as part of an input preprocessing pipeline with any backend (outside the model itself), which is how we recommend to use this layer.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Note: If working with layer outputs directly (e.g., not passing outputs to another layer, but using them in lower-level operations like `[` and `op_*`): the returned indices are 0-based. However, with default settings, the first (`0`) index is the OOV token, so the returned indices are offset by `1` and may appear to be 1-based.

Usage

```
layer_string_lookup(
  object,
  max_tokens = NULL,
  num_oov_indices = 1L,
  mask_token = NULL,
  oov_token = "[UNK]",
  vocabulary = NULL,
  idf_weights = NULL,
  invert = FALSE,
  output_mode = "int",
  pad_to_max_tokens = FALSE,
  sparse = FALSE,
  encoding = "utf-8",
  name = NULL,
  ...,
  vocabulary_dtype = NULL
)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`max_tokens` Maximum size of the vocabulary for this layer. This should only be specified when adapting the vocabulary or when setting `pad_to_max_tokens=TRUE`. If NULL, there is no cap on the size of the vocabulary. Note that this size includes the OOV and mask tokens. Defaults to `NULL`.

`num_oov_indices` The number of out-of-vocabulary tokens to use. If this value is more than 1, OOV inputs are modulated to determine their OOV value. If this value is 0, OOV inputs will cause an error when calling the layer. Defaults to `1`.

`mask_token` A token that represents masked inputs. When `output_mode` is `"int"`, the token is included in vocabulary and mapped to index 0. In other output modes, the token will not appear in the vocabulary and instances of the mask token in the input will be dropped. If set to `NULL`, no mask term will be added. Defaults to `NULL`.

`oov_token` Only used when `invert` is TRUE. The token to return for OOV indices. Defaults to `"[UNK]"`.

`vocabulary` Optional. Either an array of integers or a string path to a text file. If passing an array, can pass a list, list, 1D NumPy array, or 1D tensor containing the integer vocabulary terms. If passing a file path, the file should contain one line per term in the vocabulary. If this argument is set, there is no need to `adapt()` the layer.

`idf_weights` Only valid when `output_mode` is `"tf_idf"`. A list, list, 1D NumPy array, or 1D tensor or the same length as the vocabulary, containing the floating point inverse document frequency weights, which will be multiplied by per sample term counts for the final TF-IDF weight. If the `vocabulary` argument is set, and `output_mode` is `"tf_idf"`, this argument must be supplied.

invert
: Only valid when `output_mode` is `"int"`. If `TRUE`, this layer will map indices to vocabulary items instead of mapping vocabulary items to indices. Defaults to `FALSE`.

output_mode
: Specification for the output of the layer. Values can be `"int"`, `"one_hot"`, `"multi_hot"`, `"count"`, or `"tf_idf"` configuring the layer as follows:

  - `"int"`: Return the vocabulary indices of the input tokens.
  - `"one_hot"`: Encodes each individual element in the input into an array the same size as the vocabulary, containing a 1 at the element index. If the last dimension is size 1, will encode on that dimension. If the last dimension is not size 1, will append a new dimension for the encoded output.
  - `"multi_hot"`: Encodes each sample in the input into a single array the same size as the vocabulary, containing a 1 for each vocabulary term present in the sample. Treats the last dimension as the sample dimension, if input shape is `(..., sample_length)`, output shape will be `(..., num_tokens)`.
  - `"count"`: As `"multi_hot"`, but the int array contains a count of the number of times the token at that index appeared in the sample.
  - `"tf_idf"`: As `"multi_hot"`, but the TF-IDF algorithm is applied to find the value in each token slot. For `"int"` output, any shape of input and output is supported. For all other output modes, currently only output up to rank 2 is supported. Defaults to `"int"`.

pad_to_max_tokens
: Only applicable when `output_mode` is `"multi_hot"`, `"count"`, or `"tf_idf"`. If `TRUE`, the output will have its feature axis padded to `max_tokens` even if the number of unique tokens in the vocabulary is less than `max_tokens`, resulting in a tensor of shape `(batch_size, max_tokens)` regardless of vocabulary size. Defaults to `FALSE`.

sparse
: Boolean. Only applicable to `"multi_hot"`, `"count"`, and `"tf_idf"` output modes. Only supported with TensorFlow backend. If `TRUE`, returns a `SparseTensor` instead of a dense `Tensor`. Defaults to `FALSE`.

encoding
: Optional. The text encoding to use to interpret the input strings. Defaults to `"utf-8"`.

name
: String, name for the object

...
: For forward/backward compatability.

vocabulary_dtype
: The dtype of the vocabulary terms, for example `"int64"` or `"int32"`. Defaults to `"int64"`.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

Creating a lookup layer with a known vocabulary

This example creates a lookup layer with a pre-existing vocabulary.

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c("a", "c", "d"), c("d", "z", "b"))
layer <- layer_string_lookup(vocabulary=vocab)
layer(data)

## tf.Tensor(
## [[1 3 4]
##  [4 0 2]], shape=(2, 3), dtype=int64)
```

Creating a lookup layer with an adapted vocabulary

This example creates a lookup layer and generates the vocabulary by analyzing the dataset.

```
data <- rbind(c("a", "c", "d"), c("d", "z", "b"))
layer <- layer_string_lookup()
layer %>% adapt(data)
get_vocabulary(layer)

## [1] "[UNK]" "d"     "z"     "c"     "b"     "a"
```

Note that the OOV token `"[UNK]"` has been added to the vocabulary. The remaining tokens are sorted by frequency (`"d"`, which has 2 occurrences, is first) then by inverse sort order.

```
data <- rbind(c("a", "c", "d"), c("d", "z", "b"))
layer <- layer_string_lookup()
layer %>% adapt(data)
layer(data)

## tf.Tensor(
## [[5 3 1]
##  [1 2 4]], shape=(2, 3), dtype=int64)
```

Lookups with multiple OOV indices

This example demonstrates how to use a lookup layer with multiple OOV indices. When a layer is created with more than one OOV index, any OOV values are hashed into the number of OOV buckets, distributing OOV values in a deterministic fashion across the set.

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c("a", "c", "d"), c("m", "z", "b"))
layer <- layer_string_lookup(vocabulary = vocab, num_oov_indices = 2)
layer(data)
```

```
## tf.Tensor(
## [[2 4 5]
##  [0 1 3]], shape=(2, 3), dtype=int64)
```

Note that the output for OOV value 'm' is 0, while the output for OOV value "z" is 1. The in-vocab terms have their output index increased by 1 from earlier examples (a maps to 2, etc) in order to make space for the extra OOV value.

One-hot output

Configure the layer with output_mode='one_hot'. Note that the first num_oov_indices dimensions in the ont_hot encoding represent OOV values.

```
vocab <- c("a", "b", "c", "d")
data <- c("a", "b", "c", "d", "z")
layer <- layer_string_lookup(vocabulary = vocab, output_mode = 'one_hot')
layer(data)

## tf.Tensor(
## [[0 1 0 0 0]
##  [0 0 1 0 0]
##  [0 0 0 1 0]
##  [0 0 0 0 1]
##  [1 0 0 0 0]], shape=(5, 5), dtype=int64)
```

Multi-hot output

Configure the layer with output_mode='multi_hot'. Note that the first num_oov_indices dimensions in the multi_hot encoding represent OOV values.

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c("a", "c", "d", "d"), c("d", "z", "b", "z"))
layer <- layer_string_lookup(vocabulary = vocab, output_mode = 'multi_hot')
layer(data)

## tf.Tensor(
## [[0 1 0 1 1]
##  [1 0 1 0 1]], shape=(2, 5), dtype=int64)
```

Token count output

Configure the layer with output_mode='count'. As with multi_hot output, the first num_oov_indices dimensions in the output represent OOV values.

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c("a", "c", "d", "d"), c("d", "z", "b", "z"))
layer <- layer_string_lookup(vocabulary = vocab, output_mode = 'count')
layer(data)
```

```
## tf.Tensor(
## [[0 1 0 1 2]
##  [2 0 1 0 1]], shape=(2, 5), dtype=int64)
```

TF-IDF output

Configure the layer with `output_mode="tf_idf"`. As with multi_hot output, the first `num_oov_indices` dimensions in the output represent OOV values.

Each token bin will output `token_count * idf_weight`, where the idf weights are the inverse document frequency weights per token. These should be provided along with the vocabulary. Note that the `idf_weight` for OOV values will default to the average of all idf weights passed in.

```
vocab <- c("a", "b", "c", "d")
idf_weights <- c(0.25, 0.75, 0.6, 0.4)
data <- rbind(c("a", "c", "d", "d"), c("d", "z", "b", "z"))
layer <- layer_string_lookup(output_mode = "tf_idf")
layer %>% set_vocabulary(vocab, idf_weights=idf_weights)
layer(data)
```

```
## tf.Tensor(
## [[0.   0.25 0.   0.6  0.8 ]
##  [1.   0.   0.75 0.   0.4 ]], shape=(2, 5), dtype=float32)
```

To specify the idf weights for oov values, you will need to pass the entire vocabulary including the leading oov token.

```
vocab <- c("[UNK]", "a", "b", "c", "d")
idf_weights <- c(0.9, 0.25, 0.75, 0.6, 0.4)
data <- rbind(c("a", "c", "d", "d"), c("d", "z", "b", "z"))
layer <- layer_string_lookup(output_mode = "tf_idf")
layer %>% set_vocabulary(vocab, idf_weights=idf_weights)
layer(data)
```

```
## tf.Tensor(
## [[0.   0.25 0.   0.6  0.8 ]
##  [1.8  0.   0.75 0.   0.4 ]], shape=(2, 5), dtype=float32)
```

When adapting the layer in `"tf_idf"` mode, each input sample will be considered a document, and IDF weight per token will be calculated as `log(1 + num_documents / (1 + token_document_count))`.

Inverse lookup

This example demonstrates how to map indices to strings using this layer. (You can also use `adapt()` with `inverse=TRUE`, but for simplicity we'll pass the vocab in this example.)

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c(1, 3, 4), c(4, 0, 2))
layer <- layer_string_lookup(vocabulary = vocab, invert = TRUE)
layer(data)
```

```
## tf.Tensor(
## [[b'a' b'c' b'd']
##  [b'd' b'[UNK]' b'b']], shape=(2, 3), dtype=string)
```

Note that the first index correspond to the oov token by default.

Forward and inverse lookup pairs

This example demonstrates how to use the vocabulary of a standard lookup layer to create an inverse lookup layer.

```
vocab <- c("a", "b", "c", "d")
data <- rbind(c("a", "c", "d"), c("d", "z", "b"))
layer <- layer_string_lookup(vocabulary = vocab)
i_layer <- layer_string_lookup(vocabulary = vocab, invert = TRUE)
int_data <- layer(data)
i_layer(int_data)
```

```
## tf.Tensor(
## [[b'a' b'c' b'd']
##  [b'd' b'[UNK]' b'b']], shape=(2, 3), dtype=string)
```

In this example, the input value `"z"` resulted in an output of `"[UNK]"`, since 1000 was not in the vocabulary - it got represented as an OOV, and all OOV values are returned as `"[UNK]"` in the inverse layer. Also, note that for the inverse to work, you must have already set the forward layer vocabulary either directly or via `adapt()` before calling `get_vocabulary()`.

See Also

- https://keras.io/api/layers/preprocessing_layers/categorical/string_lookup#stringlookup-class

Other categorical features preprocessing layers:
`layer_category_encoding()`
`layer_hashed_crossing()`
`layer_hashing()`
`layer_integer_lookup()`

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`
`layer_discretization()`
`layer_equalization()`
`layer_feature_space()`
`layer_hashed_crossing()`

layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_text_vectorization()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()

layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()

layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()

layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_subtract *Performs elementwise subtraction.*

Description

It takes as input a list of tensors of size 2 both of the same shape, and returns a single tensor (`inputs[0] - inputs[1]`) of same shape.

Usage

```
layer_subtract(inputs, ...)
```

Arguments

`inputs`	layers to combine
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
input_shape <- c(2, 3, 4)
x1 <- random_uniform(input_shape)
x2 <- random_uniform(input_shape)
y <- layer_subtract(list(x1, x2))
```

Usage in a Keras model:

```
input1 <- layer_input(shape = 16)
x1 <- layer_dense(input1, units = 8, activation = 'relu')
input2 <- layer_input(shape = 32)
x2 <- layer_dense(input2, units = 8, activation = 'relu')
subtracted <- layer_subtract(list(x1, x2))
out <- layer_dense(subtracted, units = 4)
model <- keras_model(inputs = list(input1, input2), outputs = out)
```

See Also

- https://keras.io/api/layers/merging_layers/subtract#subtract-class

Other merging layers:
layer_add()
layer_average()
layer_concatenate()
layer_dot()
layer_maximum()
layer_minimum()
layer_multiply()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()

layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()

layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()

layer_string_lookup()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_text_vectorization

A preprocessing layer which maps text features to integer sequences.

Description

This layer has basic options for managing text in a Keras model. It transforms a batch of strings (one example = one string) into either a list of token indices (one example = 1D tensor of integer token indices) or a dense representation (one example = 1D tensor of float values representing data about the example's tokens). This layer is meant to handle natural language inputs. To handle simple string inputs (categorical strings or pre-tokenized strings) see `layer_string_lookup()`.

The vocabulary for the layer must be either supplied on construction or learned via `adapt()`. When this layer is adapted, it will analyze the dataset, determine the frequency of individual string values, and create a vocabulary from them. This vocabulary can have unlimited size or be capped, depending on the configuration options for this layer; if there are more unique values in the input than the maximum vocabulary size, the most frequent terms will be used to create the vocabulary.

The processing of each example contains the following steps:

1. Standardize each example (usually lowercasing + punctuation stripping)
2. Split each example into substrings (usually words)
3. Recombine substrings into tokens (usually ngrams)
4. Index tokens (associate a unique int value with each token)
5. Transform each example using this index, either into a vector of ints or a dense float vector.

Some notes on passing callables to customize splitting and normalization for this layer:

1. Any callable can be passed to this Layer, but if you want to serialize this object you should only pass functions that are registered Keras serializables (see `register_keras_serializable()` for more details).

2. When using a custom callable for `standardize`, the data received by the callable will be exactly as passed to this layer. The callable should return a tensor of the same shape as the input.
3. When using a custom callable for `split`, the data received by the callable will have the 1st dimension squeezed out - instead of `list("string to split", "another string to split")`, the Callable will see `c("string to split", "another string to split")`. The callable should return a `tf.Tensor` of dtype `string` with the first dimension containing the split tokens - in this example, we should see something like `list(c("string", "to", "split"), c("another", "string", "to", "split"))`.

Note: This layer uses TensorFlow internally. It cannot be used as part of the compiled computation graph of a model with any backend other than TensorFlow. It can however be used with any backend when running eagerly. It can also always be used as part of an input preprocessing pipeline with any backend (outside the model itself), which is how we recommend to use this layer.

Note: This layer is safe to use inside a `tf.data` pipeline (independently of which backend you're using).

Usage

```
layer_text_vectorization(
  object,
  max_tokens = NULL,
  standardize = "lower_and_strip_punctuation",
  split = "whitespace",
  ngrams = NULL,
  output_mode = "int",
  output_sequence_length = NULL,
  pad_to_max_tokens = FALSE,
  vocabulary = NULL,
  idf_weights = NULL,
  sparse = FALSE,
  ragged = FALSE,
  encoding = "utf-8",
  name = NULL,
  ...
)

get_vocabulary(object, include_special_tokens = TRUE)

set_vocabulary(object, vocabulary, idf_weights = NULL, ...)
```

Arguments

`object` Object to compose the layer with. A tensor, array, or sequential model.

`max_tokens` Maximum size of the vocabulary for this layer. This should only be specified when adapting a vocabulary or when setting `pad_to_max_tokens=TRUE`. Note that this vocabulary contains 1 OOV token, so the effective number of tokens is `(max_tokens - 1 - (1 if output_mode == "int" else 0))`.

standardize
: Optional specification for standardization to apply to the input text. Values can be:

- NULL: No standardization.
- "lower_and_strip_punctuation": Text will be lowercased and all punctuation removed.
- "lower": Text will be lowercased.
- "strip_punctuation": All punctuation will be removed.
- Callable: Inputs will passed to the callable function, which should be standardized and returned.

split
: Optional specification for splitting the input text. Values can be:

- NULL: No splitting.
- "whitespace": Split on whitespace.
- "character": Split on each unicode character.
- Callable: Standardized inputs will passed to the callable function, which should be split and returned.

ngrams
: Optional specification for ngrams to create from the possibly-split input text. Values can be NULL, an integer or list of integers; passing an integer will create ngrams up to that integer, and passing a list of integers will create ngrams for the specified values in the list. Passing NULL means that no ngrams will be created.

output_mode
: Optional specification for the output of the layer. Values can be "int", "multi_hot", "count" or "tf_idf", configuring the layer as follows:

- "int": Outputs integer indices, one integer index per split string token. When output_mode == "int", 0 is reserved for masked locations; this reduces the vocab size to max_tokens - 2 instead of max_tokens - 1.
- "multi_hot": Outputs a single int array per batch, of either vocab_size or max_tokens size, containing 1s in all elements where the token mapped to that index exists at least once in the batch item.
- "count": Like "multi_hot", but the int array contains a count of the number of times the token at that index appeared in the batch item.
- "tf_idf": Like "multi_hot", but the TF-IDF algorithm is applied to find the value in each token slot. For "int" output, any shape of input and output is supported. For all other output modes, currently only rank 1 inputs (and rank 2 outputs after splitting) are supported.

output_sequence_length
: Only valid in INT mode. If set, the output will have its time dimension padded or truncated to exactly output_sequence_length values, resulting in a tensor of shape (batch_size, output_sequence_length) regardless of how many tokens resulted from the splitting step. Defaults to NULL. If ragged is TRUE then output_sequence_length may still truncate the output.

pad_to_max_tokens
: Only valid in "multi_hot", "count", and "tf_idf" modes. If TRUE, the output will have its feature axis padded to max_tokens even if the number of unique tokens in the vocabulary is less than max_tokens, resulting in a tensor of shape (batch_size, max_tokens) regardless of vocabulary size. Defaults to FALSE.

`vocabulary` Optional. Either an array of strings or a string path to a text file. If passing an array, can pass a list, list, 1D NumPy array, or 1D tensor containing the string vocabulary terms. If passing a file path, the file should contain one line per term in the vocabulary. If this argument is set, there is no need to `adapt()` the layer.

`idf_weights` An R vector, 1D numpy array, or 1D tensor of inverse document frequency weights with equal length to vocabulary. Must be set if output_mode is "tf_idf". Should not be set otherwise.

`sparse` Boolean. Only applicable to `"multi_hot"`, `"count"`, and `"tf_idf"` output modes. Only supported with TensorFlow backend. If `TRUE`, returns a `SparseTensor` instead of a dense `Tensor`. Defaults to `FALSE`.

`ragged` Boolean. Only applicable to `"int"` output mode. Only supported with TensorFlow backend. If `TRUE`, returns a `RaggedTensor` instead of a dense `Tensor`, where each sequence may have a different length after string splitting. Defaults to `FALSE`.

`encoding` Optional. The text encoding to use to interpret the input strings. Defaults to `"utf-8"`.

`name` String, name for the object

`...` For forward/backward compatability.

`include_special_tokens` If TRUE, the returned vocabulary will include the padding and OOV tokens, and a term's index in the vocabulary will equal the term's index when calling the layer. If FALSE, the returned vocabulary will not include any padding or OOV tokens.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

This example instantiates a `TextVectorization` layer that lowercases text, splits on whitespace, strips punctuation, and outputs integer vocab indices.

```
max_tokens <- 5000  # Maximum vocab size.
max_len <- 4  # Sequence length to pad the outputs to.
# Create the layer.
vectorize_layer <- layer_text_vectorization(
    max_tokens = max_tokens,
    output_mode = 'int',
    output_sequence_length = max_len)
```

```
# Now that the vocab layer has been created, call `adapt` on the
# list of strings to create the vocabulary.
vectorize_layer %>% adapt(c("foo bar", "bar baz", "baz bada boom"))

# Now, the layer can map strings to integers -- you can use an
# embedding layer to map these integers to learned embeddings.
input_data <- rbind("foo qux bar", "qux baz")
vectorize_layer(input_data)

## tf.Tensor(
## [[4 1 3 0]
##  [1 2 0 0]], shape=(2, 4), dtype=int64)
```

This example instantiates a `TextVectorization` layer by passing a list of vocabulary terms to the layer's `initialize()` method.

```
vocab_data <- c("earth", "wind", "and", "fire")
max_len <- 4  # Sequence length to pad the outputs to.
# Create the layer, passing the vocab directly. You can also pass the
# vocabulary arg a path to a file containing one vocabulary word per
# line.
vectorize_layer <- layer_text_vectorization(
    max_tokens = max_tokens,
    output_mode = 'int',
    output_sequence_length = max_len,
    vocabulary = vocab_data)

# Because we've passed the vocabulary directly, we don't need to adapt
# the layer - the vocabulary is already set. The vocabulary contains the
# padding token ('') and OOV token ('[UNK]')
# as well as the passed tokens.
vectorize_layer %>% get_vocabulary()

## [1] ""      "[UNK]" "earth" "wind"  "and"   "fire"


# ['', '[UNK]', 'earth', 'wind', 'and', 'fire']
```

See Also

- https://keras.io/api/layers/preprocessing_layers/text/text_vectorization#textvectorization-clas

Other preprocessing layers:
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_cut_mix()`

layer_discretization()
layer_equalization()
layer_feature_space()
layer_hashed_crossing()
layer_hashing()
layer_integer_lookup()
layer_max_num_bounding_boxes()
layer_mel_spectrogram()
layer_mix_up()
layer_normalization()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_rescaling()
layer_resizing()
layer_solarization()
layer_stft_spectrogram()
layer_string_lookup()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()

layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()

layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()

layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_tfsm *Reload a Keras model/layer that was saved via* export_savedmodel().

Description

Reload a Keras model/layer that was saved via export_savedmodel().

Usage

```
layer_tfsm(
  object,
  filepath,
  call_endpoint = "serve",
  call_training_endpoint = NULL,
  trainable = TRUE,
  name = NULL,
  dtype = NULL
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`filepath`	string, the path to the SavedModel.
`call_endpoint`	Name of the endpoint to use as the `call()` method of the reloaded layer. If the SavedModel was created via `export_savedmodel()`, then the default endpoint name is `'serve'`. In other cases it may be named `'serving_default'`.
`call_training_endpoint`	see description
`trainable`	see description
`name`	String, name for the object
`dtype`	datatype (e.g., `"float32"`).

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
model <- keras_model_sequential(input_shape = c(784)) |> layer_dense(10)
model |> export_savedmodel("path/to/artifact")

## Saved artifact at 'path/to/artifact'. The following endpoints are available:
##
## * Endpoint 'serve'
##  args_0 (POSITIONAL_ONLY): TensorSpec(shape=(None, 784), dtype=tf.float32, name='keras_tensor')
## Output Type:
##   TensorSpec(shape=(None, 10), dtype=tf.float32, name=None)
## Captures:
##   139698112630416: TensorSpec(shape=(), dtype=tf.resource, name=None)
##   139698112630608: TensorSpec(shape=(), dtype=tf.resource, name=None)


reloaded_layer <- layer_tfsm(filepath = "path/to/artifact")
input <- random_normal(c(2, 784))
output <- reloaded_layer(input)
stopifnot(all.equal(as.array(output), as.array(model(input))))
```

The reloaded object can be used like a regular Keras layer, and supports training/fine-tuning of its trainable weights. Note that the reloaded object retains none of the internal structure or custom methods of the original object – it's a brand new layer created around the saved function.

Limitations:

- Only call endpoints with a single `inputs` tensor argument (which may optionally be a named list/list of tensors) are supported. For endpoints with multiple separate input tensor arguments, consider subclassing `layer_tfsm` and implementing a `call()` method with a custom signature.
- If you need training-time behavior to differ from inference-time behavior (i.e. if you need the reloaded object to support a `training=TRUE` argument in `__call__()`), make sure that the training-time call function is saved as a standalone endpoint in the artifact, and provide its name to the `layer_tfsm` via the `call_training_endpoint` argument.

See Also

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
`layer_conv_1d_transpose()`
`layer_conv_2d()`
`layer_conv_2d_transpose()`
`layer_conv_3d()`
`layer_conv_3d_transpose()`
`layer_conv_lstm_1d()`
`layer_conv_lstm_2d()`
`layer_conv_lstm_3d()`
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_cut_mix()`

layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()

layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other saving and loading functions:
export_savedmodel.keras.src.models.model.Model()
load_model()
load_model_weights()
register_keras_serializable()
save_model()
save_model_config()
save_model_weights()
with_custom_object_scope()

---

layer_time_distributed
This wrapper allows to apply a layer to every temporal slice of an input.

Description

Every input should be at least 3D, and the dimension of index one of the first input will be considered to be the temporal dimension.

Consider a batch of 32 video samples, where each sample is a 128x128 RGB image with `channels_last` data format, across 10 timesteps. The batch input shape is `(32, 10, 128, 128, 3)`.

You can then use `TimeDistributed` to apply the same `Conv2D` layer to each of the 10 timesteps, independently:

```
inputs <- keras_input(shape = c(10, 128, 128, 3), batch_size = 32)
conv_2d_layer <- layer_conv_2d(filters = 64, kernel_size = c(3, 3))
outputs <- layer_time_distributed(inputs, layer = conv_2d_layer)
shape(outputs)

## shape(32, 10, 126, 126, 64)
```

Because `layer_time_distributed` applies the same instance of `layer_conv2d` to each of the timestamps, the same set of weights are used at each timestamp.

Usage

```
layer_time_distributed(object, layer, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.
layer	A Layer instance.
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Call Arguments

- `inputs`: Input tensor of shape (batch, time, ...) or nested tensors, and each of which has shape (batch, time, ...).
- `training`: Boolean indicating whether the layer should behave in training mode or in inference mode. This argument is passed to the wrapped layer (only if the layer supports this argument).
- `mask`: Binary tensor of shape `(samples, timesteps)` indicating whether a given timestep should be masked. This argument is passed to the wrapped layer (only if the layer supports this argument).

See Also

- https://keras.io/api/layers/recurrent_layers/time_distributed#timedistributed-class

Other rnn layers:
`layer_bidirectional()`
`layer_conv_lstm_1d()`
`layer_conv_lstm_2d()`
`layer_conv_lstm_3d()`
`layer_gru()`
`layer_lstm()`
`layer_rnn()`
`layer_simple_rnn()`
`rnn_cell_gru()`
`rnn_cell_lstm()`
`rnn_cell_simple()`
`rnn_cells_stack()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`

layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()

layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()

layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_torch_module_wrapper

Torch module wrapper layer.

Description

`layer_torch_module_wrapper` is a wrapper class that can turn any `torch.nn.Module` into a Keras layer, in particular by making its parameters trackable by Keras.

`layer_torch_module_wrapper()` is only compatible with the PyTorch backend and cannot be used with the TensorFlow or JAX backends.

Usage

```
layer_torch_module_wrapper(object, module, name = NULL, ...)
```

Arguments

object	Object to compose the layer with. A tensor, array, or sequential model.

module	torch.nn.Module instance. If it's a LazyModule instance, then its parameters must be initialized before passing the instance to layer_torch_module_wrapper (e.g. by calling it once).
name	The name of the layer (string).
...	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If object is:

- a keras_model_sequential(), then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a keras_input(), then the output tensor from calling layer(input) is returned.
- NULL or missing, then a Layer instance is returned.

Example

Here's an example of how the layer_torch_module_wrapper() can be used with vanilla PyTorch modules.

```
# reticulate::py_install(
#   packages = c("torch", "torchvision", "torchaudio"),
#   envname = "r-keras",
#   pip_options = c("--index-url https://download.pytorch.org/whl/cpu")
# )
library(keras3)
use_backend("torch")
torch <- reticulate::import("torch")
nn <- reticulate::import("torch.nn")
nnf <- reticulate::import("torch.nn.functional")

Classifier(keras$Model) \%py_class\% {
  initialize <- function(...) {
    super$initialize(...)

    self$conv1 <- layer_torch_module_wrapper(module = nn$Conv2d(
      in_channels = 1L,
      out_channels = 32L,
      kernel_size = tuple(3L, 3L)
    ))
    self$conv2 <- layer_torch_module_wrapper(module = nn$Conv2d(
      in_channels = 32L,
      out_channels = 64L,
      kernel_size = tuple(3L, 3L)
    ))
    self$pool <- nn$MaxPool2d(kernel_size = tuple(2L, 2L))
    self$flatten <- nn$Flatten()
    self$dropout <- nn$Dropout(p = 0.5)
```

```
    self$fc <-
      layer_torch_module_wrapper(module = nn$Linear(1600L, 10L))
  }

  call <- function(inputs) {
    x <- nnf$relu(self$conv1(inputs))
    x <- self$pool(x)
    x <- nnf$relu(self$conv2(x))
    x <- self$pool(x)
    x <- self$flatten(x)
    x <- self$dropout(x)
    x <- self$fc(x)
    nnf$softmax(x, dim = 1L)
  }
}
model <- Classifier()
model$build(shape(1, 28, 28))
cat("Output shape:", format(shape(model(torch$ones(1L, 1L, 28L, 28L)))))

model |> compile(loss = "sparse_categorical_crossentropy",
                 optimizer = "adam",
                 metrics = "accuracy")

model |> fit(train_loader, epochs = 5)
```

See Also

Other wrapping layers:
layer_flax_module_wrapper()
layer_jax_model_wrapper()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()

layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()

layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()

layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_unit_normalization *Unit normalization layer.*

Description

Normalize a batch of inputs so that each input in the batch has a L2 norm equal to 1 (across the axes specified in `axis`).

Usage

```
layer_unit_normalization(object, axis = -1L, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`axis`	Integer or list. The axis or axes to normalize across. Typically, this is the features axis or axes. The left-out axes are typically the batch axis or axes. `-1` is the last dimension in the input. Defaults to `-1`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.

- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Examples

```
data <- 1:6 |> op_array("float32") |> op_reshape(c(2, 3))
normalized_data <- layer_unit_normalization(data)
op_sum(normalized_data[1, ]^2)

## tf.Tensor(0.9999999, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/layers/normalization_layers/unit_normalization#unitnormalization-class

Other normalization layers:
`layer_batch_normalization()`
`layer_group_normalization()`
`layer_layer_normalization()`
`layer_rms_normalization()`
`layer_spectral_normalization()`

Other layers:
`Layer()`
`layer_activation()`
`layer_activation_elu()`
`layer_activation_leaky_relu()`
`layer_activation_parametric_relu()`
`layer_activation_relu()`
`layer_activation_softmax()`
`layer_activity_regularization()`
`layer_add()`
`layer_additive_attention()`
`layer_alpha_dropout()`
`layer_attention()`
`layer_aug_mix()`
`layer_auto_contrast()`
`layer_average()`
`layer_average_pooling_1d()`
`layer_average_pooling_2d()`
`layer_average_pooling_3d()`
`layer_batch_normalization()`
`layer_bidirectional()`
`layer_category_encoding()`
`layer_center_crop()`
`layer_concatenate()`
`layer_conv_1d()`
`layer_conv_1d_transpose()`

layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()

layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()

layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

layer_upsampling_1d *Upsampling layer for 1D inputs.*

Description

Repeats each temporal step `size` times along the time axis.

Usage

```
layer_upsampling_1d(object, size = 2L, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`size`	Integer. Upsampling factor.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 2, 3)
x <- seq_len(prod(input_shape)) %>% op_reshape(input_shape)
x
```

```
## tf.Tensor(
## [[[ 1  2  3]
##   [ 4  5  6]]
##
##  [[ 7  8  9]
##   [10 11 12]]], shape=(2, 2, 3), dtype=int32)
```

```
y <- layer_upsampling_1d(x, size = 2)
y
```

```
## tf.Tensor(
## [[[ 1  2  3]
##   [ 1  2  3]
##   [ 4  5  6]
##   [ 4  5  6]]
##
##  [[ 7  8  9]
##   [ 7  8  9]
##   [10 11 12]
##   [10 11 12]]], shape=(2, 4, 3), dtype=int32)
```

Input Shape

3D tensor with shape: `(batch_size, steps, features)`.

Output Shape

3D tensor with shape: `(batch_size, upsampled_steps, features)`.

See Also

- https://keras.io/api/layers/reshaping_layers/up_sampling1d#upsampling1d-class

Other reshaping layers:
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_flatten()`
`layer_permute()`
`layer_repeat_vector()`
`layer_reshape()`
`layer_upsampling_2d()`
`layer_upsampling_3d()`
`layer_zero_padding_1d()`
`layer_zero_padding_2d()`
`layer_zero_padding_3d()`

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()

layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_upsampling_2d *Upsampling layer for 2D inputs.*

Description

The implementation uses interpolative resizing, given the resize method (specified by the `interpolation` argument). Use `interpolation=nearest` to repeat the rows and columns of the data.

Usage

```
layer_upsampling_2d(
  object,
  size = list(2L, 2L),
  data_format = NULL,
  interpolation = "nearest",
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`size`	Int, or list of 2 integers. The upsampling factors for rows and columns.
`data_format`	A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, height, width)`. When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists) else `"channels_last"`. Defaults to `"channels_last"`.
`interpolation`	A string, one of `"bicubic"`, `"bilinear"`, `"lanczos3"`, `"lanczos5"`, `"nearest"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 2, 1, 3)
x <- op_reshape(seq_len(prod(input_shape)), input_shape)
print(x)

## tf.Tensor(
## [[[[ 1  2  3]]
##
##   [[ 4  5  6]]]
##
##
##  [[[ 7  8  9]]
##
##   [[10 11 12]]]], shape=(2, 2, 1, 3), dtype=int32)
```

```
y <- layer_upsampling_2d(x, size = c(1, 2))
print(y)

## tf.Tensor(
## [[[[ 1  2  3]
##    [ 1  2  3]]
##
##   [[ 4  5  6]
##    [ 4  5  6]]]
##
##
##  [[[ 7  8  9]
##    [ 7  8  9]]
##
##   [[10 11 12]
##    [10 11 12]]]], shape=(2, 2, 2, 3), dtype=int32)
```

Input Shape

4D tensor with shape:

- If data_format is "channels_last": (batch_size, rows, cols, channels)
- If data_format is "channels_first": (batch_size, channels, rows, cols)

Output Shape

4D tensor with shape:

- If data_format is "channels_last": (batch_size, upsampled_rows, upsampled_cols, channels)
- If data_format is "channels_first": (batch_size, channels, upsampled_rows, upsampled_cols)

See Also

- https://keras.io/api/layers/reshaping_layers/up_sampling2d#upsampling2d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()

layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()

layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_upsampling_3d *Upsampling layer for 3D inputs.*

Description

Repeats the 1st, 2nd and 3rd dimensions of the data by `size[0]`, `size[1]` and `size[2]` respectively.

Usage

```
layer_upsampling_3d(object, size = list(2L, 2L, 2L), data_format = NULL, ...)
```

Arguments

object
: Object to compose the layer with. A tensor, array, or sequential model.

size
: Int, or list of 3 integers. The upsampling factors for dim1, dim2 and dim3.

data_format
: A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, spatial_dim1, s` When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists) else `"channels_last"`. Defaults to `"channels_last"`.

...
: For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 1, 2, 1, 3)
x <- array(1, dim = input_shape)
y <- layer_upsampling_3d(x, size = c(2, 2, 2))
shape(y)


## shape(2, 2, 4, 2, 3)
```

Input Shape

5D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, dim1, dim2, dim3, channels)`
- If `data_format` is `"channels_first"`: `(batch_size, channels, dim1, dim2, dim3)`

Output Shape

5D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, upsampled_dim1, upsampled_dim2, upsampled_dim3, chan`
- If `data_format` is `"channels_first"`: `(batch_size, channels, upsampled_dim1, upsampled_dim2, upsampled`

See Also

- https://keras.io/api/layers/reshaping_layers/up_sampling3d#upsampling3d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()

layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()

layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_zero_padding_1d()
layer_zero_padding_2d()

layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_zero_padding_1d *Zero-padding layer for 1D input (e.g. temporal sequence).*

Description

Zero-padding layer for 1D input (e.g. temporal sequence).

Usage

```
layer_zero_padding_1d(object, padding = 1L, data_format = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`padding`	Int, or list of int (length 2). • If int: how many zeros to add at the beginning and end of the padding dimension (axis 2). • If list of 2 ints: how many zeros to add at the beginning and the end of the padding dimension (`(left_pad, right_pad)`).
`data_format`	A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, axis_to_pad, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, axis_to_pad)`. When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists). Defaults to `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(2, 2, 3)
x <- op_reshape(seq_len(prod(input_shape)), input_shape)
x
```

```
## tf.Tensor(
## [[[ 1  2  3]
##   [ 4  5  6]]
##
##  [[ 7  8  9]
##   [10 11 12]]], shape=(2, 2, 3), dtype=int32)
```

```
y <- layer_zero_padding_1d(x, padding = 2)
y
```

```
## tf.Tensor(
## [[[ 0  0  0]
##   [ 0  0  0]
##   [ 1  2  3]
##   [ 4  5  6]
##   [ 0  0  0]
##   [ 0  0  0]]
##
##  [[ 0  0  0]
##   [ 0  0  0]
##   [ 7  8  9]
##   [10 11 12]
##   [ 0  0  0]
##   [ 0  0  0]]], shape=(2, 6, 3), dtype=int32)
```

Input Shape

3D tensor with shape:

- If `data_format` is "`channels_last`": `(batch_size, axis_to_pad, features)`
- If `data_format` is "`channels_first`": `(batch_size, features, axis_to_pad)`

Output Shape

3D tensor with shape:

- If `data_format` is "`channels_last`": `(batch_size, padded_axis, features)`
- If `data_format` is "`channels_first`": `(batch_size, features, padded_axis)`

See Also

- https://keras.io/api/layers/reshaping_layers/zero_padding1d#zeropadding1d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_2d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()

layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()

layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_2d()

layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_zero_padding_2d *Zero-padding layer for 2D input (e.g. picture).*

Description

This layer can add rows and columns of zeros at the top, bottom, left and right side of an image tensor.

Usage

```
layer_zero_padding_2d(object, padding = list(1L, 1L), data_format = NULL, ...)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`padding`	Int, or list of 2 ints, or list of 2 lists of 2 ints. • If int: the same symmetric padding is applied to height and width. • If list of 2 ints: interpreted as two different symmetric padding values for height and width: `(symmetric_height_pad, symmetric_width_pad)`. • If list of 2 lists of 2 ints: interpreted as `((top_pad, bottom_pad), (left_pad, right_pad))`.
`data_format`	A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, height, width, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, height, width)`. When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists). Defaults to `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(1, 1, 2, 2)
x <- op_reshape(seq_len(prod(input_shape)), input_shape)
x
```

```
## tf.Tensor(
## [[[[1 2]
##    [3 4]]]], shape=(1, 1, 2, 2), dtype=int32)
```

```
y <- layer_zero_padding_2d(x, padding = 1)
y
```

```
## tf.Tensor(
## [[[[0 0]
##    [0 0]
##    [0 0]
##    [0 0]]
##
##   [[0 0]
##    [1 2]
##    [3 4]
##    [0 0]]
##
##   [[0 0]
##    [0 0]
##    [0 0]
##    [0 0]]]], shape=(1, 3, 4, 2), dtype=int32)
```

Input Shape

4D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, height, width, channels)`
- If `data_format` is `"channels_first"`: `(batch_size, channels, height, width)`

Output Shape

4D tensor with shape:

- If `data_format` is `"channels_last"`: `(batch_size, padded_height, padded_width, channels)`
- If `data_format` is `"channels_first"`: `(batch_size, channels, padded_height, padded_width)`

See Also

- https://keras.io/api/layers/reshaping_layers/zero_padding2d#zeropadding2d-class

Other reshaping layers:
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_flatten()
layer_permute()
layer_repeat_vector()
layer_reshape()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_3d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()

layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()

layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()

layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

layer_zero_padding_3d *Zero-padding layer for 3D data (spatial or spatio-temporal).*

Description

Zero-padding layer for 3D data (spatial or spatio-temporal).

Usage

```
layer_zero_padding_3d(
  object,
  padding = list(list(1L, 1L), list(1L, 1L), list(1L, 1L)),
  data_format = NULL,
  ...
)
```

Arguments

`object`	Object to compose the layer with. A tensor, array, or sequential model.
`padding`	Int, or list of 3 ints, or list of 3 lists of 2 ints. • If int: the same symmetric padding is applied to depth, height, and width. • If list of 3 ints: interpreted as three different symmetric padding values for depth, height, and width: `(symmetric_dim1_pad, symmetric_dim2_pad, symmetric_dim3_pad)`. • If list of 3 lists of 2 ints: interpreted as `((left_dim1_pad, right_dim1_pad), (left_dim2_pad, r`
`data_format`	A string, one of `"channels_last"` (default) or `"channels_first"`. The ordering of the dimensions in the inputs. `"channels_last"` corresponds to inputs with shape `(batch_size, spatial_dim1, spatial_dim2, spatial_dim3, channels)` while `"channels_first"` corresponds to inputs with shape `(batch_size, channels, spatial_dim1, s` When unspecified, uses `image_data_format` value found in your Keras config file at `~/.keras/keras.json` (if exists). Defaults to `"channels_last"`.
`...`	For forward/backward compatability.

Value

The return value depends on the value provided for the first argument. If `object` is:

- a `keras_model_sequential()`, then the layer is added to the sequential model (which is modified in place). To enable piping, the sequential model is also returned, invisibly.
- a `keras_input()`, then the output tensor from calling `layer(input)` is returned.
- `NULL` or missing, then a `Layer` instance is returned.

Example

```
input_shape <- c(1, 1, 2, 2, 3)
x <- op_reshape(seq_len(prod(input_shape)), input_shape)
x

## tf.Tensor(
## [[[[[ 1  2  3]
##     [ 4  5  6]]
##
##    [[ 7  8  9]
##     [10 11 12]]]]], shape=(1, 1, 2, 2, 3), dtype=int32)


y <- layer_zero_padding_3d(x, padding = 2)
shape(y)

## shape(1, 5, 6, 6, 3)
```

Input Shape

5D tensor with shape:

- If `data_format` is "channels_last": `(batch_size, first_axis_to_pad, second_axis_to_pad, third_axis_to`
- If `data_format` is "channels_first": `(batch_size, depth, first_axis_to_pad, second_axis_to_pad, third`

Output Shape

5D tensor with shape:

- If `data_format` is "channels_last": `(batch_size, first_padded_axis, second_padded_axis, third_axis_to`
- If `data_format` is "channels_first": `(batch_size, depth, first_padded_axis, second_padded_axis, third`

See Also

- https://keras.io/api/layers/reshaping_layers/zero_padding3d#zeropadding3d-class

Other reshaping layers:
`layer_cropping_1d()`
`layer_cropping_2d()`
`layer_cropping_3d()`
`layer_flatten()`
`layer_permute()`
`layer_repeat_vector()`
`layer_reshape()`
`layer_upsampling_1d()`
`layer_upsampling_2d()`
`layer_upsampling_3d()`
`layer_zero_padding_1d()`

layer_zero_padding_2d()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

LearningRateSchedule *Define a custom* LearningRateSchedule *class*

Description

Subclass the Keras LearningRateSchedule base class.

You can use a learning rate schedule to modulate how the learning rate of your optimizer changes over time.

Several built-in learning rate schedules are available, such as `learning_rate_schedule_exponential_decay()` or `learning_rate_schedule_piecewise_constant_decay()`:

```
lr_schedule <- learning_rate_schedule_exponential_decay(
  initial_learning_rate = 1e-2,
  decay_steps = 10000,
  decay_rate = 0.9
)
optimizer <- optimizer_sgd(learning_rate = lr_schedule)
```

A `LearningRateSchedule()` instance can be passed in as the `learning_rate` argument of any optimizer.

To implement your own schedule object, you should implement the `call` method, which takes a `step` argument (a scalar integer backend tensor, the current training step count). Note that `step` is 0-based (i.e., the first step is `0`). Like for any other Keras object, you can also optionally make your object serializable by implementing the `get_config()` and `from_config()` methods.

Usage

```
LearningRateSchedule(
  classname,
  call = NULL,
  initialize = NULL,
  get_config = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

`classname`	String, the name of the custom class. (Conventionally, CamelCase).
`call`, `initialize`, `get_config`	Recommended methods to implement. See description and details sections.
`...`, `public`	Additional methods or public members of the custom class.
`private`	Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.
`inherit`	What the custom class will subclass. By default, the base keras class.
`parent_env`	The R environment that all class methods will have as a grandparent.

Value

A function that returns `LearningRateSchedule` instances, similar to the built-in `learning_rate_schedule_*` family of functions.

Example

```
my_custom_learning_rate_schedule <- LearningRateSchedule(
  classname = "MyLRSchedule",

  initialize = function(initial_learning_rate) {
    self$initial_learning_rate <- initial_learning_rate
  },

  call = function(step) {
    # note that `step` is a tensor
    # and call() will be traced via tf_function() or similar.

    str(step) # <KerasVariable shape=(), dtype=int64, path=SGD/iteration>

    # print 'step' every 1000 steps
    op_cond((step %% 1000) == 0,
            \() {tensorflow::tf$print(step); NULL},
            \() {NULL})
    self$initial_learning_rate / (step + 1)
  }
)

optimizer <- optimizer_sgd(
  learning_rate = my_custom_learning_rate_schedule(0.1)
)

# You can also call schedule instances directly
# (e.g., for interactive testing, or if implementing a custom optimizer)
schedule <- my_custom_learning_rate_schedule(0.1)
step <- keras$Variable(initializer = op_ones,
                       shape = shape(),
                       dtype = "int64")
schedule(step)

## <Variable path=variable, shape=(), dtype=int64, value=1>


## tf.Tensor(0.0, shape=(), dtype=float64)
```

Methods available:

- `get_config()`

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

See Also

Other optimizer learning rate schedules:
`learning_rate_schedule_cosine_decay()`
`learning_rate_schedule_cosine_decay_restarts()`
`learning_rate_schedule_exponential_decay()`
`learning_rate_schedule_inverse_time_decay()`
`learning_rate_schedule_piecewise_constant_decay()`
`learning_rate_schedule_polynomial_decay()`

---

learning_rate_schedule_cosine_decay

A `LearningRateSchedule` that uses a cosine decay with optional warmup.

Description

See Loshchilov & Hutter, ICLR2016, SGDR: Stochastic Gradient Descent with Warm Restarts.

For the idea of a linear warmup of our learning rate, see Goyal et al..

When we begin training a model, we often want an initial increase in our learning rate followed by a decay. If `warmup_target` is an int, this schedule applies a linear increase per optimizer step to our learning rate from `initial_learning_rate` to `warmup_target` for a duration of `warmup_steps`. Afterwards, it applies a cosine decay function taking our learning rate from `warmup_target` to `alpha` for a duration of `decay_steps`. If `warmup_target` is NULL we skip warmup and our decay will take our learning rate from `initial_learning_rate` to `alpha`. It requires a `step` value to compute the learning rate. You can just pass a backend variable that you increment at each training step.

The schedule is a 1-arg callable that produces a warmup followed by a decayed learning rate when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions.

Our warmup is computed as:

```
warmup_learning_rate <- function(step) {
  completed_fraction <- step / warmup_steps
```

```
  total_delta <- target_warmup - initial_learning_rate
  completed_fraction * total_delta
}
```

And our decay is computed as:

```
if (is.null(warmup_target)) {
  initial_decay_lr <- initial_learning_rate
} else {
  initial_decay_lr <- warmup_target
}

decayed_learning_rate <- function(step) {
  step <- min(step, decay_steps)
  cosine_decay <- 0.5 * (1 + cos(pi * step / decay_steps))
  decayed <- (1 - alpha) * cosine_decay + alpha
  initial_decay_lr * decayed
}
```

Example usage without warmup:

```
decay_steps <- 1000
initial_learning_rate <- 0.1
lr_decayed_fn <- learning_rate_schedule_cosine_decay(
    initial_learning_rate, decay_steps)
```

Example usage with warmup:

```
decay_steps <- 1000
initial_learning_rate <- 0
warmup_steps <- 1000
target_learning_rate <- 0.1
lr_warmup_decayed_fn <- learning_rate_schedule_cosine_decay(
    initial_learning_rate, decay_steps, warmup_target = target_learning_rate,
    warmup_steps = warmup_steps
)
```

You can pass this schedule directly into a `optimizer` as the learning rate. The learning rate schedule is also serializable and deserializable using `keras$optimizers$schedules$serialize` and `keras$optimizers$schedules$deserialize`.

Usage

```
learning_rate_schedule_cosine_decay(
  initial_learning_rate,
  decay_steps,
  alpha = 0,
  name = "CosineDecay",
  warmup_target = NULL,
  warmup_steps = 0L
)
```

Arguments

`initial_learning_rate`	A float. The initial learning rate.
`decay_steps`	A int. Number of steps to decay over.
`alpha`	A float. Minimum learning rate value for decay as a fraction of `initial_learning_rate`.
`name`	String. Optional name of the operation. Defaults to `"CosineDecay"`.
`warmup_target`	A float. The target learning rate for our warmup phase. Will cast to the `initial_learning_rate` datatype. Setting to `NULL` will skip warmup and begins decay phase from `initial_learning_rate`. Otherwise scheduler will warmup from `initial_learning_rate` to `warmup_target`.
`warmup_steps`	A int. Number of steps to warmup over.

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as `initial_learning_rate`.

See Also

- `https://keras.io/api/optimizers/learning_rate_schedules/cosine_decay#cosinedecay-class`

Other optimizer learning rate schedules:
`LearningRateSchedule()`
`learning_rate_schedule_cosine_decay_restarts()`
`learning_rate_schedule_exponential_decay()`
`learning_rate_schedule_inverse_time_decay()`
`learning_rate_schedule_piecewise_constant_decay()`
`learning_rate_schedule_polynomial_decay()`

`learning_rate_schedule_cosine_decay_restarts`

A `LearningRateSchedule` that uses a cosine decay schedule with restarts.

Description

See Loshchilov & Hutter, ICLR2016, SGDR: Stochastic Gradient Descent with Warm Restarts.

When training a model, it is often useful to lower the learning rate as the training progresses. This schedule applies a cosine decay function with restarts to an optimizer step, given a provided initial learning rate. It requires a `step` value to compute the decayed learning rate. You can just pass a backend variable that you increment at each training step.

The schedule is a 1-arg callable that produces a decayed learning rate when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions.

The learning rate multiplier first decays from 1 to `alpha` for `first_decay_steps` steps. Then, a warm restart is performed. Each new warm restart runs for `t_mul` times more steps and with `m_mul` times initial learning rate as the new learning rate.

Usage

```
learning_rate_schedule_cosine_decay_restarts(
  initial_learning_rate,
  first_decay_steps,
  t_mul = 2,
  m_mul = 1,
  alpha = 0,
  name = "SGDRDecay"
)
```

Arguments

- `initial_learning_rate`: A float. The initial learning rate.
- `first_decay_steps`: An integer. Number of steps to decay over.
- `t_mul`: A float. Used to derive the number of iterations in the i-th period.
- `m_mul`: A float. Used to derive the initial learning rate of the i-th period.
- `alpha`: A float. Minimum learning rate value as a fraction of the `initial_learning_rate`.
- `name`: String. Optional name of the operation. Defaults to `"SGDRDecay"`.

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as `initial_learning_rate`.

Example

```
first_decay_steps <- 1000
lr_decayed_fn <- learning_rate_schedule_cosine_decay_restarts(
        0.001,
        first_decay_steps)
```

You can pass this schedule directly into a `optimizer` as the learning rate. The learning rate schedule is also serializable and deserializable using `keras$optimizers$schedules$serialize` and `keras$optimizers$schedules$deserialize`.

See Also

- https://keras.io/api/optimizers/learning_rate_schedules/cosine_decay_restarts#cosinedecayrestarts-class

Other optimizer learning rate schedules:
`LearningRateSchedule()`
`learning_rate_schedule_cosine_decay()`
`learning_rate_schedule_exponential_decay()`
`learning_rate_schedule_inverse_time_decay()`
`learning_rate_schedule_piecewise_constant_decay()`
`learning_rate_schedule_polynomial_decay()`

`learning_rate_schedule_exponential_decay`
A `LearningRateSchedule` *that uses an exponential decay schedule.*

Description

When training a model, it is often useful to lower the learning rate as the training progresses. This schedule applies an exponential decay function to an optimizer step, given a provided initial learning rate.

The schedule is a 1-arg callable that produces a decayed learning rate when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions. It is computed as:

```
decayed_learning_rate <- function(step) {
  initial_learning_rate * decay_rate ^ (step / decay_steps)
}
```

If the argument `staircase` is `TRUE`, then `step / decay_steps` is an integer division and the decayed learning rate follows a staircase function.

You can pass this schedule directly into a `optimizer` as the learning rate.

Usage

```
learning_rate_schedule_exponential_decay(
  initial_learning_rate,
  decay_steps,
  decay_rate,
  staircase = FALSE,
  name = "ExponentialDecay"
)
```

Arguments

`initial_learning_rate`	A float. The initial learning rate.
`decay_steps`	A integer. Must be positive. See the decay computation above.
`decay_rate`	A float. The decay rate.
`staircase`	Boolean. If `TRUE` decay the learning rate at discrete intervals.
`name`	String. Optional name of the operation. Defaults to `"ExponentialDecay"`.

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as `initial_learning_rate`.

Examples

When fitting a Keras model, decay every 100000 steps with a base of 0.96:

```
initial_learning_rate <- 0.1
lr_schedule <- learning_rate_schedule_exponential_decay(
    initial_learning_rate,
    decay_steps=100000,
    decay_rate=0.96,
    staircase=TRUE)

model %>% compile(
  optimizer = optimizer_sgd(learning_rate = lr_schedule),
  loss = 'sparse_categorical_crossentropy',
  metrics = c('accuracy'))

model %>% fit(data, labels, epochs=5)
```

The learning rate schedule is also serializable and deserializable using `keras$optimizers$schedules$serialize` and `keras$optimizers$schedules$deserialize`.

See Also

- https://keras.io/api/optimizers/learning_rate_schedules/exponential_decay#exponentialdecay-clas

Other optimizer learning rate schedules:
`LearningRateSchedule()`
`learning_rate_schedule_cosine_decay()`
`learning_rate_schedule_cosine_decay_restarts()`
`learning_rate_schedule_inverse_time_decay()`
`learning_rate_schedule_piecewise_constant_decay()`
`learning_rate_schedule_polynomial_decay()`

`learning_rate_schedule_inverse_time_decay`

A `LearningRateSchedule` that uses an inverse time decay schedule.

Description

When training a model, it is often useful to lower the learning rate as the training progresses. This schedule applies the inverse decay function to an optimizer step, given a provided initial learning rate. It requires a `step` value to compute the decayed learning rate. You can just pass a backend variable that you increment at each training step.

The schedule is a 1-arg callable that produces a decayed learning rate when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions. It is computed as:

```
decayed_learning_rate <- function(step) {
  initial_learning_rate / (1 + decay_rate * step / decay_step)
}
```

or, if `staircase` is `TRUE`, as:

```
decayed_learning_rate <- function(step) {
  initial_learning_rate /
           (1 + decay_rate * floor(step / decay_step))
}
```

You can pass this schedule directly into a `optimizer_*` as the learning rate.

Usage

```
learning_rate_schedule_inverse_time_decay(
  initial_learning_rate,
  decay_steps,
  decay_rate,
  staircase = FALSE,
  name = "InverseTimeDecay"
)
```

Arguments

`initial_learning_rate`	A float. The initial learning rate.
`decay_steps`	How often to apply decay.
`decay_rate`	A number. The decay rate.
`staircase`	Whether to apply decay in a discrete staircase, as o pposed to continuous, fashion.
`name`	String. Optional name of the operation. Defaults to `"InverseTimeDecay"`.

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as `initial_learning_rate`.

Examples

Fit a Keras model when decaying 1/t with a rate of 0.5:

```
...
initial_learning_rate <- 0.1
decay_steps <- 1.0
decay_rate <- 0.5
learning_rate_fn <- learning_rate_schedule_inverse_time_decay(
    initial_learning_rate, decay_steps, decay_rate)
```

```
model %>% compile(
  optimizer = optimizer_sgd(learning_rate=learning_rate_fn),
  loss = 'sparse_categorical_crossentropy',
  metrics = 'accuracy')
)

model %>% fit(data, labels, epochs=5)
```

See Also

- https://keras.io/api/optimizers/learning_rate_schedules/inverse_time_decay#inversetimedecay-class

Other optimizer learning rate schedules:
LearningRateSchedule()
learning_rate_schedule_cosine_decay()
learning_rate_schedule_cosine_decay_restarts()
learning_rate_schedule_exponential_decay()
learning_rate_schedule_piecewise_constant_decay()
learning_rate_schedule_polynomial_decay()

---

learning_rate_schedule_piecewise_constant_decay
A LearningRateSchedule *that uses a piecewise constant decay schedule.*

Description

The function returns a 1-arg callable to compute the piecewise constant when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions.

Usage

```
learning_rate_schedule_piecewise_constant_decay(
  boundaries,
  values,
  name = "PiecewiseConstant"
)
```

Arguments

boundaries	A list of Python numbers with strictly increasing entries, and with all elements having the same type as the optimizer step.

values — A list of Python numbers that specifies the values for the intervals defined by boundaries. It should have one more element than boundaries, and all elements should have the same type.

name — A string. Optional name of the operation. Defaults to "PiecewiseConstant".

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as the boundary tensors.

The output of the 1-arg function that takes the step is values[0] when step <= boundaries[0], values[1] when step > boundaries[0] and step <= boundaries[1], ..., and values[-1] when step > boundaries[-1].

Examples

use a learning rate that's 1.0 for the first 100001 steps, 0.5 for the next 10000 steps, and 0.1 for any additional steps.

```
step <- 0
boundaries <- c(100000, 110000)
values <- c(1.0, 0.5, 0.1)
learning_rate_fn <- learning_rate_schedule_piecewise_constant_decay(
  boundaries, values)

# Later, whenever we perform an optimization step, we pass in the step.
learning_rate <- learning_rate_fn(step)
```

You can pass this schedule directly into a optimizer as the learning rate. The learning rate schedule is also serializable and deserializable using keras$optimizers$schedules$serialize and keras$optimizers$schedules$deserialize.

Raises

ValueError: if the number of elements in the boundaries and values lists do not match.

See Also

- https://keras.io/api/optimizers/learning_rate_schedules/piecewise_constant_decay#piecewiseconstantdecay-class

Other optimizer learning rate schedules:
LearningRateSchedule()
learning_rate_schedule_cosine_decay()
learning_rate_schedule_cosine_decay_restarts()
learning_rate_schedule_exponential_decay()
learning_rate_schedule_inverse_time_decay()
learning_rate_schedule_polynomial_decay()

learning_rate_schedule_polynomial_decay
A LearningRateSchedule *that uses a polynomial decay schedule.*

Description

It is commonly observed that a monotonically decreasing learning rate, whose degree of change is carefully chosen, results in a better performing model. This schedule applies a polynomial decay function to an optimizer step, given a provided initial_learning_rate, to reach an end_learning_rate in the given decay_steps.

It requires a step value to compute the decayed learning rate. You can just pass a backend variable that you increment at each training step.

The schedule is a 1-arg callable that produces a decayed learning rate when passed the current optimizer step. This can be useful for changing the learning rate value across different invocations of optimizer functions. It is computed as:

```
decayed_learning_rate <- function(step) {
  step = min(step, decay_steps)
  ((initial_learning_rate - end_learning_rate) *
    (1 - step / decay_steps) ^ (power)) +
    end_learning_rate
}
```

If cycle is TRUE then a multiple of decay_steps is used, the first one that is bigger than step.

```
decayed_learning_rate <- function(step) {
  decay_steps = decay_steps * ceil(step / decay_steps)
  ((initial_learning_rate - end_learning_rate) *
      (1 - step / decay_steps) ^ (power)) +
    end_learning_rate
}
```

You can pass this schedule directly into a Optimizer as the learning rate.

Usage

```
learning_rate_schedule_polynomial_decay(
  initial_learning_rate,
  decay_steps,
  end_learning_rate = 1e-04,
  power = 1,
  cycle = FALSE,
  name = "PolynomialDecay"
)
```

Arguments

`initial_learning_rate`	A float. The initial learning rate.
`decay_steps`	A integer. Must be positive. See the decay computation above.
`end_learning_rate`	A float. The minimal end learning rate.
`power`	A float. The power of the polynomial. Defaults to `1.0`.
`cycle`	A boolean, whether it should cycle beyond decay_steps.
`name`	String. Optional name of the operation. Defaults to `"PolynomialDecay"`.

Value

A 1-arg callable learning rate schedule that takes the current optimizer step and outputs the decayed learning rate, a scalar tensor of the same type as `initial_learning_rate`.

Examples

Fit a model while decaying from 0.1 to 0.01 in 10000 steps using sqrt (i.e. power=0.5):

```
...
starter_learning_rate <- 0.1
end_learning_rate <- 0.01
decay_steps <- 10000
learning_rate_fn <- learning_rate_schedule_polynomial_decay(
    starter_learning_rate,
    decay_steps,
    end_learning_rate,
    power=0.5)

model %>% compile(
  optimizer = optimizer_sgd(learning_rate=learning_rate_fn),
  loss = 'sparse_categorical_crossentropy',
  metrics = 'accuracy'
)

model %>% fit(data, labels, epochs=5)
```

The learning rate schedule is also serializable and deserializable using `keras$optimizers$schedules$serialize` and `keras$optimizers$schedules$deserialize`.

See Also

- https://keras.io/api/optimizers/learning_rate_schedules/polynomial_decay#polynomialdecay-class

Other optimizer learning rate schedules:
`LearningRateSchedule()`
`learning_rate_schedule_cosine_decay()`
`learning_rate_schedule_cosine_decay_restarts()`

learning_rate_schedule_exponential_decay()
learning_rate_schedule_inverse_time_decay()
learning_rate_schedule_piecewise_constant_decay()

---

load_model *Loads a model saved via* save_model().

Description

Loads a model saved via save_model().

Usage

```
load_model(model, custom_objects = NULL, compile = TRUE, safe_mode = TRUE)
```

Arguments

model	string, path to the saved model file, or a raw vector, as returned by save_model(filepath = NULL)
custom_objects	Optional named list mapping names to custom classes or functions to be considered during deserialization.
compile	Boolean, whether to compile the model after loading.
safe_mode	Boolean, whether to disallow unsafe lambda deserialization. When safe_mode=FALSE, loading an object has the potential to trigger arbitrary code execution. This argument is only applicable to the Keras v3 model format. Defaults to TRUE.

Value

A Keras model instance. If the original model was compiled, and the argument compile = TRUE is set, then the returned model will be compiled. Otherwise, the model will be left uncompiled.

Examples

```
model <- keras_model_sequential(input_shape = c(3)) |>
  layer_dense(5) |>
  layer_activation_softmax()

model |> save_model("model.keras")
loaded_model <- load_model("model.keras")

x <- random_uniform(c(10, 3))
stopifnot(all.equal(
  model |> predict(x),
  loaded_model |> predict(x)
))
```

Note that the model variables may have different name values (`var$name` property, e.g. `"dense_1/kernel:0"`) after being reloaded. It is recommended that you use layer attributes to access specific variables, e.g. `model |> get_layer("dense_1") |> _$kernel`.

See Also

- https://keras.io/api/models/model_saving_apis/model_saving_and_loading#loadmodel-function

Other saving and loading functions:
`export_savedmodel.keras.src.models.model.Model()`
`layer_tfsm()`
`load_model_weights()`
`register_keras_serializable()`
`save_model()`
`save_model_config()`
`save_model_weights()`
`with_custom_object_scope()`

`load_model_weights` *Load weights from a file saved via* `save_model_weights()`.

Description

Weights are loaded based on the network's topology. This means the architecture should be the same as when the weights were saved. Note that layers that don't have weights are not taken into account in the topological ordering, so adding or removing layers is fine as long as they don't have weights.

Partial weight loading

If you have modified your model, for instance by adding a new layer (with weights) or by changing the shape of the weights of a layer, you can choose to ignore errors and continue loading by setting `skip_mismatch=TRUE`. In this case any layer with mismatching weights will be skipped. A warning will be displayed for each skipped layer.

Usage

```
load_model_weights(model, filepath, skip_mismatch = FALSE, ...)
```

Arguments

`model`	A keras model.
`filepath`	String, path to the weights file to load. It can either be a `.weights.h5` file or a legacy `.h5` weights file.
`skip_mismatch`	Boolean, whether to skip loading of layers where there is a mismatch in the number of weights, or a mismatch in the shape of the weights.
`...`	For forward/backward compatability.

Value

This is called primarily for side effects. `model` is returned, invisibly, to enable usage with the pipe.

See Also

- https://keras.io/api/models/model_saving_apis/weights_saving_and_loading#loadweights-method

Other saving and loading functions:
`export_savedmodel.keras.src.models.model.Model()`
`layer_tfsm()`
`load_model()`
`register_keras_serializable()`
`save_model()`
`save_model_config()`
`save_model_weights()`
`with_custom_object_scope()`

`Loss` *Subclass the base* `Loss` *class*

Description

Use this to define a custom loss class. Note, in most cases you do not need to subclass `Loss` to define a custom loss: you can also pass a bare R function, or a named R function defined with `custom_metric()`, as a loss function to `compile()`.

Usage

```
Loss(
  classname,
  call = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

`classname`	String, the name of the custom class. (Conventionally, CamelCase).
`call`	`function(y_true, y_pred)` Method to be implemented by subclasses: Function that contains the logic for loss calculation using `y_true`, `y_pred`.
`..., public`	Additional methods or public members of the custom class.

`private`	Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.
`inherit`	What the custom class will subclass. By default, the base keras class.
`parent_env`	The R environment that all class methods will have as a grandparent.

Details

Example subclass implementation:

```
loss_custom_mse <- Loss(
  classname = "CustomMeanSquaredError",
  call = function(y_true, y_pred) {
    op_mean(op_square(y_pred - y_true), axis = -1)
  }
)

# Usage in compile()
model <- keras_model_sequential(input_shape = 10) |> layer_dense(10)
model |> compile(loss = loss_custom_mse())

# Standalone usage
mse <- loss_custom_mse(name = "my_custom_mse_instance")

y_true <- op_arange(20) |> op_reshape(c(4, 5))
y_pred <- op_arange(20) |> op_reshape(c(4, 5)) * 2
(loss <- mse(y_true, y_pred))

## tf.Tensor(143.5, shape=(), dtype=float32)


loss2 <- (y_pred - y_true)^2 |>
  op_mean(axis = -1) |>
  op_mean()

stopifnot(all.equal(as.array(loss), as.array(loss2)))

sample_weight <-array(c(.25, .25, 1, 1))
(weighted_loss <- mse(y_true, y_pred, sample_weight = sample_weight))

## tf.Tensor(129.0625, shape=(), dtype=float32)


weighted_loss2 <- (y_true - y_pred)^2 |>
  op_mean(axis = -1) |>
  op_multiply(sample_weight) |>
```

```
  op_mean()

stopifnot(all.equal(as.array(weighted_loss),
                    as.array(weighted_loss2)))
```

Value

A function that returns `Loss` instances, similar to the builtin loss functions.

Methods defined by base `Loss` class:

- `initialize(name=NULL, reduction="sum_over_batch_size", dtype=NULL)`
  Args:
  - `name`: Optional name for the loss instance.
  - `reduction`: Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
  - `dtype`: The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.
- `__call__(y_true, y_pred, sample_weight=NULL)`
  Call the loss instance as a function, optionally with `sample_weight`.
- `get_config()`

Readonly properties:

- `dtype`

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

See Also

Other losses:
`loss_binary_crossentropy()`
`loss_binary_focal_crossentropy()`
`loss_categorical_crossentropy()`

loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_binary_crossentropy

Computes the cross-entropy loss between true labels and predicted labels.

Description

Use this cross-entropy loss for binary (0 or 1) classification applications. The loss function requires the following inputs:

- y_true (true label): This is either 0 or 1.

- y_pred (predicted value): This is the model's prediction, i.e, a single floating-point value which either represents a logit, (i.e, value in [-inf, inf] when from_logits=TRUE) or a probability (i.e, value in [0., 1.] when from_logits=FALSE).

Usage

```
loss_binary_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  reduction = "sum_over_batch_size",
  name = "binary_crossentropy",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values. shape = [batch_size, d0, .. dN].
y_pred	The predicted values. shape = [batch_size, d0, .. dN].
from_logits	Whether to interpret y_pred as a tensor of logit values. By default, we assume that y_pred is probabilities (i.e., values in [0, 1]).
label_smoothing	Float in range [0, 1]. When 0, no smoothing occurs. When > 0, we compute the loss between the predicted labels and a smoothed version of the true labels, where the smoothing squeezes the labels towards 0.5. Larger values of label_smoothing correspond to heavier smoothing.
axis	The axis along which to compute crossentropy (the features axis). Defaults to -1.
...	For forward/backward compatability.
reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Binary crossentropy loss value. shape = [batch_size, d0, .. dN-1].

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_binary_crossentropy(y_true, y_pred)
loss

## tf.Tensor([0.91629076 0.7135582 ], shape=(2), dtype=float32)
```

Recommended Usage: (set `from_logits=TRUE`)

With `compile()` API:

```
model %>% compile(
    loss = loss_binary_crossentropy(from_logits=TRUE),
    ...
)
```

As a standalone function:

```
# Example 1: (batch_size = 1, number of samples = 4)
y_true <- op_array(c(0, 1, 0, 0))
y_pred <- op_array(c(-18.6, 0.51, 2.94, -12.8))
bce <- loss_binary_crossentropy(from_logits = TRUE)
bce(y_true, y_pred)

## tf.Tensor(0.865458, shape=(), dtype=float32)


# Example 2: (batch_size = 2, number of samples = 4)
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(-18.6, 0.51), c(2.94, -12.8))
# Using default 'auto'/'sum_over_batch_size' reduction type.
bce <- loss_binary_crossentropy(from_logits = TRUE)
bce(y_true, y_pred)

## tf.Tensor(0.865458, shape=(), dtype=float32)


# Using 'sample_weight' attribute
bce(y_true, y_pred, sample_weight = c(0.8, 0.2))

## tf.Tensor(0.2436386, shape=(), dtype=float32)


# 0.243
# Using 'sum' reduction` type.
bce <- loss_binary_crossentropy(from_logits = TRUE, reduction = "sum")
bce(y_true, y_pred)
```

```
## tf.Tensor(1.730916, shape=(), dtype=float32)


# Using 'none' reduction type.
bce <- loss_binary_crossentropy(from_logits = TRUE, reduction = NULL)
bce(y_true, y_pred)

## tf.Tensor([0.23515666 1.4957594 ], shape=(2), dtype=float32)
```

Default Usage: (set `from_logits=FALSE`)

```
# Make the following updates to the above "Recommended Usage" section
# 1. Set `from_logits=FALSE`
loss_binary_crossentropy() # OR ...('from_logits=FALSE')

## <LossFunctionWrapper(<function binary_crossentropy at 0x0>, kwargs={'from_logits': False, 'label_sm
##  signature: (y_true, y_pred, sample_weight=None)


# 2. Update `y_pred` to use probabilities instead of logits
y_pred <- c(0.6, 0.3, 0.2, 0.8) # OR [[0.6, 0.3], [0.2, 0.8]]
```

See Also

- https://keras.io/api/losses/probabilistic_losses#binarycrossentropy-class

Other losses:
Loss()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()

metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_binary_focal_crossentropy
Computes focal cross-entropy loss between true labels and predictions.

Description

According to Lin et al., 2018, it helps to apply a focal factor to down-weight easy examples and focus more on hard examples. By default, the focal tensor is computed as follows:

focal_factor = (1 - output)^gamma for class 1 focal_factor = output^gamma for class 0 where gamma is a focusing parameter. When gamma = 0, there is no focal effect on the binary crossentropy loss.

If apply_class_balancing == TRUE, this function also takes into account a weight balancing factor for the binary classes 0 and 1 as follows:

weight = alpha for class 1 (target == 1) weight = 1 - alpha for class 0 where alpha is a float in the range of [0, 1].

Binary cross-entropy loss is often used for binary (0 or 1) classification tasks. The loss function requires the following inputs:

- y_true (true label): This is either 0 or 1.
- y_pred (predicted value): This is the model's prediction, i.e, a single floating-point value which either represents a logit, (i.e, value in [-inf, inf] when from_logits=TRUE) or a probability (i.e, value in [0., 1.] when from_logits=FALSE).

According to Lin et al., 2018, it helps to apply a "focal factor" to down-weight easy examples and focus more on hard examples. By default, the focal tensor is computed as follows:

focal_factor = (1 - output) ** gamma for class 1 focal_factor = output ** gamma for class 0 where gamma is a focusing parameter. When gamma=0, this function is equivalent to the binary crossentropy loss.

Usage

```
loss_binary_focal_crossentropy(
  y_true,
  y_pred,
  apply_class_balancing = FALSE,
  alpha = 0.25,
  gamma = 2,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  reduction = "sum_over_batch_size",
  name = "binary_focal_crossentropy",
  dtype = NULL
)
```

Arguments

- `y_true` Ground truth values, of shape `(batch_size, d0, .. dN)`.
- `y_pred` The predicted values, of shape `(batch_size, d0, .. dN)`.
- `apply_class_balancing` A bool, whether to apply weight balancing on the binary classes 0 and 1.
- `alpha` A weight balancing factor for class 1, default is `0.25` as mentioned in reference Lin et al., 2018. The weight for class 0 is `1.0 - alpha`.
- `gamma` A focusing parameter used to compute the focal factor, default is `2.0` as mentioned in the reference Lin et al., 2018.
- `from_logits` Whether to interpret `y_pred` as a tensor of logit values. By default, we assume that `y_pred` are probabilities (i.e., values in `[0, 1]`).
- `label_smoothing` Float in `[0, 1]`. When `0`, no smoothing occurs. When > `0`, we compute the loss between the predicted labels and a smoothed version of the true labels, where the smoothing squeezes the labels towards `0.5`. Larger values of `label_smoothing` correspond to heavier smoothing.
- `axis` The axis along which to compute crossentropy (the features axis). Defaults to `-1`.
- `...` For forward/backward compatability.
- `reduction` Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
- `name` Optional name for the loss instance.
- `dtype` The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different

value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Binary focal crossentropy loss value with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_binary_focal_crossentropy(y_true, y_pred, gamma = 2)
loss
```

```
## tf.Tensor([0.32986468 0.20579839], shape=(2), dtype=float32)
```

With the `compile()` API:

```
model %>% compile(
    loss = loss_binary_focal_crossentropy(
        gamma = 2.0, from_logits = TRUE),
    ...
)
```

As a standalone function:

```
# Example 1: (batch_size = 1, number of samples = 4)
y_true <- op_array(c(0, 1, 0, 0))
y_pred <- op_array(c(-18.6, 0.51, 2.94, -12.8))
loss <- loss_binary_focal_crossentropy(gamma = 2, from_logits = TRUE)
loss(y_true, y_pred)
```

```
## tf.Tensor(0.6912122, shape=(), dtype=float32)
```

```
# Apply class weight
loss <- loss_binary_focal_crossentropy(
  apply_class_balancing = TRUE, gamma = 2, from_logits = TRUE)
loss(y_true, y_pred)
```

```
## tf.Tensor(0.5101333, shape=(), dtype=float32)
```

```
# Example 2: (batch_size = 2, number of samples = 4)
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(-18.6, 0.51), c(2.94, -12.8))
# Using default 'auto'/'sum_over_batch_size' reduction type.
loss <- loss_binary_focal_crossentropy(
    gamma = 3, from_logits = TRUE)
loss(y_true, y_pred)
```

```
## tf.Tensor(0.6469951, shape=(), dtype=float32)


# Apply class weight
loss <- loss_binary_focal_crossentropy(
     apply_class_balancing = TRUE, gamma = 3, from_logits = TRUE)
loss(y_true, y_pred)

## tf.Tensor(0.48214132, shape=(), dtype=float32)


# Using 'sample_weight' attribute with focal effect
loss <- loss_binary_focal_crossentropy(
    gamma = 3, from_logits = TRUE)
loss(y_true, y_pred, sample_weight = c(0.8, 0.2))

## tf.Tensor(0.13312504, shape=(), dtype=float32)


# Apply class weight
loss <- loss_binary_focal_crossentropy(
     apply_class_balancing = TRUE, gamma = 3, from_logits = TRUE)
loss(y_true, y_pred, sample_weight = c(0.8, 0.2))

## tf.Tensor(0.09735977, shape=(), dtype=float32)


# Using 'sum' reduction` type.
loss <- loss_binary_focal_crossentropy(
    gamma = 4, from_logits = TRUE,
    reduction = "sum")
loss(y_true, y_pred)

## tf.Tensor(1.2218808, shape=(), dtype=float32)


# Apply class weight
loss <- loss_binary_focal_crossentropy(
    apply_class_balancing = TRUE, gamma = 4, from_logits = TRUE,
    reduction = "sum")
loss(y_true, y_pred)

## tf.Tensor(0.9140807, shape=(), dtype=float32)


# Using 'none' reduction type.
loss <- loss_binary_focal_crossentropy(
    gamma = 5, from_logits = TRUE,
    reduction = NULL)
loss(y_true, y_pred)
```

```
## tf.Tensor([0.00174837 1.1561027 ], shape=(2), dtype=float32)


# Apply class weight
loss <- loss_binary_focal_crossentropy(
    apply_class_balancing = TRUE, gamma = 5, from_logits = TRUE,
    reduction = NULL)
loss(y_true, y_pred)

## tf.Tensor([4.3709317e-04 8.6707699e-01], shape=(2), dtype=float32)
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()

metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_categorical_crossentropy
Computes the crossentropy loss between the labels and predictions.

Description

Use this crossentropy loss function when there are two or more label classes. We expect labels to be provided in a one_hot representation. If you want to provide labels as integers, please use SparseCategoricalCrossentropy loss. There should be num_classes floating point values per feature, i.e., the shape of both y_pred and y_true are [batch_size, num_classes].

Usage

```
loss_categorical_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  reduction = "sum_over_batch_size",
  name = "categorical_crossentropy",
  dtype = NULL
)
```

Arguments

y_true	Tensor of one-hot true targets.
y_pred	Tensor of predicted targets.
from_logits	Whether y_pred is expected to be a logits tensor. By default, we assume that y_pred encodes a probability distribution.
label_smoothing	Float in [0, 1]. When > 0, label values are smoothed, meaning the confidence on label values are relaxed. For example, if 0.1, use 0.1 / num_classes for non-target labels and 0.9 + 0.1 / num_classes for target labels.
axis	The axis along which to compute crossentropy (the features axis). Defaults to -1.
...	For forward/backward compatability.

reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Categorical crossentropy loss value.

Examples

```
y_true <- rbind(c(0, 1, 0), c(0, 0, 1))
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
loss <- loss_categorical_crossentropy(y_true, y_pred)
loss

## tf.Tensor([0.05129331 2.3025851 ], shape=(2), dtype=float32)
```

Standalone usage:

```
y_true <- rbind(c(0, 1, 0), c(0, 0, 1))
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
# Using 'auto'/'sum_over_batch_size' reduction type.
cce <- loss_categorical_crossentropy()
cce(y_true, y_pred)

## tf.Tensor(1.1769392, shape=(), dtype=float32)

# Calling with 'sample_weight'.
cce(y_true, y_pred, sample_weight = op_array(c(0.3, 0.7)))

## tf.Tensor(0.8135988, shape=(), dtype=float32)

# Using 'sum' reduction type.
cce <- loss_categorical_crossentropy(reduction = "sum")
cce(y_true, y_pred)
```

```
## tf.Tensor(2.3538785, shape=(), dtype=float32)


# Using 'none' reduction type.
cce <- loss_categorical_crossentropy(reduction = NULL)
cce(y_true, y_pred)

## tf.Tensor([0.05129331 2.3025851 ], shape=(2), dtype=float32)
```

Usage with the `compile()` API:

```
model %>% compile(optimizer = 'sgd',
              loss=loss_categorical_crossentropy())
```

See Also

- https://keras.io/api/losses/probabilistic_losses#categoricalcrossentropy-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()

metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_categorical_focal_crossentropy
Computes the alpha balanced focal crossentropy loss.

Description

Use this crossentropy loss function when there are two or more label classes and if you want to handle class imbalance without using `class_weights`. We expect labels to be provided in a `one_hot` representation.

According to Lin et al., 2018, it helps to apply a focal factor to down-weight easy examples and focus more on hard examples. The general formula for the focal loss (FL) is as follows:

`FL(p_t) = (1 - p_t)^gamma * log(p_t)`

where `p_t` is defined as follows: `p_t = output if y_true == 1, else 1 - output`

`(1 - p_t)^gamma` is the `modulating_factor`, where `gamma` is a focusing parameter. When `gamma` = 0, there is no focal effect on the cross entropy. `gamma` reduces the importance given to simple examples in a smooth manner.

The authors use alpha-balanced variant of focal loss (FL) in the paper: `FL(p_t) = -alpha * (1 - p_t)^gamma * log(p_t)`

where `alpha` is the weight factor for the classes. If `alpha` = 1, the loss won't be able to handle class imbalance properly as all classes will have the same weight. This can be a constant or a list of constants. If alpha is a list, it must have the same length as the number of classes.

The formula above can be generalized to: `FL(p_t) = alpha * (1 - p_t)^gamma * CrossEntropy(y_true, y_pred)`

where minus comes from `CrossEntropy(y_true, y_pred)` (CE).

Extending this to multi-class case is straightforward: `FL(p_t) = alpha * (1 - p_t) ** gamma * CategoricalCE(y_true, y_pred)`

In the snippet below, there is `num_classes` floating pointing values per example. The shape of both `y_pred` and `y_true` are `(batch_size, num_classes)`.

Usage

```
loss_categorical_focal_crossentropy(
  y_true,
  y_pred,
  alpha = 0.25,
  gamma = 2,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  reduction = "sum_over_batch_size",
  name = "categorical_focal_crossentropy",
  dtype = NULL
)
```

Arguments

- `y_true` Tensor of one-hot true targets.
- `y_pred` Tensor of predicted targets.
- `alpha` A weight balancing factor for all classes, default is `0.25` as mentioned in the reference. It can be a list of floats or a scalar. In the multi-class case, alpha may be set by inverse class frequency by using `compute_class_weight` from `sklearn.utils`.
- `gamma` A focusing parameter, default is `2.0` as mentioned in the reference. It helps to gradually reduce the importance given to simple examples in a smooth manner. When `gamma` = 0, there is no focal effect on the categorical crossentropy.
- `from_logits` Whether `output` is expected to be a logits tensor. By default, we consider that `output` encodes a probability distribution.
- `label_smoothing` Float in `[0, 1]`. When > 0, label values are smoothed, meaning the confidence on label values are relaxed. For example, if `0.1`, use `0.1` / `num_classes` for non-target labels and `0.9` + `0.1` / `num_classes` for target labels.
- `axis` The axis along which to compute crossentropy (the features axis). Defaults to `-1`.
- `...` For forward/backward compatability.
- `reduction` Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
- `name` Optional name for the loss instance.
- `dtype` The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Categorical focal crossentropy loss value.

Examples

```
y_true <- rbind(c(0, 1, 0), c(0, 0, 1))
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
loss <- loss_categorical_focal_crossentropy(y_true, y_pred)
loss

## tf.Tensor([3.2058331e-05 4.6627346e-01], shape=(2), dtype=float32)
```

Standalone usage:

```
y_true <- rbind(c(0, 1, 0), c(0, 0, 1))
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
# Using 'auto'/'sum_over_batch_size' reduction type.
cce <- loss_categorical_focal_crossentropy()
cce(y_true, y_pred)

## tf.Tensor(0.23315276, shape=(), dtype=float32)


# Calling with 'sample_weight'.
cce(y_true, y_pred, sample_weight = op_array(c(0.3, 0.7)))

## tf.Tensor(0.16320053, shape=(), dtype=float32)


# Using 'sum' reduction type.
cce <- loss_categorical_focal_crossentropy(reduction = "sum")
cce(y_true, y_pred)

## tf.Tensor(0.46630552, shape=(), dtype=float32)


# Using 'none' reduction type.
cce <- loss_categorical_focal_crossentropy(reduction = NULL)
cce(y_true, y_pred)

## tf.Tensor([3.2058331e-05 4.6627346e-01], shape=(2), dtype=float32)
```

Usage with the `compile()` API:

```
model %>% compile(
  optimizer = 'adam',
  loss = loss_categorical_focal_crossentropy())
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_categorical_hinge

Computes the categorical hinge loss between `y_true` *&* `y_pred`*.*

Description

Formula:

```
loss <- maximum(neg - pos + 1, 0)
```

where `neg=maximum((1-y_true)*y_pred)` and `pos=sum(y_true*y_pred)`

Usage

```
loss_categorical_hinge(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "categorical_hinge",
  dtype = NULL
)
```

Arguments

`y_true`	The ground truth values. `y_true` values are expected to be either `{-1, +1}` or `{0, 1}` (i.e. a one-hot-encoded tensor) with shape <- `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Categorical hinge loss values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_categorical_hinge(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/hinge_losses#categoricalhinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

`loss_circle` *Computes Circle Loss between integer labels and L2-normalized embeddings.*

Description

It is designed to minimize within-class distances and maximize between-class distances in L2 normalized embedding space.

This is a metric learning loss designed to minimize within-class distance and maximize between-class distance in a flexible manner by dynamically adjusting the penalty strength based on optimization status of each similarity score.

To use Circle Loss effectively, the model should output embeddings without an activation function (such as a `Dense` layer with `activation=NULL`) followed by `UnitNormalization` layer to ensure unit-norm embeddings.

Usage

```
loss_circle(
  y_true,
  y_pred,
  ref_labels = NULL,
  ref_embeddings = NULL,
  remove_diagonal = TRUE,
  gamma = 80L,
  margin = 0.4,
  ...,
  reduction = "sum_over_batch_size",
  name = "circle",
  dtype = NULL
)
```

Arguments

`y_true`	Tensor with ground truth labels in integer format.
`y_pred`	Tensor with predicted L2 normalized embeddings.
`ref_labels`	Optional integer tensor with labels for reference embeddings. If `NULL`, defaults to `y_true`.
`ref_embeddings`	Optional tensor with L2 normalized reference embeddings. If `NULL`, defaults to `y_pred`.
`remove_diagonal`	Boolean, whether to remove self-similarities from the positive mask. Defaults to `TRUE`.
`gamma`	Scaling factor that determines the largest scale of each similarity score. Defaults to `80`.
`margin`	The relaxation factor, below this distance, negatives are up weighted and positives are down weighted. Similarly, above this distance negatives are down weighted and positive are up weighted. Defaults to `0.4`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"`

	or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras.DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Circle loss value.

Examples

Usage with the compile() API:

```
model <- keras_model_sequential(input_shape = c(224, 224, 3)) |>
  layer_conv_2d(16, c(3, 3), activation = 'relu') |>
  layer_flatten() |>
  layer_dense(64, activation = NULL) |>   # No activation
  layer_unit_normalization()  # L2 normalization

model |>
  compile(optimizer = "adam", loss = loss_circle())
```

Reference

- Yifan Sun et al., 2020

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()

loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_cosine_similarity
Computes the cosine similarity between y_true *&* y_pred.

Description

Formula:

```
loss <- -sum(l2_norm(y_true) * l2_norm(y_pred))
```

Note that it is a number between -1 and 1. When it is a negative number between -1 and 0, 0 indicates orthogonality and values closer to -1 indicate greater similarity. This makes it usable as a loss function in a setting where you try to maximize the proximity between predictions and targets. If either y_true or y_pred is a zero vector, cosine similarity will be 0 regardless of the proximity between predictions and targets.

Usage

```
loss_cosine_similarity(
  y_true,
  y_pred,
  axis = -1L,
  ...,
```

```
  reduction = "sum_over_batch_size",
  name = "cosine_similarity",
  dtype = NULL
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
axis	The axis along which the cosine similarity is computed (the features axis). Defaults to -1.
...	For forward/backward compatability.
reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Cosine similarity tensor.

Examples

```
y_true <- rbind(c(0., 1.), c(1., 1.), c(1., 1.))
y_pred <- rbind(c(1., 0.), c(1., 1.), c(-1., -1.))
loss <- loss_cosine_similarity(y_true, y_pred, axis=-1)
loss

## tf.Tensor([-0.         -0.99999994  0.99999994], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/losses/regression_losses#cosinesimilarity-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()

loss_categorical_hinge()
loss_circle()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_ctc *CTC (Connectionist Temporal Classification) loss.*

Description

CTC (Connectionist Temporal Classification) loss.

Usage

```
loss_ctc(
  y_true,
  y_pred,
  ...,
```

```
  reduction = "sum_over_batch_size",
  name = "ctc",
  dtype = NULL
)
```

Arguments

- `y_true` A tensor of shape `(batch_size, target_max_length)` containing the true labels in integer format. `0` always represents the blank/mask index and should not be used for classes.
- `y_pred` A tensor of shape `(batch_size, output_max_length, num_classes)` containing logits (the output of your model). They should *not* be normalized via softmax.
- `...` For forward/backward compatability.
- `reduction` Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
- `name` Optional name for the loss instance.
- `dtype` The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

CTC loss value.

See Also

Other losses:
`Loss()`
`loss_binary_crossentropy()`
`loss_binary_focal_crossentropy()`
`loss_categorical_crossentropy()`
`loss_categorical_focal_crossentropy()`
`loss_categorical_hinge()`
`loss_circle()`
`loss_cosine_similarity()`
`loss_dice()`
`loss_hinge()`
`loss_huber()`
`loss_kl_divergence()`
`loss_log_cosh()`
`loss_mean_absolute_error()`
`loss_mean_absolute_percentage_error()`

loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_dice *Computes the Dice loss value between* y_true *and* y_pred*.*

Description

Formula:

```
loss = 1 - (2 * sum(y_true * y_pred)) / (sum(y_true) + sum(y_pred))
```

Formula:

```
loss = 1 - (2 * sum(y_true * y_pred)) / (sum(y_true) + sum(y_pred))
```

Usage

```
loss_dice(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "dice",
  axis = NULL,
  dtype = NULL
)
```

Arguments

`y_true`	Tensor of true targets.
`y_pred`	Tensor of predicted targets.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	String, name for the object
`axis`	List of which dimensions the loss is calculated. Defaults to `NULL`.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

if `y_true` and `y_pred` are provided, Dice loss value. Otherwise, a `Loss()` instance.

Example

```
y_true <- array(c(1, 1, 0, 0,
                  1, 1, 0, 0), dim = c(2, 2, 2, 1))
y_pred <- array(c(0, 0.4, 0,   0,
                  1,   0, 1, 0.9), dim = c(2, 2, 2, 1))

axis <- c(2, 3, 4)
loss <- loss_dice(y_true, y_pred, axis = axis)
stopifnot(shape(loss) == shape(2))
loss


## tf.Tensor([0.5        0.75757575], shape=(2), dtype=float32)



loss = loss_dice(y_true, y_pred)
stopifnot(shape(loss) == shape())
loss


## tf.Tensor(0.6164384, shape=(), dtype=float32)
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_hinge — *Computes the hinge loss between* `y_true` *&* `y_pred`*.*

Description

Formula:

```
loss <- mean(maximum(1 - y_true * y_pred, 0), axis=-1)
```

y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1.

Usage

```
loss_hinge(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "hinge",
  dtype = NULL
)
```

Arguments

y_true	The ground truth values. y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided they will be converted to -1 or 1 with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Hinge loss values with shape = [batch_size, d0, .. dN-1].

Examples

```
y_true <- array(sample(c(-1,1), 6, replace = TRUE), dim = c(2, 3))
y_pred <- random_uniform(c(2, 3))
loss <- loss_hinge(y_true, y_pred)
loss

## tf.Tensor([1.0610152  0.93285507], shape=(2), dtype=float32)
```

See Also

- https://keras.io/api/losses/hinge_losses#hinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_huber *Computes the Huber loss between* y_true *&* y_pred.

Description

Formula:

```
for (x in error) {
  if (abs(x) <= delta){
    loss <- c(loss, (0.5 * x^2))
  } else if (abs(x) > delta) {
    loss <- c(loss, (delta * abs(x) - 0.5 * delta^2))
  }
}
loss <- mean(loss)
```

See: Huber loss.

Usage

```
loss_huber(
  y_true,
  y_pred,
  delta = 1,
  ...,
  reduction = "sum_over_batch_size",
  name = "huber_loss",
  dtype = NULL
)
```

Arguments

`y_true`	tensor of true targets.
`y_pred`	tensor of predicted targets.
`delta`	A float, the point where the Huber loss function changes from a quadratic to linear. Defaults to `1.0`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to loss. Options are `"sum"`, `"sum_over_batch_size"` or `NULL`. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Tensor with one scalar loss entry per sample.

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_huber(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/regression_losses#huber-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_kl_divergence   *Computes Kullback-Leibler divergence loss between* `y_true` *&* `y_pred`*.*

Description

Formula:

```
loss <- y_true * log(y_true / y_pred)
```

`y_true` and `y_pred` are expected to be probability distributions, with values between 0 and 1. They will get clipped to the `[0, 1]` range.

Usage

```
loss_kl_divergence(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "kl_divergence",
  dtype = NULL
)
```

Arguments

`y_true`	Tensor of true targets.
`y_pred`	Tensor of predicted targets.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

KL Divergence loss values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- random_uniform(c(2, 3), 0, 2)
y_pred <- random_uniform(c(2,3))
loss <- loss_kl_divergence(y_true, y_pred)
loss

## tf.Tensor([ 2.4290292 -0.6284211], shape=(2), dtype=float32)
```

See Also

- https://keras.io/api/losses/probabilistic_losses#kldivergence-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()

metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_log_cosh — *Computes the logarithm of the hyperbolic cosine of the prediction error.*

Description

Formula:

```
loss <- mean(log(cosh(y_pred - y_true)), axis=-1)
```

Note that `log(cosh(x))` is approximately equal to `(x ** 2) / 2` for small `x` and to `abs(x) - log(2)` for large `x`. This means that 'logcosh' works mostly like the mean squared error, but will not be so strongly affected by the occasional wildly incorrect prediction.

Usage

```
loss_log_cosh(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "log_cosh",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = `[batch_size, d0, .. dN]`.
y_pred	The predicted values with shape = `[batch_size, d0, .. dN]`.
...	For forward/backward compatability.
reduction	Type of reduction to apply to loss. Options are `"sum"`, `"sum_over_batch_size"` or `NULL`. Defaults to `"sum_over_batch_size"`.
name	Optional name for the instance.
dtype	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Logcosh error values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- rbind(c(0., 1.), c(0., 0.))
y_pred <- rbind(c(1., 1.), c(0., 0.))
loss <- loss_log_cosh(y_true, y_pred)
# 0.108
```

See Also

- https://keras.io/api/losses/regression_losses#logcosh-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_mean_absolute_error

Computes the mean of absolute difference between labels and predictions.

Description

Formula:

```
loss <- mean(abs(y_true - y_pred))
```

Usage

```
loss_mean_absolute_error(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "mean_absolute_error",
  dtype = NULL
)
```

Arguments

`y_true`	Ground truth values with shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Mean absolute error values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- random_uniform(c(2, 3), 0, 2)
y_pred <- random_uniform(c(2, 3))
loss <- loss_mean_absolute_error(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/regression_losses#meanabsoluteerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_mean_absolute_percentage_error
Computes the mean absolute percentage error between `y_true` *and* `y_pred`*.*

Description

Formula:

```
loss <- 100 * op_mean(op_abs((y_true - y_pred) / y_true),
                      axis=-1)
```

Division by zero is prevented by dividing by `max(y_true, epsilon)` where `epsilon = config_epsilon()` (default to `1e-7`).

Usage

```
loss_mean_absolute_percentage_error(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "mean_absolute_percentage_error",
  dtype = NULL
)
```

Arguments

`y_true`	Ground truth values with shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Mean absolute percentage error values with shape = `[batch_size, d0, ..dN-1]`.

Examples

```
y_true <- random_uniform(c(2, 3))
y_pred <- random_uniform(c(2, 3))
loss <- loss_mean_absolute_percentage_error(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/regression_losses#meanabsolutepercentageerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_mean_squared_error

Computes the mean of squares of errors between labels and predictions.

Description

Formula:

```
loss <- mean(square(y_true - y_pred))
```

Usage

```
loss_mean_squared_error(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "mean_squared_error",
  dtype = NULL
)
```

Arguments

`y_true`	Ground truth values with shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Mean squared error values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- random_uniform(c(2, 3), 0, 2)
y_pred <- random_uniform(c(2, 3))
loss <- loss_mean_squared_error(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/regression_losses#meansquarederror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_mean_squared_logarithmic_error
Computes the mean squared logarithmic error between y_true *and* y_pred*.*

Description

Note that y_pred and y_true cannot be less or equal to 0. Negative values and 0 values will be replaced with config_epsilon() (default to 1e-7).

Formula:

```
loss <- mean(square(log(y_true + 1) - log(y_pred + 1)))
```

Usage

```
loss_mean_squared_logarithmic_error(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "mean_squared_logarithmic_error",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Mean squared logarithmic error values with shape = [batch_size, d0, .. dN-1].

Examples

```
y_true <- random_uniform(c(2, 3), 0, 2)
y_pred <- random_uniform(c(2, 3))
loss <- loss_mean_squared_logarithmic_error(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/regression_losses#meansquaredlogarithmicerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

loss_poisson *Computes the Poisson loss between* `y_true` *&* `y_pred`*.*

Description

Formula:

```
loss <- y_pred - y_true * log(y_pred)
```

Usage

```
loss_poisson(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "poisson",
  dtype = NULL
)
```

Arguments

`y_true`	Ground truth values. shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values. shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`reduction`	Type of reduction to apply to the loss. In almost all cases this should be `"sum_over_batch_size"`. Supported options are `"sum"`, `"sum_over_batch_size"`, `"mean"`, `"mean_with_sample_weight"` or `NULL`. `"sum"` sums the loss, `"sum_over_batch_size"` and `"mean"` sum the loss and divide by the sample size, and `"mean_with_sample_weight"` sums the loss and divides by the sum of the sample weights. `"none"` and `NULL` perform no aggregation. Defaults to `"sum_over_batch_size"`.
`name`	Optional name for the loss instance.
`dtype`	The dtype of the loss's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

Value

Poisson loss values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- random_uniform(c(2, 3), 0, 2)
y_pred <- random_uniform(c(2, 3))
loss <- loss_poisson(y_true, y_pred)
loss

## tf.Tensor([1.6422468  0.81166863], shape=(2), dtype=float32)
```

See Also

- https://keras.io/api/losses/probabilistic_losses#poisson-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()

```
metric_sparse_categorical_crossentropy()
metric_squared_hinge()
```

---

loss_sparse_categorical_crossentropy
Computes the crossentropy loss between the labels and predictions.

Description

Use this crossentropy loss function when there are two or more label classes. We expect labels to be provided as integers. If you want to provide labels using one-hot representation, please use CategoricalCrossentropy loss. There should be # classes floating point values per feature for y_pred and a single floating point value per feature for y_true.

In the snippet below, there is a single floating point value per example for y_true and num_classes floating pointing values per example for y_pred. The shape of y_true is [batch_size] and the shape of y_pred is [batch_size, num_classes].

Usage

```
loss_sparse_categorical_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  ignore_class = NULL,
  axis = -1L,
  ...,
  reduction = "sum_over_batch_size",
  name = "sparse_categorical_crossentropy",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values.
y_pred	The predicted values.
from_logits	Whether y_pred is expected to be a logits tensor. By default, we assume that y_pred encodes a probability distribution.
ignore_class	Optional integer. The ID of a class to be ignored during loss computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (ignore_class=NULL), all classes are considered.
axis	Defaults to -1. The dimension along which the entropy is computed.
...	For forward/backward compatability.

reduction — Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".

name — Optional name for the loss instance.

dtype — The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Sparse categorical crossentropy loss value.

Examples

```
y_true <- c(1, 2)
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
loss <- loss_sparse_categorical_crossentropy(y_true, y_pred)
loss

## tf.Tensor([0.05129344 2.3025851 ], shape=(2), dtype=float32)


y_true <- c(1, 2)
y_pred <- rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1))
# Using 'auto'/'sum_over_batch_size' reduction type.
scce <- loss_sparse_categorical_crossentropy()
scce(op_array(y_true), op_array(y_pred))

## tf.Tensor(1.1769392, shape=(), dtype=float32)


# 1.177

# Calling with 'sample_weight'.
scce(op_array(y_true), op_array(y_pred), sample_weight = op_array(c(0.3, 0.7)))

## tf.Tensor(0.8135988, shape=(), dtype=float32)


# Using 'sum' reduction type.
scce <- loss_sparse_categorical_crossentropy(reduction="sum")
scce(op_array(y_true), op_array(y_pred))
```

```
## tf.Tensor(2.3538785, shape=(), dtype=float32)


# 2.354

# Using 'none' reduction type.
scce <- loss_sparse_categorical_crossentropy(reduction=NULL)
scce(op_array(y_true), op_array(y_pred))

## tf.Tensor([0.05129344 2.3025851 ], shape=(2), dtype=float32)


# array([0.0513, 2.303], dtype=float32)
```

Usage with the `compile()` API:

```
model %>% compile(optimizer = 'sgd',
                  loss = loss_sparse_categorical_crossentropy())
```

See Also

- https://keras.io/api/losses/probabilistic_losses#sparsecategoricalcrossentropy-class

Other losses:
`Loss()`
`loss_binary_crossentropy()`
`loss_binary_focal_crossentropy()`
`loss_categorical_crossentropy()`
`loss_categorical_focal_crossentropy()`
`loss_categorical_hinge()`
`loss_circle()`
`loss_cosine_similarity()`
`loss_ctc()`
`loss_dice()`
`loss_hinge()`
`loss_huber()`
`loss_kl_divergence()`
`loss_log_cosh()`
`loss_mean_absolute_error()`
`loss_mean_absolute_percentage_error()`
`loss_mean_squared_error()`
`loss_mean_squared_logarithmic_error()`
`loss_poisson()`
`loss_squared_hinge()`
`loss_tversky()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_categorical_crossentropy()`
`metric_categorical_focal_crossentropy()`

metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_squared_hinge *Computes the squared hinge loss between* y_true *&* y_pred.

Description

Formula:

```
loss <- square(maximum(1 - y_true * y_pred, 0))
```

y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1.

Usage

```
loss_squared_hinge(
  y_true,
  y_pred,
  ...,
  reduction = "sum_over_batch_size",
  name = "squared_hinge",
  dtype = NULL
)
```

Arguments

y_true	The ground truth values. y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1 with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.

reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance.
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Squared hinge loss values with shape = [batch_size, d0, .. dN-1].

Examples

```
y_true <- array(sample(c(-1,1), 6, replace = TRUE), dim = c(2, 3))
y_pred <- random_uniform(c(2, 3))
loss <- loss_squared_hinge(y_true, y_pred)
```

See Also

- https://keras.io/api/losses/hinge_losses#squaredhinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_tversky()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

---

loss_tversky — *Computes the Tversky loss value between* y_true *and* y_pred.

Description

This loss function is weighted by the alpha and beta coefficients that penalize false positives and false negatives.

With alpha=0.5 and beta=0.5, the loss value becomes equivalent to Dice Loss.

This loss function is weighted by the alpha and beta coefficients that penalize false positives and false negatives.

With alpha=0.5 and beta=0.5, the loss value becomes equivalent to Dice Loss.

Usage

```
loss_tversky(
  y_true,
  y_pred,
  ...,
  alpha = 0.5,
  beta = 0.5,
  reduction = "sum_over_batch_size",
  name = "tversky",
  axis = NULL,
  dtype = NULL
)
```

Arguments

y_true	tensor of true targets.
y_pred	tensor of predicted targets.
...	For forward/backward compatability.
alpha	The coefficient controlling incidence of false positives. Defaults to 0.5.
beta	The coefficient controlling incidence of false negatives. Defaults to 0.5.
reduction	Type of reduction to apply to the loss. In almost all cases this should be "sum_over_batch_size". Supported options are "sum", "sum_over_batch_size", "mean", "mean_with_sample_weight" or NULL. "sum" sums the loss, "sum_over_batch_size" and "mean" sum the loss and divide by the sample size, and "mean_with_sample_weight" sums the loss and divides by the sum of the sample weights. "none" and NULL perform no aggregation. Defaults to "sum_over_batch_size".
name	Optional name for the loss instance. (string)
axis	Axis (1-based)
dtype	The dtype of the loss's computations. Defaults to NULL, which means using config_floatx(). config_floatx() is a "float32" unless set to different value (via config_set_floatx()). If a keras$DTypePolicy is provided, then the compute_dtype will be utilized.

Value

Tversky loss value.

Reference

- Salehi et al., 2017

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()

loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Metric *Subclass the base* Metric *class*

Description

A Metric object encapsulates metric logic and state that can be used to track model performance during training. It is what is returned by the family of metric functions that start with prefix metric_*, as well as what is returned by custom metrics defined with Metric().

Usage

```
Metric(
  classname,
  initialize = NULL,
  update_state = NULL,
  result = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

classname	String, the name of the custom class. (Conventionally, CamelCase).
initialize, update_state, result	Recommended methods to implement. See description section.
..., public	Additional methods or public members of the custom class.
private	Named list of R objects (typically, functions) to include in instance private environments. private methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own private environment. Any objects in private will be invisible from the Keras framework and the Python runtime.
inherit	What the custom class will subclass. By default, the base keras class.
parent_env	The R environment that all class methods will have as a grandparent.

Value

A function that returns `Metric` instances, similar to the builtin metric functions.

Examples

Usage with `compile()`:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = c(metric_SOME_METRIC(), metric_SOME_OTHER_METRIC())
)
```

Standalone usage:

```
m <- metric_SOME_METRIC()
for (e in seq(epochs)) {
  for (i in seq(train_steps)) {
    c(y_true, y_pred, sample_weight = NULL) %<-% ...
    m$update_state(y_true, y_pred, sample_weight)
  }
  cat('Final epoch result: ', as.numeric(m$result()), "\n")
  m$reset_state()
}
```

Full Examples

Usage with `compile()`:

```
model <- keras_model_sequential()
model |>
  layer_dense(64, activation = "relu") |>
  layer_dense(64, activation = "relu") |>
  layer_dense(10, activation = "softmax")
```

```
model |>
  compile(optimizer = optimizer_rmsprop(0.01),
          loss = loss_categorical_crossentropy(),
          metrics = metric_categorical_accuracy())

data <- random_uniform(c(1000, 32))
labels <- random_uniform(c(1000, 10))

model |> fit(data, labels, verbose = 0)
```

To be implemented by subclasses (custom metrics):

- `initialize()`: All state variables should be created in this method by calling `self$add_variable()` like: `self$var <- self$add_variable(...)`.
- `update_state()`: Updates all the state variables like: `self$var$assign(...)`.
- `result()`: Computes and returns a scalar value or a named list of scalar values for the metric from the state variables.

Example subclass implementation:

```
metric_binary_true_positives <- Metric(
  classname = "BinaryTruePositives",

  initialize = function(name = 'binary_true_positives', ...) {
    super$initialize(name = name, ...)
    self$true_positives <-
      self$add_weight(shape = shape(),
                      initializer = 'zeros',
                      name = 'true_positives')
  },

  update_state = function(y_true, y_pred, sample_weight = NULL) {
    y_true <- op_cast(y_true, "bool")
    y_pred <- op_cast(y_pred, "bool")

    values <- y_true & y_pred # `&` calls op_logical_and()
    values <- op_cast(values, self$dtype)
    if (!is.null(sample_weight)) {
      sample_weight <- op_cast(sample_weight, self$dtype)
      sample_weight <- op_broadcast_to(sample_weight, shape(values))
      values <- values * sample_weight # `*` calls op_multiply()
    }
    self$true_positives$assign(self$true_positives + op_sum(values))
  },

  result = function() {
    self$true_positives
  }
)
model <- keras_model_sequential(input_shape = 32) |> layer_dense(10)
```

```
model |> compile(loss = loss_binary_crossentropy(),
                 metrics = list(metric_binary_true_positives()))
model |> fit(data, labels, verbose = 0)
```

Methods defined by the base `Metric` class:

- `__call__(...)`

  Calling a metric instance self like `m(...)` is equivalent to calling:

  ```
  function(...) {
    m$update_state(...)
    m$result()
  }
  ```

- `initialize(dtype=NULL, name=NULL)`

  Initialize self.

  Args:

  – `name`: Optional name for the metric instance.
  – `dtype`: The dtype of the metric's computations. Defaults to `NULL`, which means using `config_floatx()`. `config_floatx()` is a `"float32"` unless set to different value (via `config_set_floatx()`). If a `keras$DTypePolicy` is provided, then the `compute_dtype` will be utilized.

- `add_variable(shape, initializer, dtype=NULL, aggregation = 'sum', name=NULL)`
- `add_weight(shape=shape(), initializer=NULL, dtype=NULL, name=NULL)`
- `get_config()`

  Return the serializable config of the metric.

- `reset_state()`

  Reset all of the metric state variables.

  This function is called between epochs/steps, when a metric is evaluated during training.

- `result()`

  Compute the current metric value.

  Returns: A scalar tensor, or a named list of scalar tensors.

- `stateless_result(metric_variables)`
- `stateless_reset_state()`
- `stateless_update_state(metric_variables, ...)`
- `update_state(...)`

  Accumulate statistics for the metric.

Readonly properties

- `dtype`
- `variables`

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

See Also

Other metrics:
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()

metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_auc *Approximates the AUC (Area under the curve) of the ROC or PR curves.*

Description

The AUC (Area under the curve) of the ROC (Receiver operating characteristic; default) or PR (Precision Recall) curves are quality measures of binary classifiers. Unlike the accuracy, and like cross-entropy losses, ROC-AUC and PR-AUC evaluate all the operational points of a model.

This class approximates AUCs using a Riemann sum. During the metric accumulation phrase, predictions are accumulated within predefined buckets by value. The AUC is then computed by interpolating per-bucket averages. These buckets define the evaluated operational points.

This metric creates four local variables, `true_positives`, `true_negatives`, `false_positives` and `false_negatives` that are used to compute the AUC. To discretize the AUC curve, a linearly spaced set of thresholds is used to compute pairs of recall and precision values. The area under the ROC-curve is therefore computed using the height of the recall values by the false positive rate, while the area under the PR-curve is the computed using the height of the precision values by the recall.

This value is ultimately returned as `auc`, an idempotent operation that computes the area under a discretized curve of precision versus recall values (computed using the aforementioned variables). The `num_thresholds` variable controls the degree of discretization with larger numbers of thresholds more closely approximating the true AUC. The quality of the approximation may vary dramatically depending on `num_thresholds`. The `thresholds` parameter can be used to manually specify thresholds which split the predictions more evenly.

For a best approximation of the real AUC, `predictions` should be distributed approximately uniformly in the range `[0, 1]` (if `from_logits=FALSE`). The quality of the AUC approximation may be poor if this is not the case. Setting `summation_method` to 'minoring' or 'majoring' can help quantify the error in the approximation by providing lower or upper bound estimate of the AUC.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

Usage

```
metric_auc(
  ...,
  num_thresholds = 200L,
  curve = "ROC",
  summation_method = "interpolation",
  name = NULL,
  dtype = NULL,
  thresholds = NULL,
  multi_label = FALSE,
  num_labels = NULL,
  label_weights = NULL,
  from_logits = FALSE
)
```

Arguments

`...`	For forward/backward compatability.
`num_thresholds`	(Optional) The number of thresholds to use when discretizing the roc curve. Values must be > 1. Defaults to `200`.
`curve`	(Optional) Specifies the name of the curve to be computed, `'ROC'` (default) or `'PR'` for the Precision-Recall-curve.
`summation_method`	(Optional) Specifies the Riemann summation method used. 'interpolation' (default) applies mid-point summation scheme for `ROC`. For PR-AUC, interpolates (true/false) positives but not the ratio that is precision (see Davis & Goadrich 2006 for details); 'minoring' applies left summation for increasing intervals and right summation for decreasing intervals; 'majoring' does the opposite.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.
`thresholds`	(Optional) A list of floating point values to use as the thresholds for discretizing the curve. If set, the `num_thresholds` parameter is ignored. Values should be in `[0, 1]`. Endpoint thresholds equal to {`-epsilon`, `1+epsilon`} for a small positive epsilon value will be automatically included with these to correctly handle predictions equal to exactly 0 or 1.
`multi_label`	boolean indicating whether multilabel data should be treated as such, wherein AUC is computed separately for each label and then averaged across labels, or (when `FALSE`) if the data should be flattened into a single label before AUC computation. In the latter case, when multilabel data is passed to AUC, each label-prediction pair is treated as an individual data point. Should be set to 'FALSE" for multi-class data.
`num_labels`	(Optional) The number of labels, used when `multi_label` is TRUE. If `num_labels` is not specified, then state variables get created on the first call to `update_state`.
`label_weights`	(Optional) list, array, or tensor of non-negative weights used to compute AUCs for multilabel data. When `multi_label` is TRUE, the weights are applied to the individual label AUCs when they are averaged to produce the multi-label AUC.

	When it's FALSE, they are used to weight the individual label predictions in computing the confusion matrix on the flattened data. Note that this is unlike `class_weights` in that `class_weights` weights the example depending on the value of its label, whereas `label_weights` depends only on the index of that label before flattening; therefore `label_weights` should not be used for multi-class data.
`from_logits`	boolean indicating whether the predictions (`y_pred` in `update_state`) are probabilities or sigmoid logits. As a rule of thumb, when using a keras loss, the `from_logits` constructor argument of the loss should match the AUC `from_logits` constructor argument.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_auc(num_thresholds = 3)
m$update_state(c(0,   0,   1,   1),
               c(0, 0.5, 0.3, 0.9))
# threshold values are [0 - 1e-7, 0.5, 1 + 1e-7]
# tp = [2, 1, 0], fp = [2, 0, 0], fn = [0, 1, 2], tn = [0, 2, 2]
# tp_rate = recall = [1, 0.5, 0], fp_rate = [1, 0, 0]
# auc = ((((1 + 0.5) / 2) * (1 - 0)) + (((0.5 + 0) / 2) * (0 - 0)))
#     = 0.75
m$result()
```

```
## tf.Tensor(0.75, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(c(0,   0,   1,   1),
               c(0, 0.5, 0.3, 0.9),
               sample_weight=c(1, 0, 0, 1))
m$result()
```

```
## tf.Tensor(1.0, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
# Reports the AUC of a model outputting a probability.
model |> compile(
  optimizer = 'sgd',
  loss = loss_binary_crossentropy(),
```

```
  metrics = list(metric_auc())
)

# Reports the AUC of a model outputting a logit.
model |> compile(
  optimizer = 'sgd',
  loss = loss_binary_crossentropy(from_logits = TRUE),
  metrics = list(metric_auc(from_logits = TRUE))
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#auc-class

Other confusion metrics:
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()

metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_binary_accuracy

Calculates how often predictions match binary labels.

Description

This metric creates two local variables, `total` and `count` that are used to compute the frequency with which `y_pred` matches `y_true`. This frequency is ultimately returned as `binary accuracy`: an idempotent operation that simply divides `total` by `count`.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

Usage

```
metric_binary_accuracy(
  y_true,
  y_pred,
  threshold = 0.5,
  ...,
```

```
  name = "binary_accuracy",
  dtype = NULL
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
threshold	(Optional) Float representing the threshold for deciding whether prediction values are 1 or 0.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If `y_true` and `y_pred` are missing, a `Metric` instance is returned. The `Metric` instance that can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage. If `y_true` and `y_pred` are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_binary_accuracy()
m$update_state(rbind(1, 1, 0, 0), rbind(0.98, 1, 0, 0.6))
m$result()

## tf.Tensor(0.75, shape=(), dtype=float32)


# 0.75

m$reset_state()
m$update_state(rbind(1, 1, 0, 0), rbind(0.98, 1, 0, 0.6),
               sample_weight = c(1, 0, 0, 1))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


# 0.5
```

Usage with `compile()` API:

```
model %>% compile(optimizer='sgd',
                  loss='binary_crossentropy',
                  metrics=list(metric_binary_accuracy()))
```

See Also

- https://keras.io/api/metrics/accuracy_metrics#binaryaccuracy-class

Other accuracy metrics:
metric_categorical_accuracy()
metric_sparse_categorical_accuracy()
metric_sparse_top_k_categorical_accuracy()
metric_top_k_categorical_accuracy()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()

metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_binary_crossentropy

Computes the crossentropy metric between the labels and predictions.

Description

This is the crossentropy metric class to be used when there are only two label classes (0 and 1).

Usage

```
metric_binary_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  name = "binary_crossentropy",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values. shape = `[batch_size, d0, .. dN]`.
y_pred	The predicted values. shape = `[batch_size, d0, .. dN]`.
from_logits	(Optional) Whether output is expected to be a logits tensor. By default, we consider that output encodes a probability distribution.
label_smoothing	(Optional) Float in `[0, 1]`. When > 0, label values are smoothed, meaning the confidence on label values are relaxed. e.g. `label_smoothing=0.2` means that we will use a value of 0.1 for label "0" and 0.9 for label "1".
axis	The axis along which the mean is computed. Defaults to `-1`.
...	For forward/backward compatability.

name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_binary_crossentropy()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)))
m$result()
```

```
## tf.Tensor(0.8149245, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)),
               sample_weight=c(1, 0))
m$result()
```

```
## tf.Tensor(0.91629076, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(
    optimizer = 'sgd',
    loss = 'mse',
    metrics = list(metric_binary_crossentropy()))
```

See Also

- https://keras.io/api/metrics/probabilistic_metrics#binarycrossentropy-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()

loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()

metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other probabilistic metrics:
metric_categorical_crossentropy()
metric_kl_divergence()
metric_poisson()
metric_sparse_categorical_crossentropy()

`metric_binary_focal_crossentropy`
Computes the binary focal crossentropy loss.

Description

According to Lin et al., 2018, it helps to apply a focal factor to down-weight easy examples and focus more on hard examples. By default, the focal tensor is computed as follows:

focal_factor = (1 - output)^gamma for class 1 focal_factor = output^gamma for class 0 where gamma is a focusing parameter. When gamma = 0, there is no focal effect on the binary crossentropy loss.

If apply_class_balancing == TRUE, this function also takes into account a weight balancing factor for the binary classes 0 and 1 as follows:

weight = alpha for class 1 (target == 1) weight = 1 - alpha for class 0 where alpha is a float in the range of [0, 1].

Usage

```
metric_binary_focal_crossentropy(
  y_true,
  y_pred,
  apply_class_balancing = FALSE,
  alpha = 0.25,
  gamma = 2,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L
)
```

Arguments

y_true	Ground truth values, of shape (batch_size, d0, .. dN).
y_pred	The predicted values, of shape (batch_size, d0, .. dN).
apply_class_balancing	A bool, whether to apply weight balancing on the binary classes 0 and 1.
alpha	A weight balancing factor for class 1, default is 0.25 as mentioned in the reference. The weight for class 0 is 1.0 - alpha.
gamma	A focusing parameter, default is 2.0 as mentioned in the reference.
from_logits	Whether y_pred is expected to be a logits tensor. By default, we assume that y_pred encodes a probability distribution.
label_smoothing	Float in [0, 1]. If > 0 then smooth the labels by squeezing them towards 0.5, that is, using 1. - 0.5 * label_smoothing for the target class and 0.5 * label_smoothing for the non-target class.
axis	The axis along which the mean is computed. Defaults to -1.

Value

Binary focal crossentropy loss value with shape = [batch_size, d0, .. dN-1].

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_binary_focal_crossentropy(y_true, y_pred, gamma=2)
loss
```

```
## tf.Tensor([0.32986468 0.20579839], shape=(2), dtype=float32)
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()

metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

`metric_binary_iou` *Computes the Intersection-Over-Union metric for class 0 and/or 1.*

Description

Formula:

```
iou <- true_positives / (true_positives + false_positives + false_negatives)
```

Intersection-Over-Union is a common evaluation metric for semantic image segmentation.

To compute IoUs, the predictions are accumulated in a confusion matrix, weighted by `sample_weight` and the metric is then calculated from it.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

This class can be used to compute IoUs for a binary classification task where the predictions are provided as logits. First a `threshold` is applied to the predicted values such that those that are below the `threshold` are converted to class 0 and those that are above the `threshold` are converted to class 1.

IoUs for classes 0 and 1 are then computed, the mean of IoUs for the classes that are specified by `target_class_ids` is returned.

Usage

```
metric_binary_iou(
  ...,
  target_class_ids = list(0L, 1L),
  threshold = 0.5,
  name = NULL,
  dtype = NULL
)
```

Arguments

`...`	For forward/backward compatability.
`target_class_ids`	A list or list of target class ids for which the metric is returned. Options are `0`, `1`, or `c(0, 1)`. With `0` (or `1`), the IoU metric for class 0 (or class 1, respectively) is returned. With `c(0, 1)`, the mean of IoUs for the two classes is returned.
`threshold`	A threshold that applies to the prediction logits to convert them to either predicted class 0 if the logit is below `threshold` or predicted class 1 if the logit is above `threshold`.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Note

with `threshold=0`, this metric has the same behavior as `IoU`.

Examples

Standalone usage:

```
m <- metric_binary_iou(target_class_ids=c(0L, 1L), threshold = 0.3)
m$update_state(c(0, 1, 0, 1), c(0.1, 0.2, 0.4, 0.7))

## tf.Tensor(
## [[1 1]
##  [1 1]], shape=(2, 2), dtype=int64)


m$result()

## tf.Tensor(0.33333334, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0, 1, 0, 1), c(0.1, 0.2, 0.4, 0.7),
               sample_weight = 10 * c(0.2, 0.3, 0.4, 0.1))

## tf.Tensor(
## [[2 4]
##  [3 1]], shape=(2, 2), dtype=int64)


m$result()

## tf.Tensor(0.1736111, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
    optimizer = 'sgd',
    loss = 'mse',
    metrics = list(metric_binary_iou(
        target_class_ids = 0L,
        threshold = 0.5
    ))
)
```

See Also

Other iou metrics:
metric_iou()
metric_mean_iou()
metric_one_hot_iou()
metric_one_hot_mean_iou()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()

metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_categorical_accuracy
Calculates how often predictions match one-hot labels.

Description

You can provide logits of classes as `y_pred`, since argmax of logits and probabilities are same.

This metric creates two local variables, `total` and `count` that are used to compute the frequency with which `y_pred` matches `y_true`. This frequency is ultimately returned as `categorical accuracy`: an idempotent operation that simply divides `total` by `count`.

`y_pred` and `y_true` should be passed in as vectors of probabilities, rather than as labels. If necessary, use `op_one_hot` to expand `y_true` as a vector.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

Usage

```
metric_categorical_accuracy(
  y_true,
  y_pred,
  ...,
  name = "categorical_accuracy",
  dtype = NULL
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_categorical_accuracy()
m$update_state(rbind(c(0, 0, 1), c(0, 1, 0)), rbind(c(0.1, 0.9, 0.8),
                c(0.05, 0.95, 0)))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 0, 1), c(0, 1, 0)), rbind(c(0.1, 0.9, 0.8),
               c(0.05, 0.95, 0)),
               sample_weight = c(0.7, 0.3))
m$result()

## tf.Tensor(0.3, shape=(), dtype=float32)


# 0.3
```

Usage with compile() API:

```
model %>% compile(optimizer = 'sgd',
                  loss = 'categorical_crossentropy',
                  metrics = list(metric_categorical_accuracy()))
```

See Also

- https://keras.io/api/metrics/accuracy_metrics#categoricalaccuracy-class

Other accuracy metrics:
metric_binary_accuracy()
metric_sparse_categorical_accuracy()
metric_sparse_top_k_categorical_accuracy()
metric_top_k_categorical_accuracy()

Other metrics:
Metric()
custom_metric()
metric_auc()

metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

metric_categorical_crossentropy
Computes the crossentropy metric between the labels and predictions.

Description

This is the crossentropy metric class to be used when there are multiple label classes (2 or more). It assumes that labels are one-hot encoded, e.g., when labels values are `c(2, 0, 1)`, then `y_true` is `rbind(c([0, 0, 1), c(1, 0, 0), c(0, 1, 0))`.

Usage

```
metric_categorical_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L,
  ...,
  name = "categorical_crossentropy",
  dtype = NULL
)
```

Arguments

`y_true`	Tensor of one-hot true targets.
`y_pred`	Tensor of predicted targets.
`from_logits`	(Optional) Whether output is expected to be a logits tensor. By default, we consider that output encodes a probability distribution.
`label_smoothing`	(Optional) Float in `[0, 1]`. When > 0, label values are smoothed, meaning the confidence on label values are relaxed. e.g. `label_smoothing=0.2` means that we will use a value of 0.1 for label "0" and 0.9 for label "1".
`axis`	(Optional) Defaults to `-1`. The dimension along which entropy is computed.
`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

If `y_true` and `y_pred` are missing, a `Metric` instance is returned. The `Metric` instance that can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage. If `y_true` and `y_pred` are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
# EPSILON = 1e-7, y = y_true, y` = y_pred
# y` = clip_op_clip_by_value(output, EPSILON, 1. - EPSILON)
# y` = rbind(c(0.05, 0.95, EPSILON), c(0.1, 0.8, 0.1))
# xent = -sum(y * log(y'), axis = -1)
#      = -((log 0.95), (log 0.1))
#      = [0.051, 2.302]
# Reduced xent = (0.051 + 2.302) / 2

m <- metric_categorical_crossentropy()
m$update_state(rbind(c(0, 1, 0), c(0, 0, 1)),
               rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1)))
m$result()

## tf.Tensor(1.1769392, shape=(), dtype=float32)


# 1.1769392

m$reset_state()
m$update_state(rbind(c(0, 1, 0), c(0, 0, 1)),
               rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1)),
               sample_weight = c(0.3, 0.7))
m$result()

## tf.Tensor(1.6271976, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_categorical_crossentropy()))
```

See Also

- https://keras.io/api/metrics/probabilistic_metrics#categoricalcrossentropy-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()

loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()

metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other probabilistic metrics:
metric_binary_crossentropy()
metric_kl_divergence()
metric_poisson()
metric_sparse_categorical_crossentropy()

---

metric_categorical_focal_crossentropy

Computes the categorical focal crossentropy loss.

Description

Computes the categorical focal crossentropy loss.

Usage

```
metric_categorical_focal_crossentropy(
  y_true,
  y_pred,
  alpha = 0.25,
  gamma = 2,
  from_logits = FALSE,
  label_smoothing = 0,
  axis = -1L
)
```

Arguments

y_true	Tensor of one-hot true targets.
y_pred	Tensor of predicted targets.
alpha	A weight balancing factor for all classes, default is 0.25 as mentioned in the reference. It can be a list of floats or a scalar. In the multi-class case, alpha may be set by inverse class frequency by using compute_class_weight from sklearn.utils.
gamma	A focusing parameter, default is 2.0 as mentioned in the reference. It helps to gradually reduce the importance given to simple examples in a smooth manner. When gamma = 0, there is no focal effect on the categorical crossentropy.
from_logits	Whether y_pred is expected to be a logits tensor. By default, we assume that y_pred encodes a probability distribution.
label_smoothing	Float in [0, 1]. If > 0 then smooth the labels. For example, if 0.1, use 0.1 / num_classes for non-target labels and 0.9 + 0.1 / num_classes for target labels.
axis	Defaults to -1. The dimension along which the entropy is computed.

Value

Categorical focal crossentropy loss value.

Examples

```
y_true <- rbind(c(0, 1, 0), c(0, 0, 1))
y_pred <- rbind(c(0.05, 0.9, 0.05), c(0.1, 0.85, 0.05))
loss <- loss_categorical_focal_crossentropy(y_true, y_pred)
loss

## tf.Tensor([2.6340148e-04 6.7591208e-01], shape=(2), dtype=float32)
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()

metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_categorical_hinge

Computes the categorical hinge metric between `y_true` *and* `y_pred`.

Description

Formula:

```
loss <- maximum(neg - pos + 1, 0)
```

where `neg=maximum((1-y_true)*y_pred)` and `pos=sum(y_true*y_pred)`

Usage

```
metric_categorical_hinge(
  y_true,
  y_pred,
  ...,
  name = "categorical_hinge",
  dtype = NULL
)
```

Arguments

`y_true`	The ground truth values. `y_true` values are expected to be either `{-1, +1}` or `{0, 1}` (i.e. a one-hot-encoded tensor) with shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.
`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

Categorical hinge loss values with shape = `[batch_size, d0, .. dN-1]`.

Usage

Standalone usage:

```
m <- metric_categorical_hinge()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)))
m$result()

## tf.Tensor(1.4000001, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(1.2, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/hinge_metrics#categoricalhinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other hinge metrics:
metric_hinge()
metric_squared_hinge()

metric_concordance_correlation

Calculates the Concordance Correlation Coefficient (CCC).

Description

Formula:

```
loss <- mean(
  2 * (y_true - mean(y_true)) * (y_pred - mean(y_pred)) /
    (var(y_true) + var(y_pred) + (mean(y_true) - mean(y_pred))^2)
)
```

CCC evaluates the agreement between true values (`y_true`) and predicted values (`y_pred`) by considering both precision and accuracy. The coefficient ranges from -1 to 1, where a value of 1 indicates perfect agreement.

This metric is useful in regression tasks where it is important to assess how well the predictions match the true values, taking into account both their correlation and proximity to the 45-degree line of perfect concordance.

Usage

```
metric_concordance_correlation(
  y_true,
  y_pred,
  axis = -1L,
  ...,
  name = "concordance_correlation",
  dtype = NULL
)
```

Arguments

`y_true`	Tensor of true targets.
`y_pred`	Tensor of predicted targets.
`axis`	(Optional) integer or tuple of integers of the axis/axes along which to compute the metric. Defaults to `-1`.
`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Examples

```
ccc <- metric_concordance_correlation(axis=-1)
y_true <- rbind(c(0, 1, 0.5),
                c(1, 1, 0.2))
y_pred <- rbind(c(0.1, 0.9, 0.5),
                c(1, 0.9, 0.2))
ccc$update_state(y_true, y_pred)
ccc$result()

## tf.Tensor(0.9816317, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'mean_squared_error',
  metrics = c(metric_concordance_correlation())
)
```

See Also

Other regression metrics:
`metric_cosine_similarity()`
`metric_log_cosh_error()`
`metric_mean_absolute_error()`
`metric_mean_absolute_percentage_error()`
`metric_mean_squared_error()`
`metric_mean_squared_logarithmic_error()`
`metric_pearson_correlation()`
`metric_r2_score()`
`metric_root_mean_squared_error()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`
`metric_categorical_accuracy()`
`metric_categorical_crossentropy()`
`metric_categorical_focal_crossentropy()`
`metric_categorical_hinge()`
`metric_cosine_similarity()`
`metric_f1_score()`
`metric_false_negatives()`

metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_cosine_similarity
Computes the cosine similarity between the labels and predictions.

Description

Formula:

```
loss <- sum(l2_norm(y_true) * l2_norm(y_pred))
```

See: Cosine Similarity. This metric keeps the average cosine similarity between `predictions` and `labels` over a stream of data.

Usage

```
metric_cosine_similarity(
  ...,
  name = "cosine_similarity",
  dtype = NULL,
  axis = -1L
)
```

Arguments

`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.
`axis`	(Optional) Defaults to `-1`. The dimension along which the cosine similarity is computed.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

Standalone usage:

```
m <- metric_cosine_similarity(axis=2)
m$update_state(rbind(c(0., 1.), c(1., 1.)), rbind(c(1., 0.), c(1., 1.)))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0., 1.), c(1., 1.)), rbind(c(1., 0.), c(1., 1.)),
               sample_weight = c(0.3, 0.7))
m$result()

## tf.Tensor(0.7, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_cosine_similarity(axis=2)))
```

See Also

- https://keras.io/api/metrics/regression_metrics#cosinesimilarity-class

Other regression metrics:
metric_concordance_correlation()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()

metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_f1_score *Computes F-1 Score.*

Description

Formula:

```
f1_score <- 2 * (precision * recall) / (precision + recall)
```

This is the harmonic mean of precision and recall. Its output range is [0, 1]. It works for both multi-class and multi-label classification.

Usage

```
metric_f1_score(
  ...,
  average = NULL,
  threshold = NULL,
  name = "f1_score",
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
average	Type of averaging to be performed on data. Acceptable values are NULL, "micro", "macro" and "weighted". Defaults to NULL. If NULL, no averaging is performed and result() will return the score for each class. If "micro", compute metrics globally by counting the total true positives, false negatives and false positives.

If "macro", compute metrics for each label, and return their unweighted mean. This does not take label imbalance into account. If "weighted", compute metrics for each label, and return their average weighted by support (the number of true instances for each label). This alters "macro" to account for label imbalance. It can result in an score that is not between precision and recall.

threshold — Elements of y_pred greater than threshold are converted to be 1, and the rest 0. If threshold is NULL, the argmax of y_pred is converted to 1, and the rest to 0.

name — Optional. String name of the metric instance.

dtype — Optional. Data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Examples

```
metric <- metric_f1_score(threshold = 0.5)
y_true <- rbind(c(1, 1, 1),
                c(1, 0, 0),
                c(1, 1, 0))
y_pred <- rbind(c(0.2, 0.6, 0.7),
                c(0.2, 0.6, 0.6),
                c(0.6, 0.8, 0.0))
metric$update_state(y_true, y_pred)
result <- metric$result()
result

## tf.Tensor([0.49999997 0.79999995 0.66666657], shape=(3), dtype=float32)
```

Returns

F-1 Score: float.

See Also

Other f score metrics:
metric_fbeta_score()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()

metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

metric_false_negatives

Calculates the number of false negatives.

Description

If sample_weight is given, calculates the sum of the weights of false negatives. This metric creates one local variable, accumulator that is used to keep track of the number of false negatives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

Usage

```
metric_false_negatives(..., thresholds = NULL, name = NULL, dtype = NULL)
```

Arguments

...	For forward/backward compatability.
thresholds	(Optional) Defaults to 0.5. A float value, or a Python list of float threshold values in [0, 1]. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is TRUE, below is FALSE). If used with a loss function that sets from_logits=TRUE (i.e. no sigmoid applied to predictions), thresholds should be set to 0. One metric value is generated for each threshold value.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Usage

Standalone usage:

```
m <- metric_false_negatives()
m$update_state(c(0, 1, 1, 1), c(0, 1, 0, 0))
m$result()
```

```
## tf.Tensor(2.0, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(c(0, 1, 1, 1), c(0, 1, 0, 0), sample_weight=c(0, 0, 1, 0))
m$result()
```

```
## tf.Tensor(1.0, shape=(), dtype=float32)
```

```
# 1.0
```

See Also

- https://keras.io/api/metrics/classification_metrics#falsenegatives-class

Other confusion metrics:
metric_auc()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()

metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_false_positives *Calculates the number of false positives.*

Description

If sample_weight is given, calculates the sum of the weights of false positives. This metric creates one local variable, accumulator that is used to keep track of the number of false positives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

Usage

```
metric_false_positives(..., thresholds = NULL, name = NULL, dtype = NULL)
```

Arguments

...	For forward/backward compatability.
thresholds	(Optional) Defaults to 0.5. A float value, or a Python list of float threshold values in [0, 1]. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is TRUE, below is FALSE). If used with a loss function that sets from_logits=TRUE (i.e. no sigmoid applied to predictions), thresholds should be set to 0. One metric value is generated for each threshold value.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_false_positives()
m$update_state(c(0, 1, 0, 0), c(0, 0, 1, 1))
m$result()

## tf.Tensor(2.0, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0, 1, 0, 0), c(0, 0, 1, 1), sample_weight = c(0, 0, 1, 0))
m$result()

## tf.Tensor(1.0, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/classification_metrics#falsepositives-class

Other confusion metrics:
`metric_auc()`
`metric_false_negatives()`
`metric_precision()`
`metric_precision_at_recall()`
`metric_recall()`
`metric_recall_at_precision()`
`metric_sensitivity_at_specificity()`
`metric_specificity_at_sensitivity()`
`metric_true_negatives()`
`metric_true_positives()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`
`metric_categorical_accuracy()`
`metric_categorical_crossentropy()`

metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_fbeta_score *Computes F-Beta score.*

Description

Formula:

```
b2 <- beta^2
f_beta_score <- (1 + b2) * (precision * recall) / (precision * b2 + recall)
```

This is the weighted harmonic mean of precision and recall. Its output range is `[0, 1]`. It works for both multi-class and multi-label classification.

Usage

```
metric_fbeta_score(
  ...,
  average = NULL,
  beta = 1,
  threshold = NULL,
  name = "fbeta_score",
  dtype = NULL
)
```

Arguments

`...`	For forward/backward compatability.
`average`	Type of averaging to be performed across per-class results in the multi-class case. Acceptable values are `NULL`, `"micro"`, `"macro"` and `"weighted"`. Defaults to `NULL`. If `NULL`, no averaging is performed and `result()` will return the score for each class. If `"micro"`, compute metrics globally by counting the total true positives, false negatives and false positives. If `"macro"`, compute metrics for each label, and return their unweighted mean. This does not take label imbalance into account. If `"weighted"`, compute metrics for each label, and return their average weighted by support (the number of true instances for each label). This alters `"macro"` to account for label imbalance. It can result in an score that is not between precision and recall.
`beta`	Determines the weight of given to recall in the harmonic mean between precision and recall (see pseudocode equation above). Defaults to `1`.
`threshold`	Elements of `y_pred` greater than `threshold` are converted to be 1, and the rest 0. If `threshold` is `NULL`, the argmax of `y_pred` is converted to 1, and the rest to 0.
`name`	Optional. String name of the metric instance.
`dtype`	Optional. Data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

```
metric <- metric_fbeta_score(beta = 2.0, threshold = 0.5)
y_true <- rbind(c(1, 1, 1),
                c(1, 0, 0),
                c(1, 1, 0))
y_pred <- rbind(c(0.2, 0.6, 0.7),
                c(0.2, 0.6, 0.6),
                c(0.6, 0.8, 0.0))
metric$update_state(y_true, y_pred)
metric$result()

## tf.Tensor([0.3846154  0.90909094 0.8333332 ], shape=(3), dtype=float32)
```

Returns

F-Beta Score: float.

See Also

Other f score metrics:
metric_f1_score()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()

metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_hinge *Computes the hinge metric between* y_true *and* y_pred.

Description

Formula:

```
loss <- mean(maximum(1 - y_true * y_pred, 0), axis=-1)
```

y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1.

Usage

```
metric_hinge(y_true, y_pred, ..., name = "hinge", dtype = NULL)
```

Arguments

y_true	The ground truth values. y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided they will be converted to -1 or 1 with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_hinge()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)))
m$result()

## tf.Tensor(1.3, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(1.1, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/hinge_metrics#hinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()

loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_huber()

metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other hinge metrics:
metric_categorical_hinge()
metric_squared_hinge()

---

metric_huber *Computes Huber loss value.*

Description

Formula:

```
for (x in error) {
  if (abs(x) <= delta){
```

```
    loss <- c(loss, (0.5 * x^2))
  } else if (abs(x) > delta) {
    loss <- c(loss, (delta * abs(x) - 0.5 * delta^2))
  }
}
loss <- mean(loss)
```

See: Huber loss.

Usage

```
metric_huber(y_true, y_pred, delta = 1)
```

Arguments

y_true	tensor of true targets.
y_pred	tensor of predicted targets.
delta	A float, the point where the Huber loss function changes from a quadratic to linear. Defaults to `1.0`.

Value

Tensor with one scalar loss entry per sample.

Examples

```
y_true <- rbind(c(0, 1), c(0, 0))
y_pred <- rbind(c(0.6, 0.4), c(0.4, 0.6))
loss <- loss_huber(y_true, y_pred)
```

See Also

Other losses:
`Loss()`
`loss_binary_crossentropy()`
`loss_binary_focal_crossentropy()`
`loss_categorical_crossentropy()`
`loss_categorical_focal_crossentropy()`
`loss_categorical_hinge()`
`loss_circle()`
`loss_cosine_similarity()`
`loss_ctc()`
`loss_dice()`
`loss_hinge()`
`loss_huber()`
`loss_kl_divergence()`
`loss_log_cosh()`
`loss_mean_absolute_error()`
`loss_mean_absolute_percentage_error()`

loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()

metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_iou *Computes the Intersection-Over-Union metric for specific target classes.*

Description

Formula:

```
iou <- true_positives / (true_positives + false_positives + false_negatives)
```

Intersection-Over-Union is a common evaluation metric for semantic image segmentation.

To compute IoUs, the predictions are accumulated in a confusion matrix, weighted by `sample_weight` and the metric is then calculated from it.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

Note, this class first computes IoUs for all individual classes, then returns the mean of IoUs for the classes that are specified by `target_class_ids`. If `target_class_ids` has only one id value, the IoU of that specific class is returned.

Usage

```
metric_iou(
  ...,
  num_classes,
  target_class_ids,
  name = NULL,
  dtype = NULL,
  ignore_class = NULL,
  sparse_y_true = TRUE,
  sparse_y_pred = TRUE,
  axis = -1L
)
```

Arguments

`...`	For forward/backward compatability.
`num_classes`	The possible number of labels the prediction task can have.
`target_class_ids`	A list of target class ids for which the metric is returned. To compute IoU for a specific class, a list of a single id value should be provided.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.
`ignore_class`	Optional integer. The ID of a class to be ignored during metric computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (`ignore_class=NULL`), all classes are considered.
`sparse_y_true`	Whether labels are encoded using integers or dense floating point vectors. If `FALSE`, the `argmax` function is used to determine each sample's most likely associated label.
`sparse_y_pred`	Whether predictions are encoded using integers or dense floating point vectors. If `FALSE`, the `argmax` function is used to determine each sample's most likely associated label.
`axis`	(Optional) -1 is the dimension containing the logits. Defaults to `-1`.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

Standalone usage:

```
m <- metric_iou(num_classes = 2L, target_class_ids = list(0L))
m$update_state(c(0, 0, 1, 1), c(0, 1, 0, 1))
```

```
## tf.Tensor(
## [[1 1]
##  [1 1]], shape=(2, 2), dtype=int64)
```

```
m$result()
```

```
## tf.Tensor(0.3333333, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(c(0, 0, 1, 1), c(0, 1, 0, 1),
               sample_weight = 10 * c(0.3, 0.3, 0.3, 0.1))
```

```
## tf.Tensor(
## [[3 3]
##  [3 1]], shape=(2, 2), dtype=int64)
```

```
m$result()
```

```
## tf.Tensor(0.3333333, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_iou(num_classes = 2L, target_class_ids = list(0L))))
```

See Also

Other iou metrics:
`metric_binary_iou()`
`metric_mean_iou()`
`metric_one_hot_iou()`
`metric_one_hot_mean_iou()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`
`metric_categorical_accuracy()`

metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_kl_divergence *Computes Kullback-Leibler divergence metric between* y_true *and*

Description

Formula:

```
loss <- y_true * log(y_true / y_pred)
```

y_true and y_pred are expected to be probability distributions, with values between 0 and 1. They will get clipped to the [0, 1] range.

Usage

```
metric_kl_divergence(y_true, y_pred, ..., name = "kl_divergence", dtype = NULL)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_kl_divergence()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)))
m$result()
```

```
## tf.Tensor(0.45814303, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)),
               sample_weight = c(1, 0))
m$result()
```

```
## tf.Tensor(0.91628915, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(optimizer = 'sgd',
                  loss = 'mse',
                  metrics = list(metric_kl_divergence()))
```

See Also

- https://keras.io/api/metrics/probabilistic_metrics#kldivergence-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other probabilistic metrics:
metric_binary_crossentropy()
metric_categorical_crossentropy()

```
metric_poisson()
metric_sparse_categorical_crossentropy()
```

`metric_log_cosh` *Logarithm of the hyperbolic cosine of the prediction error.*

Description

Formula:

```
loss <- mean(log(cosh(y_pred - y_true)), axis=-1)
```

Note that `log(cosh(x))` is approximately equal to `(x ** 2) / 2` for small `x` and to `abs(x) - log(2)` for large `x`. This means that 'logcosh' works mostly like the mean squared error, but will not be so strongly affected by the occasional wildly incorrect prediction.

Usage

```
metric_log_cosh(y_true, y_pred)
```

Arguments

`y_true`	Ground truth values with shape = `[batch_size, d0, .. dN]`.
`y_pred`	The predicted values with shape = `[batch_size, d0, .. dN]`.

Value

Logcosh error values with shape = `[batch_size, d0, .. dN-1]`.

Examples

```
y_true <- rbind(c(0., 1.), c(0., 0.))
y_pred <- rbind(c(1., 1.), c(0., 0.))
loss <- metric_log_cosh(y_true, y_pred)
loss
```

```
## tf.Tensor([0.2168904 0.        ], shape=(2), dtype=float32)
```

See Also

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()

metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

`metric_log_cosh_error` *Computes the logarithm of the hyperbolic cosine of the prediction error.*

Description

Formula:

```
error <- y_pred - y_true
logcosh <- mean(log((exp(error) + exp(-error))/2), axis=-1)
```

Usage

```
metric_log_cosh_error(..., name = "logcosh", dtype = NULL)
```

Arguments

`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

Standalone usage:

```
m <- metric_log_cosh_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()
```

```
## tf.Tensor(0.108445205, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()
```

```
## tf.Tensor(0.21689041, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(optimizer = 'sgd',
                  loss = 'mse',
                  metrics = list(metric_log_cosh_error()))
```

See Also

- https://keras.io/api/metrics/regression_metrics#logcosherror-class

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()

metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_mean   *Compute the (weighted) mean of the given values.*

Description

For example, if values is `c(1, 3, 5, 7)` then the mean is 4. If `sample_weight` was specified as `c(1, 1, 0, 0)` then the mean would be 2.

This metric creates two variables, `total` and `count`. The mean value returned is simply `total` divided by `count`.

Usage

```
metric_mean(..., name = "mean", dtype = NULL)
```

Arguments

...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

```
m <- metric_mean()
m$update_state(c(1, 3, 5, 7))
m$result()

## tf.Tensor(4.0, shape=(), dtype=float32)


# calling a metric directly is equivalent to calling
# m$update_state(); m$result()
m <- metric_mean()
m(c(1, 3, 5, 7))

## tf.Tensor(4.0, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(1, 3, 5, 7), sample_weight = c(1, 1, 0, 0))
m$result()

## tf.Tensor(2.0, shape=(), dtype=float32)
```

See Also

Other reduction metrics:
metric_mean_wrapper()
metric_sum()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()

metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_mean_absolute_error
Computes the mean absolute error between the labels and predictions.

Description

Formula:

```
loss <- mean(abs(y_true - y_pred))
```

Usage

```
metric_mean_absolute_error(
  y_true,
  y_pred,
  ...,
  name = "mean_absolute_error",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_mean_absolute_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()

## tf.Tensor(0.25, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(
    optimizer = 'sgd',
    loss = 'mse',
    metrics = list(metric_mean_absolute_error()))
```

See Also

- https://keras.io/api/metrics/regression_metrics#meanabsoluteerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()

metric_log_cosh_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

---

metric_mean_absolute_percentage_error
Computes mean absolute percentage error between y_true *and* y_pred*.*

Description

Formula:

```
loss <- 100 * mean(abs((y_true - y_pred) / y_true), axis=-1)
```

Division by zero is prevented by dividing by maximum(y_true, epsilon) where epsilon = keras$backend$epsilon() (default to 1e-7).

Usage

```
metric_mean_absolute_percentage_error(
  y_true,
  y_pred,
  ...,
  name = "mean_absolute_percentage_error",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_mean_absolute_percentage_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()

## tf.Tensor(250000000.0, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(500000000.0, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
    optimizer = 'sgd',
    loss = 'mse',
    metrics = list(metric_mean_absolute_percentage_error()))
```

See Also

- https://keras.io/api/metrics/regression_metrics#meanabsolutepercentageerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()

loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_iou()
metric_mean_squared_error()

metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

---

metric_mean_iou *Computes the mean Intersection-Over-Union metric.*

Description

Formula:

```
iou <- true_positives / (true_positives + false_positives + false_negatives)
```

Intersection-Over-Union is a common evaluation metric for semantic image segmentation.

To compute IoUs, the predictions are accumulated in a confusion matrix, weighted by sample_weight and the metric is then calculated from it.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

Note that this class first computes IoUs for all individual classes, then returns the mean of these values.

Usage

```
metric_mean_iou(
  ...,
  num_classes,
  name = NULL,
  dtype = NULL,
  ignore_class = NULL,
  sparse_y_true = TRUE,
  sparse_y_pred = TRUE,
  axis = -1L
)
```

Arguments

...	For forward/backward compatability.
num_classes	The possible number of labels the prediction task can have. This value must be provided, since a confusion matrix of dimension = [num_classes, num_classes] will be allocated.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.
ignore_class	Optional integer. The ID of a class to be ignored during metric computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (ignore_class=NULL), all classes are considered.
sparse_y_true	Whether labels are encoded using integers or dense floating point vectors. If FALSE, the argmax function is used to determine each sample's most likely associated label.
sparse_y_pred	Whether predictions are encoded using integers or dense floating point vectors. If FALSE, the argmax function is used to determine each sample's most likely associated label.
axis	(Optional) The dimension containing the logits. Defaults to -1.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Examples

Standalone usage:

```
# cm = [[1, 1],
#       [1, 1]]
# sum_row = [2, 2], sum_col = [2, 2], true_positives = [1, 1]
# iou = true_positives / (sum_row + sum_col - true_positives))
# result = (1 / (2 + 2 - 1) + 1 / (2 + 2 - 1)) / 2 = 0.33
m <- metric_mean_iou(num_classes = 2)
m$update_state(c(0, 0, 1, 1), c(0, 1, 0, 1))
```

```
## tf.Tensor(
## [[1 1]
##  [1 1]], shape=(2, 2), dtype=int64)
```

```
m$result()
```

```
## tf.Tensor(0.33333334, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(c(0, 0, 1, 1), c(0, 1, 0, 1),
               sample_weight= 10 * c(0.3, 0.3, 0.3, 0.1))
```

```
## tf.Tensor(
## [[3 3]
##  [3 1]], shape=(2, 2), dtype=int64)
```

```
m$result()
```

```
## tf.Tensor(0.23809525, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_mean_iou(num_classes=2)))
```

See Also

- https://keras.io/api/metrics/segmentation_metrics#meaniou-class

Other iou metrics:
metric_binary_iou()
metric_iou()
metric_one_hot_iou()
metric_one_hot_mean_iou()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()

metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_mean_squared_error
Computes the mean squared error between `y_true` *and* `y_pred`.

Description

Formula:

```
loss <- mean(square(y_true - y_pred))
```

Usage

```
metric_mean_squared_error(
  y_true,
  y_pred,
  ...,
  name = "mean_squared_error",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = `[batch_size, d0, .. dN]`.
y_pred	The predicted values with shape = `[batch_size, d0, .. dN]`.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If `y_true` and `y_pred` are missing, a `Metric` instance is returned. The `Metric` instance that can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage. If `y_true` and `y_pred` are provided, then a tensor with the computed value is returned.

Examples

```
m <- metric_mean_squared_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()

## tf.Tensor(0.25, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/regression_metrics#meansquarederror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()

metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()

metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

---

metric_mean_squared_logarithmic_error

Computes mean squared logarithmic error between y_true *and* y_pred.

Description

Formula:

```
loss <- mean(square(log(y_true + 1) - log(y_pred + 1)), axis=-1)
```

Note that y_pred and y_true cannot be less or equal to 0. Negative values and 0 values will be replaced with keras$backend$epsilon() (default to 1e-7).

Usage

```
metric_mean_squared_logarithmic_error(
  y_true,
  y_pred,
  ...,
  name = "mean_squared_logarithmic_error",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_mean_squared_logarithmic_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()
```

```
## tf.Tensor(0.12011322, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()
```

```
## tf.Tensor(0.24022643, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_mean_squared_logarithmic_error()))
```

See Also

- https://keras.io/api/metrics/regression_metrics#meansquaredlogarithmicerror-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()

loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_poisson()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()

metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_pearson_correlation()
metric_r2_score()
metric_root_mean_squared_error()

metric_mean_wrapper   *Wrap a stateless metric function with the* Mean *metric.*

Description

You could use this class to quickly build a mean metric from a function. The function needs to have the signature `fn(y_true, y_pred)` and return a per-sample loss array. `metric_mean_wrapper$result()` will return the average metric value across all samples seen so far.

For example:

```
mse <- function(y_true, y_pred) {
  (y_true - y_pred)^2
}

mse_metric <- metric_mean_wrapper(fn = mse)
mse_metric$update_state(c(0, 1), c(1, 1))
mse_metric$result()

## tf.Tensor(0.5, shape=(), dtype=float32)
```

Usage

```
metric_mean_wrapper(..., fn, name = NULL, dtype = NULL)
```

Arguments

`...`	Keyword arguments to pass on to `fn`.
`fn`	The metric function to wrap, with signature `fn(y_true, y_pred)`.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

See Also

Other reduction metrics:
`metric_mean()`
`metric_sum()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`

metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

`metric_one_hot_iou` *Computes the Intersection-Over-Union metric for one-hot encoded labels.*

Description

Formula:

```
iou <- true_positives / (true_positives + false_positives + false_negatives)
```

Intersection-Over-Union is a common evaluation metric for semantic image segmentation.

To compute IoUs, the predictions are accumulated in a confusion matrix, weighted by `sample_weight` and the metric is then calculated from it.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

This class can be used to compute IoU for multi-class classification tasks where the labels are one-hot encoded (the last axis should have one dimension per class). Note that the predictions should also have the same shape. To compute the IoU, first the labels and predictions are converted back into integer format by taking the argmax over the class axis. Then the same computation steps as for the base `IoU` class apply.

Note, if there is only one channel in the labels and predictions, this class is the same as class `IoU`. In this case, use `IoU` instead.

Also, make sure that `num_classes` is equal to the number of classes in the data, to avoid a "labels out of bound" error when the confusion matrix is computed.

Usage

```
metric_one_hot_iou(
  ...,
  num_classes,
  target_class_ids,
  name = NULL,
  dtype = NULL,
  ignore_class = NULL,
  sparse_y_pred = FALSE,
  axis = -1L
)
```

Arguments

`...`	For forward/backward compatability.
`num_classes`	The possible number of labels the prediction task can have.
`target_class_ids`	A list or list of target class ids for which the metric is returned. To compute IoU for a specific class, a list (or list) of a single id value should be provided.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.
`ignore_class`	Optional integer. The ID of a class to be ignored during metric computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (`ignore_class=NULL`), all classes are considered.

sparse_y_pred Whether predictions are encoded using integers or dense floating point vectors. If FALSE, the argmax function is used to determine each sample's most likely associated label.

axis (Optional) The dimension containing the logits. Defaults to -1.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Examples

Standalone usage:

```
y_true <- rbind(c(0, 0, 1),
                c(1, 0, 0),
                c(0, 1, 0),
                c(1, 0, 0))
y_pred <- rbind(c(0.2, 0.3, 0.5),
                c(0.1, 0.2, 0.7),
                c(0.5, 0.3, 0.1),
                c(0.1, 0.4, 0.5))
sample_weight <- c(0.1, 0.2, 0.3, 0.4)

m <- metric_one_hot_iou(num_classes = 3, target_class_ids = c(0, 2))
m$update_state(y_true = y_true,
               y_pred = y_pred,
               sample_weight = 10*sample_weight)

## tf.Tensor(
## [[0 0 6]
##  [3 0 0]
##  [0 0 1]], shape=(3, 3), dtype=int64)


m$result()

## tf.Tensor(0.071428575, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_one_hot_iou(
    num_classes = 3L,
    target_class_id = list(1L)
  ))
)
```

See Also

Other iou metrics:
metric_binary_iou()
metric_iou()
metric_mean_iou()
metric_one_hot_mean_iou()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()

metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_one_hot_mean_iou
Computes mean Intersection-Over-Union metric for one-hot encoded labels.

Description

Formula:

```
iou <- true_positives / (true_positives + false_positives + false_negatives)
```

Intersection-Over-Union is a common evaluation metric for semantic image segmentation.

To compute IoUs, the predictions are accumulated in a confusion matrix, weighted by `sample_weight` and the metric is then calculated from it.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

This class can be used to compute the mean IoU for multi-class classification tasks where the labels are one-hot encoded (the last axis should have one dimension per class). Note that the predictions should also have the same shape. To compute the mean IoU, first the labels and predictions are converted back into integer format by taking the argmax over the class axis. Then the same computation steps as for the base `MeanIoU` class apply.

Note, if there is only one channel in the labels and predictions, this class is the same as class `metric_mean_iou`. In this case, use `metric_mean_iou` instead.

Also, make sure that `num_classes` is equal to the number of classes in the data, to avoid a "labels out of bound" error when the confusion matrix is computed.

Usage

```
metric_one_hot_mean_iou(
  ...,
  num_classes,
  name = NULL,
  dtype = NULL,
  ignore_class = NULL,
  sparse_y_pred = FALSE,
  axis = -1L
)
```

Arguments

`...`	For forward/backward compatability.
`num_classes`	The possible number of labels the prediction task can have.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.
`ignore_class`	Optional integer. The ID of a class to be ignored during metric computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (`ignore_class=NULL`), all classes are considered.
`sparse_y_pred`	Whether predictions are encoded using natural numbers or probability distribution vectors. If `FALSE`, the `argmax` function will be used to determine each sample's most likely associated label.
`axis`	(Optional) The dimension containing the logits. Defaults to `-1`.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

Standalone usage:

```
y_true <- rbind(c(0, 0, 1), c(1, 0, 0), c(0, 1, 0), c(1, 0, 0))
y_pred <- rbind(c(0.2, 0.3, 0.5), c(0.1, 0.2, 0.7), c(0.5, 0.3, 0.1),
                c(0.1, 0.4, 0.5))
sample_weight <- 10 * c(0.1, 0.2, 0.3, 0.4)
m <- metric_one_hot_mean_iou(num_classes = 3L)
m$update_state(
    y_true = y_true, y_pred = y_pred, sample_weight = sample_weight)

## tf.Tensor(
## [[0 0 6]
##  [3 0 0]
##  [0 0 1]], shape=(3, 3), dtype=int64)


m$result()

## tf.Tensor(0.04761905, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
    optimizer = 'sgd',
    loss = 'mse',
    metrics = list(metric_one_hot_mean_iou(num_classes = 3L)))
```

See Also

Other iou metrics:
metric_binary_iou()
metric_iou()
metric_mean_iou()
metric_one_hot_iou()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()

metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_pearson_correlation
Calculates the Pearson Correlation Coefficient (PCC).

Description

Formula:

```
loss = mean(l2norm(y_true - mean(y_true) * l2norm(y_pred - mean(y_pred)))
```

PCC measures the linear relationship between the true values (y_true) and the predicted values (y_pred). The coefficient ranges from -1 to 1, where a value of 1 implies a perfect positive linear correlation, 0 indicates no linear correlation, and -1 indicates a perfect negative linear correlation.

This metric is widely used in regression tasks where the strength of the linear relationship between predictions and true labels is an important evaluation criterion.

Usage

```
metric_pearson_correlation(
  y_true,
  y_pred,
  axis = -1L,
  ...,
  name = "pearson_correlation",
  dtype = NULL
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
axis	(Optional) integer or tuple of integers of the axis/axes along which to compute the metric. Defaults to -1.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Examples

```
pcc <- metric_pearson_correlation(axis = -1)
y_true <- rbind(c(0, 1, 0.5),
                c(1, 1, 0.2))
y_pred <- rbind(c(0.1, 0.9, 0.5),
                c(1, 0.9, 0.2))
pcc$update_state(y_true, y_pred)
pcc$result()
```

```
## tf.Tensor(0.99669963, shape=(), dtype=float32)
```

```
# equivalent operation using R's stats::cor()
mean(sapply(1:nrow(y_true), function(i) {
  cor(y_true[i, ], y_pred[i, ])
}))
```

```
## [1] 0.9966996
```

Usage with `compile()` API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'mean_squared_error',
  metrics = c(keras.metrics.PearsonCorrelation())
)
```

See Also

Other regression metrics:
`metric_concordance_correlation()`
`metric_cosine_similarity()`
`metric_log_cosh_error()`
`metric_mean_absolute_error()`
`metric_mean_absolute_percentage_error()`
`metric_mean_squared_error()`
`metric_mean_squared_logarithmic_error()`
`metric_r2_score()`
`metric_root_mean_squared_error()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_poisson *Computes the Poisson metric between* y_true *and* y_pred.

Description

Formula:

```
metric <- y_pred - y_true * log(y_pred)
```

Usage

```
metric_poisson(y_true, y_pred, ..., name = "poisson", dtype = NULL)
```

Arguments

y_true	Ground truth values. shape = [batch_size, d0, .. dN].
y_pred	The predicted values. shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_poisson()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()

## tf.Tensor(0.49999997, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(0.99999994, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_poisson())
)
```

See Also

- https://keras.io/api/metrics/probabilistic_metrics#poisson-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_sparse_categorical_crossentropy()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other probabilistic metrics:
metric_binary_crossentropy()
metric_categorical_crossentropy()

metric_kl_divergence()
metric_sparse_categorical_crossentropy()

---

metric_precision *Computes the precision of the predictions with respect to the labels.*

Description

The metric creates two local variables, true_positives and false_positives that are used to compute the precision. This value is ultimately returned as precision, an idempotent operation that simply divides true_positives by the sum of true_positives and false_positives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

If top_k is set, we'll calculate precision as how often on average a class among the top-k classes with the highest predicted values of a batch entry is correct and can be found in the label for that entry.

If class_id is specified, we calculate precision by considering only the entries in the batch for which class_id is above the threshold and/or in the top-k highest predictions, and computing the fraction of them for which class_id is indeed a correct label.

Usage

```
metric_precision(
  ...,
  thresholds = NULL,
  top_k = NULL,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
thresholds	(Optional) A float value, or a Python list of float threshold values in [0, 1]. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is TRUE, below is FALSE). If used with a loss function that sets from_logits=TRUE (i.e. no sigmoid applied to predictions), thresholds should be set to 0. One metric value is generated for each threshold value. If neither thresholds nor top_k are set, the default is to calculate precision with thresholds=0.5.
top_k	(Optional) Unset by default. An int value specifying the top-k predictions to consider when calculating precision.
class_id	(Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval [0, num_classes), where num_classes is the last dimension of predictions.

name (Optional) string name of the metric instance.

dtype (Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Usage

Standalone usage:

```
m <- metric_precision()
m$update_state(c(0, 1, 1, 1),
               c(1, 0, 1, 1))
m$result() |> as.double() |> signif()

## [1] 0.666667


m$reset_state()
m$update_state(c(0, 1, 1, 1),
               c(1, 0, 1, 1),
               sample_weight = c(0, 0, 1, 0))
m$result() |> as.double() |> signif()

## [1] 1


# With top_k=2, it will calculate precision over y_true[1:2]
# and y_pred[1:2]
m <- metric_precision(top_k = 2)
m$update_state(c(0, 0, 1, 1), c(1, 1, 1, 1))
m$result()

## tf.Tensor(0.0, shape=(), dtype=float32)


# With top_k=4, it will calculate precision over y_true[1:4]
# and y_pred[1:4]
m <- metric_precision(top_k = 4)
m$update_state(c(0, 0, 1, 1), c(1, 1, 1, 1))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_precision())
)
```

Usage with a loss with `from_logits=TRUE`:

```
model |> compile(
  optimizer = 'adam',
  loss = loss_binary_crossentropy(from_logits = TRUE),
  metrics = list(metric_precision(thresholds = 0))
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#precision-class

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()

metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_precision_at_recall

Computes best precision where recall is >= specified value.

Description

This metric creates four local variables, `true_positives`, `true_negatives`, `false_positives` and `false_negatives` that are used to compute the precision at the given recall. The threshold for the given recall value is computed and used to evaluate the corresponding precision.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

If `class_id` is specified, we calculate precision by considering only the entries in the batch for which `class_id` is above the threshold predictions, and computing the fraction of them for which `class_id` is indeed a correct label.

Usage

```
metric_precision_at_recall(
  ...,
  recall,
  num_thresholds = 200L,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

`...`	For forward/backward compatability.
`recall`	A scalar value in range `[0, 1]`.
`num_thresholds`	(Optional) Defaults to 200. The number of thresholds to use for matching the given recall.
`class_id`	(Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval `[0, num_classes)`, where `num_classes` is the last dimension of predictions.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_precision_at_recall(recall = 0.5)
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8),
               sample_weight = c(2, 2, 2, 1, 1))
m$result()

## tf.Tensor(0.33333334, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_precision_at_recall(recall = 0.8))
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#precisionatrecall-class

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()

metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_r2_score *Computes R2 score.*

Description

Formula:

```
sum_squares_residuals <- sum((y_true - y_pred) ** 2)
sum_squares <- sum((y_true - mean(y_true)) ** 2)
R2 <- 1 - sum_squares_residuals / sum_squares
```

This is also called the coefficient of determination.

It indicates how close the fitted regression line is to ground-truth data.

- The highest score possible is 1.0. It indicates that the predictors perfectly accounts for variation in the target.
- A score of 0.0 indicates that the predictors do not account for variation in the target.
- It can also be negative if the model is worse than random.

This metric can also compute the "Adjusted R2" score.

Usage

```
metric_r2_score(
  ...,
  class_aggregation = "uniform_average",
  num_regressors = 0L,
  name = "r2_score",
  dtype = NULL
)
```

Arguments

`...`	For forward/backward compatability.
`class_aggregation`	Specifies how to aggregate scores corresponding to different output classes (or target dimensions), i.e. different dimensions on the last axis of the predictions. Equivalent to `multioutput` argument in Scikit-Learn. Should be one of `NULL` (no aggregation), `"uniform_average"`, `"variance_weighted_average"`.
`num_regressors`	Number of independent regressors used ("Adjusted R2" score). 0 is the standard R2 score. Defaults to `0`.
`name`	Optional. string name of the metric instance.
`dtype`	Optional. data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

```
y_true <- rbind(1, 4, 3)
y_pred <- rbind(2, 4, 4)
metric <- metric_r2_score()
metric$update_state(y_true, y_pred)
metric$result()

## tf.Tensor(0.57142854, shape=(), dtype=float32)
```

See Also

Other regression metrics:
`metric_concordance_correlation()`
`metric_cosine_similarity()`
`metric_log_cosh_error()`
`metric_mean_absolute_error()`
`metric_mean_absolute_percentage_error()`
`metric_mean_squared_error()`
`metric_mean_squared_logarithmic_error()`

metric_pearson_correlation()
metric_root_mean_squared_error()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()

metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

metric_recall *Computes the recall of the predictions with respect to the labels.*

Description

This metric creates two local variables, true_positives and false_negatives, that are used to compute the recall. This value is ultimately returned as recall, an idempotent operation that simply divides true_positives by the sum of true_positives and false_negatives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

If top_k is set, recall will be computed as how often on average a class among the labels of a batch entry is in the top-k predictions.

If class_id is specified, we calculate recall by considering only the entries in the batch for which class_id is in the label, and computing the fraction of them for which class_id is above the threshold and/or in the top-k predictions.

Usage

```
metric_recall(
  ...,
  thresholds = NULL,
  top_k = NULL,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
thresholds	(Optional) A float value, or a Python list of float threshold values in [0, 1]. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is TRUE, below is FALSE). If used with a loss function that sets from_logits=TRUE (i.e. no sigmoid applied to predictions), thresholds should be set to 0. One metric value is generated for each threshold value. If neither thresholds nor top_k are set, the default is to calculate recall with thresholds=0.5.
top_k	(Optional) Unset by default. An int value specifying the top-k predictions to consider when calculating recall.

class_id (Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval `[0, num_classes)`, where `num_classes` is the last dimension of predictions.

name (Optional) string name of the metric instance.

dtype (Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_recall()
m$update_state(c(0, 1, 1, 1),
               c(1, 0, 1, 1))
m$result()

## tf.Tensor(0.6666667, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0, 1, 1, 1),
               c(1, 0, 1, 1),
               sample_weight = c(0, 0, 1, 0))
m$result()

## tf.Tensor(1.0, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_recall())
)
```

Usage with a loss with `from_logits=TRUE`:

```
model |> compile(
  optimizer = 'adam',
  loss = loss_binary_crossentropy(from_logits = TRUE),
  metrics = list(metric_recall(thresholds = 0))
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#recall-class

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()

metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_recall_at_precision

Computes best recall where precision is >= specified value.

Description

For a given score-label-distribution the required precision might not be achievable, in this case 0.0 is returned as recall.

This metric creates four local variables, `true_positives`, `true_negatives`, `false_positives` and `false_negatives` that are used to compute the recall at the given precision. The threshold for the given precision value is computed and used to evaluate the corresponding recall.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

If `class_id` is specified, we calculate precision by considering only the entries in the batch for which `class_id` is above the threshold predictions, and computing the fraction of them for which `class_id` is indeed a correct label.

Usage

```
metric_recall_at_precision(
  ...,
  precision,
  num_thresholds = 200L,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
precision	A scalar value in range [0, 1].
num_thresholds	(Optional) Defaults to 200. The number of thresholds to use for matching the given precision.
class_id	(Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval [0, num_classes), where num_classes is the last dimension of predictions.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Usage

Standalone usage:

```
m <- metric_recall_at_precision(precision = 0.8)
m$update_state(c(0,   0,   1,   1),
               c(0, 0.5, 0.3, 0.9))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0,   0,   1,   1),
               c(0, 0.5, 0.3, 0.9),
               sample_weight = c(1, 0, 0, 1))
m$result()

## tf.Tensor(1.0, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_recall_at_precision(precision = 0.8))
)
```

See Also

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()

metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_root_mean_squared_error
Computes root mean squared error metric between y_true *and* y_pred.

Description

Formula:

```
loss <- sqrt(mean((y_pred - y_true) ^ 2))
```

Usage

```
metric_root_mean_squared_error(
  ...,
  name = "root_mean_squared_error",
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Examples

Standalone usage:

```
m <- metric_root_mean_squared_error()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(1, 1), c(0, 0)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(0.70710677, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model %>% compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_root_mean_squared_error()))
```

See Also

- https://keras.io/api/metrics/regression_metrics#rootmeansquarederror-class

Other regression metrics:
metric_concordance_correlation()
metric_cosine_similarity()
metric_log_cosh_error()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_pearson_correlation()
metric_r2_score()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()

metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_sensitivity_at_specificity

Computes best sensitivity where specificity is >= specified value.

Description

`Sensitivity` measures the proportion of actual positives that are correctly identified as such `(tp / (tp + fn))`. `Specificity` measures the proportion of actual negatives that are correctly identified as such `(tn / (tn + fp))`.

This metric creates four local variables, `true_positives`, `true_negatives`, `false_positives` and `false_negatives` that are used to compute the sensitivity at the given specificity. The threshold for the given specificity value is computed and used to evaluate the corresponding sensitivity.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

If `class_id` is specified, we calculate precision by considering only the entries in the batch for which `class_id` is above the threshold predictions, and computing the fraction of them for which `class_id` is indeed a correct label.

For additional information about specificity and sensitivity, see the following.

Usage

```
metric_sensitivity_at_specificity(
  ...,
  specificity,
  num_thresholds = 200L,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

`...`	For forward/backward compatability.
`specificity`	A scalar value in range `[0, 1]`.
`num_thresholds`	(Optional) Defaults to 200. The number of thresholds to use for matching the given specificity.
`class_id`	(Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval `[0, num_classes)`, where `num_classes` is the last dimension of predictions.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_sensitivity_at_specificity(specificity = 0.5)
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8))
m$result()
```

```
## tf.Tensor(0.5, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8),
               sample_weight = c(1, 1, 2, 2, 1))
m$result()
```

```
## tf.Tensor(0.33333334, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_sensitivity_at_specificity())
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#sensitivityatspecificity-class

Other confusion metrics:
`metric_auc()`
`metric_false_negatives()`
`metric_false_positives()`
`metric_precision()`
`metric_precision_at_recall()`
`metric_recall()`
`metric_recall_at_precision()`
`metric_specificity_at_sensitivity()`
`metric_true_negatives()`
`metric_true_positives()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`

metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_sparse_categorical_accuracy

Calculates how often predictions match integer labels.

Description

```
acc <- sample_weight %*% (y_true == which.max(y_pred))
```

You can provide logits of classes as `y_pred`, since argmax of logits and probabilities are same.

This metric creates two local variables, `total` and `count` that are used to compute the frequency with which `y_pred` matches `y_true`. This frequency is ultimately returned as `sparse categorical accuracy`: an idempotent operation that simply divides `total` by `count`.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

Usage

```
metric_sparse_categorical_accuracy(
  y_true,
  y_pred,
  ...,
  name = "sparse_categorical_accuracy",
  dtype = NULL
)
```

Arguments

`y_true`	Tensor of true targets.
`y_pred`	Tensor of predicted targets.
`...`	For forward/backward compatability.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

If `y_true` and `y_pred` are missing, a `Metric` instance is returned. The `Metric` instance that can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage. If `y_true` and `y_pred` are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_sparse_categorical_accuracy()
m$update_state(rbind(2L, 1L), rbind(c(0.1, 0.6, 0.3), c(0.05, 0.95, 0)))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(2L, 1L), rbind(c(0.1, 0.6, 0.3), c(0.05, 0.95, 0)),
               sample_weight = c(0.7, 0.3))
m$result()
```

```
## tf.Tensor(0.3, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(optimizer = 'sgd',
                 loss = 'sparse_categorical_crossentropy',
                 metrics = list(metric_sparse_categorical_accuracy()))
```

See Also

- https://keras.io/api/metrics/accuracy_metrics#sparsecategoricalaccuracy-class

Other accuracy metrics:
metric_binary_accuracy()
metric_categorical_accuracy()
metric_sparse_top_k_categorical_accuracy()
metric_top_k_categorical_accuracy()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()

metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_sparse_categorical_crossentropy
Computes the crossentropy metric between the labels and predictions.

Description

Use this crossentropy metric when there are two or more label classes. It expects labels to be provided as integers. If you want to provide labels that are one-hot encoded, please use the `metric_categorical_crossentropy` metric instead.

There should be `num_classes` floating point values per feature for `y_pred` and a single floating point value per feature for `y_true`.

Usage

```
metric_sparse_categorical_crossentropy(
  y_true,
  y_pred,
  from_logits = FALSE,
  ignore_class = NULL,
  axis = -1L,
  ...,
  name = "sparse_categorical_crossentropy",
  dtype = NULL
)
```

Arguments

y_true	Ground truth values.
y_pred	The predicted values.
from_logits	(Optional) Whether output is expected to be a logits tensor. By default, we consider that output encodes a probability distribution.
ignore_class	Optional integer. The ID of a class to be ignored during loss computation. This is useful, for example, in segmentation problems featuring a "void" class (commonly -1 or 255) in segmentation maps. By default (ignore_class=NULL), all classes are considered.
axis	(Optional) Defaults to -1. The dimension along which entropy is computed.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Examples

Standalone usage:

```
m <- metric_sparse_categorical_crossentropy()
m$update_state(array(c(1, 2)),
               rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1)))
m$result()
```

```
## tf.Tensor(1.1769392, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(array(c(1, 2)),
               rbind(c(0.05, 0.95, 0), c(0.1, 0.8, 0.1)),
               sample_weight = c(0.3, 0.7))
m$result()
```

```
## tf.Tensor(1.6271976, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'mse',
  metrics = list(metric_sparse_categorical_crossentropy())
)
```

See Also

- https://keras.io/api/metrics/probabilistic_metrics#sparsecategoricalcrossentropy-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()
loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_squared_hinge()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()

metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other probabilistic metrics:
metric_binary_crossentropy()
metric_categorical_crossentropy()

metric_kl_divergence()
metric_poisson()

---

metric_sparse_top_k_categorical_accuracy
Computes how often integer targets are in the top K predictions.

Description

Computes how often integer targets are in the top K predictions.

By default, the arguments expected by update_state() are:

- y_true: a tensor of shape (batch_size) representing indices of true categories.
- y_pred: a tensor of shape (batch_size, num_categories) containing the scores for each sample for all possible categories.

With from_sorted_ids=TRUE, the arguments expected by update_state are:

- y_true: a tensor of shape (batch_size) representing indices or IDs of true categories.
- y_pred: a tensor of shape (batch_size, N) containing the indices or IDs of the top N categories sorted in order from highest score to lowest score. N must be greater or equal to k.

The from_sorted_ids=TRUE option can be more efficient when the set of categories is very large and the model has an optimized way to retrieve the top ones either without scoring or without maintaining the scores for all the possible categories.

Usage

```
metric_sparse_top_k_categorical_accuracy(
  y_true,
  y_pred,
  k = 5L,
  ...,
  name = "sparse_top_k_categorical_accuracy",
  dtype = NULL,
  from_sorted_ids = FALSE
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
k	(Optional) Number of top elements to look at for computing accuracy. Defaults to 5.
...	For forward/backward compatability.

name (Optional) string name of the metric instance.

dtype (Optional) data type of the metric result.

from_sorted_ids
(Optional) When FALSE, the default, the tensor passed in y_pred contains the unsorted scores of all possible categories. When TRUE, y_pred contains the indices or IDs for the top categories.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_sparse_top_k_categorical_accuracy(k = 1L)
m$update_state(
  rbind(2, 1),
  op_array(rbind(c(0.1, 0.9, 0.8), c(0.05, 0.95, 0)), dtype = "float32")
)
m$result()
```

```
## tf.Tensor(0.5, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(
  rbind(2, 1),
  op_array(rbind(c(0.1, 0.9, 0.8), c(0.05, 0.95, 0)), dtype = "float32"),
  sample_weight = c(0.7, 0.3)
)
m$result()
```

```
## tf.Tensor(0.3, shape=(), dtype=float32)
```

```
m <- metric_sparse_top_k_categorical_accuracy(k = 1, from_sorted_ids = TRUE)
m$update_state(array(c(2, 1)), rbind(c(1, 0, 3),
                                     c(1, 2, 3)))
m$result()
```

```
## tf.Tensor(0.5, shape=(), dtype=float32)
```

Usage with compile() API:

```
model %>% compile(optimizer = 'sgd',
                  loss = 'sparse_categorical_crossentropy',
                  metrics = list(metric_sparse_top_k_categorical_accuracy()))
```

See Also

- https://keras.io/api/metrics/accuracy_metrics#sparsetopkcategoricalaccuracy-class

Other accuracy metrics:
metric_binary_accuracy()
metric_categorical_accuracy()
metric_sparse_categorical_accuracy()
metric_top_k_categorical_accuracy()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()

metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_specificity_at_sensitivity
Computes best specificity where sensitivity is >= specified value.

Description

`Sensitivity` measures the proportion of actual positives that are correctly identified as such `(tp / (tp + fn))`. `Specificity` measures the proportion of actual negatives that are correctly identified as such `(tn / (tn + fp))`.

This metric creates four local variables, `true_positives`, `true_negatives`, `false_positives` and `false_negatives` that are used to compute the specificity at the given sensitivity. The threshold for the given sensitivity value is computed and used to evaluate the corresponding specificity.

If `sample_weight` is `NULL`, weights default to 1. Use `sample_weight` of 0 to mask values.

If `class_id` is specified, we calculate precision by considering only the entries in the batch for which `class_id` is above the threshold predictions, and computing the fraction of them for which `class_id` is indeed a correct label.

For additional information about specificity and sensitivity, see the following.

Usage

```
metric_specificity_at_sensitivity(
  ...,
  sensitivity,
  num_thresholds = 200L,
  class_id = NULL,
  name = NULL,
  dtype = NULL
)
```

Arguments

...	For forward/backward compatability.
sensitivity	A scalar value in range [0, 1].
num_thresholds	(Optional) Defaults to 200. The number of thresholds to use for matching the given sensitivity.
class_id	(Optional) Integer class ID for which we want binary metrics. This must be in the half-open interval [0, num_classes), where num_classes is the last dimension of predictions.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Usage

Standalone usage:

```
m <- metric_specificity_at_sensitivity(sensitivity = 0.5)
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8))
m$result()

## tf.Tensor(0.6666667, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0,   0,   0,   1,   1),
               c(0, 0.3, 0.8, 0.3, 0.8),
               sample_weight = c(1, 1, 2, 2, 2))
m$result()

## tf.Tensor(0.5, shape=(), dtype=float32)
```

Usage with compile() API:

```
model |> compile(
  optimizer = 'sgd',
  loss = 'binary_crossentropy',
  metrics = list(metric_sensitivity_at_specificity())
)
```

See Also

- https://keras.io/api/metrics/classification_metrics#specificityatsensitivity-class

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_true_negatives()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()

metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_squared_hinge *Computes the hinge metric between* y_true *and* y_pred.

Description

Formula:

```
loss <- mean(square(maximum(1 - y_true * y_pred, 0)))
```

y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1.

Usage

```
metric_squared_hinge(y_true, y_pred, ..., name = "squared_hinge", dtype = NULL)
```

Arguments

y_true	The ground truth values. y_true values are expected to be -1 or 1. If binary (0 or 1) labels are provided we will convert them to -1 or 1 with shape = [batch_size, d0, .. dN].
y_pred	The predicted values with shape = [batch_size, d0, .. dN].
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If y_true and y_pred are missing, a Metric instance is returned. The Metric instance that can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage. If y_true and y_pred are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_squared_hinge()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)))
m$result()

## tf.Tensor(1.86, shape=(), dtype=float32)


m$reset_state()
m$update_state(rbind(c(0, 1), c(0, 0)), rbind(c(0.6, 0.4), c(0.4, 0.6)),
               sample_weight = c(1, 0))
m$result()

## tf.Tensor(1.46, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/hinge_metrics#squaredhinge-class

Other losses:
Loss()
loss_binary_crossentropy()
loss_binary_focal_crossentropy()
loss_categorical_crossentropy()
loss_categorical_focal_crossentropy()
loss_categorical_hinge()
loss_circle()
loss_cosine_similarity()
loss_ctc()
loss_dice()
loss_hinge()
loss_huber()
loss_kl_divergence()
loss_log_cosh()
loss_mean_absolute_error()
loss_mean_absolute_percentage_error()
loss_mean_squared_error()
loss_mean_squared_logarithmic_error()
loss_poisson()
loss_sparse_categorical_crossentropy()

loss_squared_hinge()
loss_tversky()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_hinge()
metric_huber()
metric_kl_divergence()
metric_log_cosh()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_poisson()
metric_sparse_categorical_crossentropy()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()

metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

Other hinge metrics:
metric_categorical_hinge()
metric_hinge()

---

metric_sum *Compute the (weighted) sum of the given values.*

Description

For example, if values is [1, 3, 5, 7] then their sum is 16. If sample_weight was specified as [1, 1, 0, 0] then the sum would be 4.

This metric creates one variable, total. This is ultimately returned as the sum value.

Usage

```
metric_sum(..., name = "sum", dtype = NULL)
```

Arguments

...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Examples

```
m <- metric_sum()
m$update_state(c(1, 3, 5, 7))
m$result()

## tf.Tensor(16.0, shape=(), dtype=float32)


m <- metric_sum()
m$update_state(c(1, 3, 5, 7), sample_weight = c(1, 1, 0, 0))
m$result()

## tf.Tensor(4.0, shape=(), dtype=float32)
```

See Also

Other reduction metrics:
`metric_mean()`
`metric_mean_wrapper()`

Other metrics:
`Metric()`
`custom_metric()`
`metric_auc()`
`metric_binary_accuracy()`
`metric_binary_crossentropy()`
`metric_binary_focal_crossentropy()`
`metric_binary_iou()`
`metric_categorical_accuracy()`
`metric_categorical_crossentropy()`
`metric_categorical_focal_crossentropy()`
`metric_categorical_hinge()`
`metric_concordance_correlation()`
`metric_cosine_similarity()`
`metric_f1_score()`
`metric_false_negatives()`
`metric_false_positives()`
`metric_fbeta_score()`
`metric_hinge()`
`metric_huber()`
`metric_iou()`
`metric_kl_divergence()`

metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_top_k_categorical_accuracy()
metric_true_negatives()
metric_true_positives()

---

metric_top_k_categorical_accuracy
Computes how often targets are in the top K predictions.

Description

Computes how often targets are in the top K predictions.

Usage

```
metric_top_k_categorical_accuracy(
  y_true,
  y_pred,
  k = 5L,
  ...,
  name = "top_k_categorical_accuracy",
  dtype = NULL
)
```

Arguments

y_true	Tensor of true targets.
y_pred	Tensor of predicted targets.
k	(Optional) Number of top elements to look at for computing accuracy. Defaults to 5.
...	For forward/backward compatability.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

If `y_true` and `y_pred` are missing, a `Metric` instance is returned. The `Metric` instance that can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage. If `y_true` and `y_pred` are provided, then a tensor with the computed value is returned.

Usage

Standalone usage:

```
m <- metric_top_k_categorical_accuracy(k = 1)
m$update_state(
  rbind(c(0, 0, 1), c(0, 1, 0)),
  op_array(rbind(c(0.1, 0.9, 0.8), c(0.05, 0.95, 0)), dtype = "float32")
)
m$result()
```

```
## tf.Tensor(0.5, shape=(), dtype=float32)
```

```
m$reset_state()
m$update_state(
  rbind(c(0, 0, 1), c(0, 1, 0)),
  op_array(rbind(c(0.1, 0.9, 0.8), c(0.05, 0.95, 0)), dtype = "float32"),
  sample_weight = c(0.7, 0.3))
m$result()
```

```
## tf.Tensor(0.3, shape=(), dtype=float32)
```

Usage with `compile()` API:

```
model |> compile(optimizer = 'sgd',
                 loss = 'categorical_crossentropy',
                 metrics = list(metric_top_k_categorical_accuracy()))
```

See Also

- https://keras.io/api/metrics/accuracy_metrics#topkcategoricalaccuracy-class

Other accuracy metrics:
metric_binary_accuracy()
metric_categorical_accuracy()
metric_sparse_categorical_accuracy()
metric_sparse_top_k_categorical_accuracy()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()

metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_true_negatives()
metric_true_positives()

---

metric_true_negatives *Calculates the number of true negatives.*

Description

If sample_weight is given, calculates the sum of the weights of true negatives. This metric creates one local variable, accumulator that is used to keep track of the number of true negatives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

Usage

```
metric_true_negatives(..., thresholds = NULL, name = NULL, dtype = NULL)
```

Arguments

...	For forward/backward compatability.
thresholds	(Optional) Defaults to 0.5. A float value, or a Python list of float threshold values in [0, 1]. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is TRUE, below is FALSE). If used with a loss function that sets from_logits=TRUE (i.e. no sigmoid applied to predictions), thresholds should be set to 0. One metric value is generated for each threshold value.
name	(Optional) string name of the metric instance.
dtype	(Optional) data type of the metric result.

Value

a Metric instance is returned. The Metric instance can be passed directly to compile(metrics =), or used as a standalone object. See ?Metric for example usage.

Usage

Standalone usage:

```
m <- metric_true_negatives()
m$update_state(c(0, 1, 0, 0), c(1, 1, 0, 0))
m$result()

## tf.Tensor(2.0, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0, 1, 0, 0), c(1, 1, 0, 0), sample_weight = c(0, 0, 1, 0))
m$result()

## tf.Tensor(1.0, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/classification_metrics#truenegatives-class

Other confusion metrics:
metric_auc()
metric_false_negatives()
metric_false_positives()
metric_precision()
metric_precision_at_recall()
metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_positives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()

metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()
metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_positives()

---

metric_true_positives *Calculates the number of true positives.*

Description

If sample_weight is given, calculates the sum of the weights of true positives. This metric creates one local variable, true_positives that is used to keep track of the number of true positives.

If sample_weight is NULL, weights default to 1. Use sample_weight of 0 to mask values.

Usage

```
metric_true_positives(..., thresholds = NULL, name = NULL, dtype = NULL)
```

Arguments

`...`	For forward/backward compatability.
`thresholds`	(Optional) Defaults to `0.5`. A float value, or a Python list of float threshold values in `[0, 1]`. A threshold is compared with prediction values to determine the truth value of predictions (i.e., above the threshold is `TRUE`, below is `FALSE`). If used with a loss function that sets `from_logits=TRUE` (i.e. no sigmoid applied to predictions), `thresholds` should be set to 0. One metric value is generated for each threshold value.
`name`	(Optional) string name of the metric instance.
`dtype`	(Optional) data type of the metric result.

Value

a `Metric` instance is returned. The `Metric` instance can be passed directly to `compile(metrics = )`, or used as a standalone object. See `?Metric` for example usage.

Usage

Standalone usage:

```
m <- metric_true_positives()
m$update_state(c(0, 1, 1, 1), c(1, 0, 1, 1))
m$result()

## tf.Tensor(2.0, shape=(), dtype=float32)


m$reset_state()
m$update_state(c(0, 1, 1, 1), c(1, 0, 1, 1), sample_weight = c(0, 0, 1, 0))
m$result()

## tf.Tensor(1.0, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/metrics/classification_metrics#truepositives-class

Other confusion metrics:
`metric_auc()`
`metric_false_negatives()`
`metric_false_positives()`
`metric_precision()`
`metric_precision_at_recall()`

metric_recall()
metric_recall_at_precision()
metric_sensitivity_at_specificity()
metric_specificity_at_sensitivity()
metric_true_negatives()

Other metrics:
Metric()
custom_metric()
metric_auc()
metric_binary_accuracy()
metric_binary_crossentropy()
metric_binary_focal_crossentropy()
metric_binary_iou()
metric_categorical_accuracy()
metric_categorical_crossentropy()
metric_categorical_focal_crossentropy()
metric_categorical_hinge()
metric_concordance_correlation()
metric_cosine_similarity()
metric_f1_score()
metric_false_negatives()
metric_false_positives()
metric_fbeta_score()
metric_hinge()
metric_huber()
metric_iou()
metric_kl_divergence()
metric_log_cosh()
metric_log_cosh_error()
metric_mean()
metric_mean_absolute_error()
metric_mean_absolute_percentage_error()
metric_mean_iou()
metric_mean_squared_error()
metric_mean_squared_logarithmic_error()
metric_mean_wrapper()
metric_one_hot_iou()
metric_one_hot_mean_iou()
metric_pearson_correlation()
metric_poisson()
metric_precision()
metric_precision_at_recall()
metric_r2_score()
metric_recall()
metric_recall_at_precision()
metric_root_mean_squared_error()
metric_sensitivity_at_specificity()

metric_sparse_categorical_accuracy()
metric_sparse_categorical_crossentropy()
metric_sparse_top_k_categorical_accuracy()
metric_specificity_at_sensitivity()
metric_squared_hinge()
metric_sum()
metric_top_k_categorical_accuracy()
metric_true_negatives()

Model *Subclass the base Keras* Model *Class*

Description

This is for advanced use cases where you need to subclass the base Model type, e.g., you want to override the train_step() method.

If you just want to create or define a keras model, prefer keras_model() or keras_model_sequential().

If you just want to encapsulate some custom logic and state, and don't need to customize training behavior (besides calling self$add_loss() in the call() method), prefer Layer().

Usage

```
Model(
  classname,
  initialize = NULL,
  call = NULL,
  train_step = NULL,
  predict_step = NULL,
  test_step = NULL,
  compute_loss = NULL,
  compute_metrics = NULL,
  ...,
  public = list(),
  private = list(),
  inherit = NULL,
  parent_env = parent.frame()
)
```

Arguments

classname	String, the name of the custom class. (Conventionally, CamelCase).
initialize, call, train_step, predict_step, test_step, compute_loss, compute_metrics	Optional methods that can be overridden.
..., public	Additional methods or public members of the custom class.

`private` Named list of R objects (typically, functions) to include in instance private environments. `private` methods will have all the same symbols in scope as public methods (See section "Symbols in Scope"). Each instance will have it's own `private` environment. Any objects in `private` will be invisible from the Keras framework and the Python runtime.

`inherit` What the custom class will subclass. By default, the base keras class.

`parent_env` The R environment that all class methods will have as a grandparent.

Value

A model constructor function, which you can call to create an instance of the new model type.

Symbols in scope

All R function custom methods (public and private) will have the following symbols in scope:

- `self`: The custom class instance.
- `super`: The custom class superclass.
- `private`: An R environment specific to the class instance. Any objects assigned here are invisible to the Keras framework.
- `__class__` and `as.symbol(classname)`: the custom class type object.

See Also

`active_property()` (e.g., for a `metrics` property implemented as a function).

`newaxis` *New axis*

Description

This is an alias for `NULL`. It is meant to be used in `[` on tensors, to expand dimensions of a tensor

Usage

```
newaxis
```

Format

An object of class `NULL` of length 0.

Details

```
x <- op_convert_to_tensor(1:10)

op_shape(x)
op_shape(x[])
op_shape(x[newaxis])
op_shape(x@py[newaxis])
op_shape(x@r[newaxis])

op_shape(x[newaxis, .., newaxis])
op_shape(x@py[newaxis, .., newaxis])
op_shape(x@r[newaxis, .., newaxis])
```

`normalize` *Normalizes an array.*

Description

If the input is an R array, an R array will be returned. If it's a backend tensor, a backend tensor will be returned.

Usage

```
normalize(x, axis = -1L, order = 2L)
```

Arguments

`x`	Array to normalize.
`axis`	axis along which to normalize.
`order`	Normalization order (e.g. `order=2` for L2 norm).

Value

A normalized copy of the array.

See Also

- https://keras.io/api/utils/python_utils#normalize-function

Other numerical utils:
`to_categorical()`

Other utils:
`audio_dataset_from_directory()`
`clear_session()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`

config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

optimizer_adadelta *Optimizer that implements the Adadelta algorithm.*

Description

Adadelta optimization is a stochastic gradient descent method that is based on adaptive learning rate per dimension to address two drawbacks:

- The continual decay of learning rates throughout training.
- The need for a manually selected global learning rate.

Adadelta is a more robust extension of Adagrad that adapts learning rates based on a moving window of gradient updates, instead of accumulating all past gradients. This way, Adadelta continues learning even when many updates have been done. Compared to Adagrad, in the original version of Adadelta you don't have to set an initial learning rate. In this version, the initial learning rate can be set, as in most other Keras optimizers.

Usage

```
optimizer_adadelta(
  learning_rate = 0.001,
  rho = 0.95,
  epsilon = 1e-07,
  weight_decay = NULL,
  clipnorm = NULL,
```

```
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adadelta",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

learning_rate	A float, a [LearningRateSchedule()] instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to 0.001. Note that Adadelta tends to benefit from higher initial learning rate values compared to other optimizers. To match the exact form in the original paper, use 1.0.
rho	A floating point value. The decay rate. Defaults to 0.95.
epsilon	Small floating point value for maintaining numerical stability.
weight_decay	Float. If set, weight decay is applied.
clipnorm	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
clipvalue	Float. If set, the gradient of each weight is clipped to be no higher than this value.
global_clipnorm	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
use_ema	Boolean, defaults to FALSE. If TRUE, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.
ema_momentum	Float, defaults to 0.99. Only used if use_ema = TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.
ema_overwrite_frequency	Int or NULL, defaults to NULL. Only used if use_ema = TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.
name	String. The name to use for momentum accumulator weights created by the optimizer.
...	For forward/backward compatability.

loss_scale_factor
: Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

Reference

- Zeiler, 2012

See Also

- https://keras.io/api/optimizers/adadelta#adadelta-class

Other optimizers:
optimizer_adafactor()
optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()
optimizer_rmsprop()
optimizer_sgd()

---

optimizer_adafactor *Optimizer that implements the Adafactor algorithm.*

Description

Adafactor is commonly used in NLP tasks, and has the advantage of taking less memory because it only saves partial information of previous gradients.

The default argument setup is based on the original paper (see reference). When gradients are of dimension > 2, Adafactor optimizer will delete the last 2 dimensions separately in its accumulator variables.

Usage

```
optimizer_adafactor(
  learning_rate = 0.001,
  beta_2_decay = -0.8,
  epsilon_1 = 1e-30,
  epsilon_2 = 0.001,
  clip_threshold = 1,
  relative_step = TRUE,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adafactor",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

learning_rate	A float, a LearningRateSchedule() instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to 0.001.
beta_2_decay	float, defaults to -0.8. The decay rate of beta_2.
epsilon_1	float, defaults to 1e-30. A small offset to keep denominator away from 0.
epsilon_2	float, defaults to 1e-3. A small offset to avoid learning rate becoming too small by time.
clip_threshold	float, defaults to 1.0. Clipping threshold. This is a part of Adafactor algorithm, independent from clipnorm, clipvalue, and global_clipnorm.
relative_step	bool, defaults to TRUE. If learning_rate is a constant and relative_step=TRUE, learning rate will be adjusted based on current iterations. This is a default learning rate decay in Adafactor.
weight_decay	Float. If set, weight decay is applied.
clipnorm	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.

clipvalue
: Float. If set, the gradient of each weight is clipped to be no higher than this value.

global_clipnorm
: Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.

use_ema
: Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

ema_momentum
: Float, defaults to 0.99. Only used if `use_ema = TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.

ema_overwrite_frequency
: Int or `NULL`, defaults to `NULL`. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If `NULL`, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.

name
: String. The name to use for momentum accumulator weights created by the optimizer.

...
: For forward/backward compatability.

loss_scale_factor
: Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps` steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

Reference

- Shazeer, Noam et al., 2018.

See Also

- https://keras.io/api/optimizers/adafactor#adafactor-class

Other optimizers:
optimizer_adadelta()
optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()
optimizer_rmsprop()
optimizer_sgd()

---

optimizer_adagrad *Optimizer that implements the Adagrad algorithm.*

Description

Adagrad is an optimizer with parameter-specific learning rates, which are adapted relative to how frequently a parameter gets updated during training. The more updates a parameter receives, the smaller the updates.

Usage

```
optimizer_adagrad(
  learning_rate = 0.001,
  initial_accumulator_value = 0.1,
  epsilon = 1e-07,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adagrad",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate` A float, a `LearningRateSchedule()` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`. Note that `Adagrad` tends to benefit from higher initial learning rate values compared to other optimizers. To match the exact form in the original paper, use `1.0`.

`initial_accumulator_value` Floating point value. Starting value for the accumulators (per-parameter momentum values). Must be non-negative.

`epsilon` Small floating point value for maintaining numerical stability.

`weight_decay` Float. If set, weight decay is applied.

`clipnorm` Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.

`clipvalue` Float. If set, the gradient of each weight is clipped to be no higher than this value.

`global_clipnorm` Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.

`use_ema` Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

`ema_momentum` Float, defaults to 0.99. Only used if `use_ema=TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.

`ema_overwrite_frequency` Int or `NULL`, defaults to `NULL`. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If `NULL`, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.

`name` String. The name to use for momentum accumulator weights created by the optimizer.

`...` For forward/backward compatability.

`loss_scale_factor` Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.

`gradient_accumulation_steps` Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps`

steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

Reference

- Duchi et al., 2011.

See Also

- `https://keras.io/api/optimizers/adagrad#adagrad-class`

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`
`optimizer_adam()`
`optimizer_adam_w()`
`optimizer_adamax()`
`optimizer_ftrl()`
`optimizer_lamb()`
`optimizer_lion()`
`optimizer_loss_scale()`
`optimizer_nadam()`
`optimizer_rmsprop()`
`optimizer_sgd()`

`optimizer_adam` *Optimizer that implements the Adam algorithm.*

Description

Adam optimization is a stochastic gradient descent method that is based on adaptive estimation of first-order and second-order moments.

According to Kingma et al., 2014, the method is "*computationally efficient, has little memory requirement, invariant to diagonal rescaling of gradients, and is well suited for problems that are large in terms of data/parameters*".

Usage

```
optimizer_adam(
  learning_rate = 0.001,
  beta_1 = 0.9,
  beta_2 = 0.999,
  epsilon = 1e-07,
  amsgrad = FALSE,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adam",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate`	A float, a `LearningRateSchedule()` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`.
`beta_1`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 1st moment estimates. Defaults to `0.9`.
`beta_2`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 2nd moment estimates. Defaults to `0.999`.
`epsilon`	A small constant for numerical stability. This epsilon is "epsilon hat" in the Kingma and Ba paper (in the formula just before Section 2.1), not the epsilon in Algorithm 1 of the paper. Defaults to `1e-7`.
`amsgrad`	Boolean. Whether to apply AMSGrad variant of this algorithm from the paper "On the Convergence of Adam and beyond". Defaults to `FALSE`.
`weight_decay`	Float. If set, weight decay is applied.
`clipnorm`	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
`clipvalue`	Float. If set, the gradient of each weight is clipped to be no higher than this value.
`global_clipnorm`	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
`use_ema`	Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

ema_momentum Float, defaults to 0.99. Only used if use_ema=TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.

ema_overwrite_frequency
Int or NULL, defaults to NULL. Only used if use_ema=TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.

name String. The name to use for momentum accumulator weights created by the optimizer.

... For forward/backward compatability.

loss_scale_factor
Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.

gradient_accumulation_steps
Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

See Also

- https://keras.io/api/optimizers/adam#adam-class

Other optimizers:
optimizer_adadelta()
optimizer_adafactor()
optimizer_adagrad()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()

optimizer_rmsprop()
optimizer_sgd()

---

optimizer_adamax *Optimizer that implements the Adamax algorithm.*

Description

Adamax, a variant of Adam based on the infinity norm, is a first-order gradient-based optimization method. Due to its capability of adjusting the learning rate based on data characteristics, it is suited to learn time-variant process, e.g., speech data with dynamically changed noise conditions. Default parameters follow those provided in the paper (see references below).

Initialization:

```
m <- 0  # Initialize initial 1st moment vector
u <- 0  # Initialize the exponentially weighted infinity norm
t <- 0  # Initialize timestep
```

The update rule for parameter w with gradient g is described at the end of section 7.1 of the paper (see the reference section):

```
t <-  t + 1
m <- beta1 * m + (1 - beta) * g
u <- max(beta2 * u, abs(g))
current_lr <- learning_rate / (1 - beta1 ** t)
w <- w - current_lr * m / (u + epsilon)
```

Usage

```
optimizer_adamax(
  learning_rate = 0.001,
  beta_1 = 0.9,
  beta_2 = 0.999,
  epsilon = 1e-07,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adamax",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

learning_rate	A float, a LearningRateSchedule() instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to 0.001.
beta_1	A float value or a constant float tensor. The exponential decay rate for the 1st moment estimates.
beta_2	A float value or a constant float tensor. The exponential decay rate for the exponentially weighted infinity norm.
epsilon	A small constant for numerical stability. name: String. The name to use for momentum accumulator weights created by the optimizer.
weight_decay	Float. If set, weight decay is applied.
clipnorm	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
clipvalue	Float. If set, the gradient of each weight is clipped to be no higher than this value.
global_clipnorm	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
use_ema	Boolean, defaults to FALSE. If TRUE, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.
ema_momentum	Float, defaults to 0.99. Only used if use_ema=TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.
ema_overwrite_frequency	Int or NULL, defaults to NULL. Only used if use_ema=TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.
name	String, name for the object
...	For forward/backward compatability.
loss_scale_factor	Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.
gradient_accumulation_steps	Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is

known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

Reference

- Kingma et al., 2014

See Also

- `https://keras.io/api/optimizers/adamax#adamax-class`

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`
`optimizer_adagrad()`
`optimizer_adam()`
`optimizer_adam_w()`
`optimizer_ftrl()`
`optimizer_lamb()`
`optimizer_lion()`
`optimizer_loss_scale()`
`optimizer_nadam()`
`optimizer_rmsprop()`
`optimizer_sgd()`

`optimizer_adam_w` *Optimizer that implements the AdamW algorithm.*

Description

AdamW optimization is a stochastic gradient descent method that is based on adaptive estimation of first-order and second-order moments with an added method to decay weights per the techniques discussed in the paper, 'Decoupled Weight Decay Regularization' by Loshchilov, Hutter et al., 2019.

According to Kingma et al., 2014, the underlying Adam method is "*computationally efficient, has little memory requirement, invariant to diagonal rescaling of gradients, and is well suited for problems that are large in terms of data/parameters*".

Usage

```
optimizer_adam_w(
  learning_rate = 0.001,
  weight_decay = 0.004,
  beta_1 = 0.9,
  beta_2 = 0.999,
  epsilon = 1e-07,
  amsgrad = FALSE,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "adamw",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate`	A float, a `LearningRateSchedule()` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`.
`weight_decay`	Float. If set, weight decay is applied.
`beta_1`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 1st moment estimates. Defaults to `0.9`.
`beta_2`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 2nd moment estimates. Defaults to `0.999`.
`epsilon`	A small constant for numerical stability. This epsilon is "epsilon hat" in the Kingma and Ba paper (in the formula just before Section 2.1), not the epsilon in Algorithm 1 of the paper. Defaults to 1e-7.
`amsgrad`	Boolean. Whether to apply AMSGrad variant of this algorithm from the paper "On the Convergence of Adam and beyond". Defaults to `FALSE`.
`clipnorm`	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
`clipvalue`	Float. If set, the gradient of each weight is clipped to be no higher than this value.
`global_clipnorm`	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
`use_ema`	Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

ema_momentum
: Float, defaults to 0.99. Only used if use_ema=TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.

ema_overwrite_frequency
: Int or NULL, defaults to NULL. Only used if use_ema=TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.

name
: String. The name to use for momentum accumulator weights created by the optimizer.

...
: For forward/backward compatability.

loss_scale_factor
: Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

References

- Loshchilov et al., 2019
- Kingma et al., 2014 for adam
- Reddi et al., 2018 for amsgrad.

See Also

- https://keras.io/api/optimizers/adamw#adamw-class

Other optimizers:
optimizer_adadelta()
optimizer_adafactor()
optimizer_adagrad()

optimizer_adam()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()
optimizer_rmsprop()
optimizer_sgd()

---

optimizer_ftrl *Optimizer that implements the FTRL algorithm.*

Description

"Follow The Regularized Leader" (FTRL) is an optimization algorithm developed at Google for click-through rate prediction in the early 2010s. It is most suitable for shallow models with large and sparse feature spaces. The algorithm is described by McMahan et al., 2013. The Keras version has support for both online L2 regularization (the L2 regularization described in the paper above) and shrinkage-type L2 regularization (which is the addition of an L2 penalty to the loss function).

Initialization:

```
n <- 0
sigma <- 0
z <- 0
```

Update rule for one variable w:

```
prev_n <- n
n <- n + g^2
sigma <- (n^(-lr_power) - prev_n^(-lr_power)) / lr
z <- z + g - sigma * w
if (abs(z) < lambda_1) {
  w <- 0
} else {
  w <- (sgn(z) * lambda_1 - z) / ((beta + sqrt(n)) / alpha + lambda_2)
}
```

Notation:

- lr is the learning rate
- g is the gradient for the variable
- lambda_1 is the L1 regularization strength
- lambda_2 is the L2 regularization strength
- lr_power is the power to scale n.

Check the documentation for the l2_shrinkage_regularization_strength parameter for more details when shrinkage is enabled, in which case gradient is replaced with a gradient with shrinkage.

Usage

```
optimizer_ftrl(
  learning_rate = 0.001,
  learning_rate_power = -0.5,
  initial_accumulator_value = 0.1,
  l1_regularization_strength = 0,
  l2_regularization_strength = 0,
  l2_shrinkage_regularization_strength = 0,
  beta = 0,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "ftrl",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate` A float, a `LearningRateSchedule()` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`.

`learning_rate_power` A float value, must be less or equal to zero. Controls how the learning rate decreases during training. Use zero for a fixed learning rate.

`initial_accumulator_value` The starting value for accumulators. Only zero or positive values are allowed.

`l1_regularization_strength` A float value, must be greater than or equal to zero. Defaults to `0.0`.

`l2_regularization_strength` A float value, must be greater than or equal to zero. Defaults to `0.0`.

`l2_shrinkage_regularization_strength` A float value, must be greater than or equal to zero. This differs from L2 above in that the L2 above is a stabilization penalty, whereas this L2 shrinkage is a magnitude penalty. When input is sparse shrinkage will only happen on the active weights.

`beta` A float value, representing the beta value from the paper. Defaults to `0.0`.

`weight_decay` Float. If set, weight decay is applied.

`clipnorm` Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.

`clipvalue` Float. If set, the gradient of each weight is clipped to be no higher than this value.

global_clipnorm
: Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.

use_ema
: Boolean, defaults to FALSE. If TRUE, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

ema_momentum
: Float, defaults to 0.99. Only used if use_ema=TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.

ema_overwrite_frequency
: Int or NULL, defaults to NULL. Only used if use_ema=TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.

name
: String. The name to use for momentum accumulator weights created by the optimizer.

...
: For forward/backward compatability.

loss_scale_factor
: Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

See Also

- https://keras.io/api/optimizers/ftrl#ftrl-class

Other optimizers:
optimizer_adadelta()
optimizer_adafactor()

optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()
optimizer_rmsprop()
optimizer_sgd()

---

optimizer_lamb *Optimizer that implements the Lamb algorithm.*

Description

Lamb is a stochastic gradient descent method that uses layer-wise adaptive moments to adjusts the learning rate for each parameter based on the ratio of the norm of the weight to the norm of the gradient This helps to stabilize the training process and improves convergence especially for large batch sizes.

Usage

```
optimizer_lamb(
  learning_rate = 0.001,
  beta_1 = 0.9,
  beta_2 = 0.999,
  epsilon = 1e-07,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL,
  name = "lamb",
  ...
)
```

Arguments

learning_rate	A float, a LearningRateSchedule() instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to 0.001.

- `beta_1` A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 1st moment estimates. Defaults to `0.9`.
- `beta_2` A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 2nd moment estimates. Defaults to `0.999`.
- `epsilon` A small constant for numerical stability. Defaults to `1e-7`.
- `weight_decay` Float. If set, weight decay is applied.
- `clipnorm` Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
- `clipvalue` Float. If set, the gradient of each weight is clipped to be no higher than this value.
- `global_clipnorm` Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
- `use_ema` Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.
- `ema_momentum` Float, defaults to `0.99`. Only used if `use_ema = TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.
- `ema_overwrite_frequency` Int or `NULL`, defaults to `NULL`. Only used if `use_ema = TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If `NULL`, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.
- `loss_scale_factor` Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.
- `gradient_accumulation_steps` Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps` steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

name	String. The name to use for momentum accumulator weights created by the optimizer.
...	For forward/backward compatability.

Value

an `Optimizer` instance

References

- Yang et al.

See Also

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`
`optimizer_adagrad()`
`optimizer_adam()`
`optimizer_adam_w()`
`optimizer_adamax()`
`optimizer_ftrl()`
`optimizer_lion()`
`optimizer_loss_scale()`
`optimizer_nadam()`
`optimizer_rmsprop()`
`optimizer_sgd()`

`optimizer_lion` *Optimizer that implements the Lion algorithm.*

Description

The Lion optimizer is a stochastic-gradient-descent method that uses the sign operator to control the magnitude of the update, unlike other adaptive optimizers such as Adam that rely on second-order moments. This make Lion more memory-efficient as it only keeps track of the momentum. According to the authors (see reference), its performance gain over Adam grows with the batch size. Because the update of Lion is produced through the sign operation, resulting in a larger norm, a suitable learning rate for Lion is typically 3-10x smaller than that for AdamW. The weight decay for Lion should be in turn 3-10x larger than that for AdamW to maintain a similar strength (lr * wd).

Usage

```
optimizer_lion(
  learning_rate = 0.001,
  beta_1 = 0.9,
  beta_2 = 0.99,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "lion",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate`	A float, a `LearningRateSchedule()` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`.
`beta_1`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The rate to combine the current gradient and the 1st moment estimate. Defaults to `0.9`.
`beta_2`	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 1st moment estimate. Defaults to `0.99`.
`weight_decay`	Float. If set, weight decay is applied.
`clipnorm`	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
`clipvalue`	Float. If set, the gradient of each weight is clipped to be no higher than this value.
`global_clipnorm`	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
`use_ema`	Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.
`ema_momentum`	Float, defaults to 0.99. Only used if `use_ema=TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.
`ema_overwrite_frequency`	Int or `NULL`, defaults to `NULL`. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If

NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.

name
: String. The name to use for momentum accumulator weights created by the optimizer.

...
: For forward/backward compatability.

loss_scale_factor
: Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

References

- Chen et al., 2023
- Authors' implementation

See Also

Other optimizers:
optimizer_adadelta()
optimizer_adafactor()
optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_loss_scale()
optimizer_nadam()
optimizer_rmsprop()
optimizer_sgd()

`optimizer_loss_scale` *An optimizer that dynamically scales the loss to prevent underflow.*

Description

Loss scaling is a technique to prevent numeric underflow in intermediate gradients when float16 is used. To prevent underflow, the loss is multiplied (or "scaled") by a certain factor called the "loss scale", which causes intermediate gradients to be scaled by the loss scale as well. The final gradients are divided (or "unscaled") by the loss scale to bring them back to their original value.

`LossScaleOptimizer` wraps another optimizer and applies dynamic loss scaling to it. This loss scale is dynamically updated over time as follows:

- On any train step, if a nonfinite gradient is encountered, the loss scale is halved, and the train step is skipped.
- If `dynamic_growth_steps` have occurred since the last time the loss scale was updated, and no nonfinite gradients have occurred, the loss scale is doubled.

Usage

```
optimizer_loss_scale(
  inner_optimizer,
  initial_scale = 32768,
  dynamic_growth_steps = 2000L,
  ...,
  name = NULL,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = NULL,
  ema_momentum = NULL,
  ema_overwrite_frequency = NULL,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`inner_optimizer`
: The keras `Optimizer` instance to wrap.

`initial_scale`
: Float. The initial loss scale. This scale will be updated during training. It is recommended for this to be a very high number, because a loss scale that is too high gets lowered far more quickly than a loss scale that is too low gets raised.

`dynamic_growth_steps`
: Int. How often to update the scale upwards. After every `dynamic_growth_steps` steps with finite gradients, the loss scale is doubled.

`...` For forward/backward compatability.

`name` String. The name to use for momentum accumulator weights created by the optimizer.

`weight_decay` Float. If set, weight decay is applied.

`clipnorm` Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.

`clipvalue` Float. If set, the gradient of each weight is clipped to be no higher than this value.

`global_clipnorm`
Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.

`use_ema` Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

`ema_momentum` Float, defaults to 0.99. Only used if `use_ema=TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.

`ema_overwrite_frequency`
Int or `NULL`, defaults to `NULL`. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If `NULL`, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.

`loss_scale_factor`
Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.

`gradient_accumulation_steps`
Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps` steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

See Also

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`
`optimizer_adagrad()`
`optimizer_adam()`
`optimizer_adam_w()`
`optimizer_adamax()`
`optimizer_ftrl()`
`optimizer_lamb()`
`optimizer_lion()`
`optimizer_nadam()`
`optimizer_rmsprop()`
`optimizer_sgd()`

`optimizer_nadam` *Optimizer that implements the Nadam algorithm.*

Description

Much like Adam is essentially RMSprop with momentum, Nadam is Adam with Nesterov momentum.

Usage

```
optimizer_nadam(
  learning_rate = 0.001,
  beta_1 = 0.9,
  beta_2 = 0.999,
  epsilon = 1e-07,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "nadam",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

learning_rate	A float, a LearningRateSchedule() instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to 0.001.
beta_1	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 1st moment estimates. Defaults to 0.9.
beta_2	A float value or a constant float tensor, or a callable that takes no arguments and returns the actual value to use. The exponential decay rate for the 2nd moment estimates. Defaults to 0.999.
epsilon	A small constant for numerical stability. This epsilon is "epsilon hat" in the Kingma and Ba paper (in the formula just before Section 2.1), not the epsilon in Algorithm 1 of the paper. Defaults to 1e-7.
weight_decay	Float. If set, weight decay is applied.
clipnorm	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
clipvalue	Float. If set, the gradient of each weight is clipped to be no higher than this value.
global_clipnorm	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
use_ema	Boolean, defaults to FALSE. If TRUE, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.
ema_momentum	Float, defaults to 0.99. Only used if use_ema=TRUE. This is the momentum to use when computing the EMA of the model's weights: new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value.
ema_overwrite_frequency	Int or NULL, defaults to NULL. Only used if use_ema=TRUE. Every ema_overwrite_frequency steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling optimizer$finalize_variable_values() (which updates the model variables in-place). When using the built-in fit() training loop, this happens automatically after the last epoch, and you don't need to do anything.
name	String. The name to use for momentum accumulator weights created by the optimizer.
...	For forward/backward compatability.
loss_scale_factor	Float or NULL. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, optimizer_loss_scale() will automatically set a loss scale factor.

gradient_accumulation_steps
: Int or NULL. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every gradient_accumulation_steps steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an Optimizer instance

Reference

- Dozat, 2015.

See Also

- https://keras.io/api/optimizers/Nadam#nadam-class

Other optimizers:
optimizer_adadelta()
optimizer_adafactor()
optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_rmsprop()
optimizer_sgd()

---

optimizer_rmsprop *Optimizer that implements the RMSprop algorithm.*

Description

The gist of RMSprop is to:

- Maintain a moving (discounted) average of the square of gradients
- Divide the gradient by the root of this average

This implementation of RMSprop uses plain momentum, not Nesterov momentum.

The centered version additionally maintains a moving average of the gradients, and uses that average to estimate the variance.

Usage

```
optimizer_rmsprop(
  learning_rate = 0.001,
  rho = 0.9,
  momentum = 0,
  epsilon = 1e-07,
  centered = FALSE,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "rmsprop",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate`	A float, a `learning_rate_schedule_*` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.001`.
`rho`	float, defaults to 0.9. Discounting factor for the old gradients.
`momentum`	float, defaults to 0.0. If not 0.0., the optimizer tracks the momentum value, with a decay rate equals to `1 - momentum`.
`epsilon`	A small constant for numerical stability. This epsilon is "epsilon hat" in the Kingma and Ba paper (in the formula just before Section 2.1), not the epsilon in Algorithm 1 of the paper. Defaults to 1e-7.
`centered`	Boolean. If `TRUE`, gradients are normalized by the estimated variance of the gradient; if FALSE, by the uncentered second moment. Setting this to `TRUE` may help with training, but is slightly more expensive in terms of computation and memory. Defaults to `FALSE`.
`weight_decay`	Float. If set, weight decay is applied.
`clipnorm`	Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.
`clipvalue`	Float. If set, the gradient of each weight is clipped to be no higher than this value.
`global_clipnorm`	Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.
`use_ema`	Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

`ema_momentum` Float, defaults to 0.99. Only used if `use_ema=TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.

`ema_overwrite_frequency`
Int or NULL, defaults to NULL. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.

`name` String. The name to use for momentum accumulator weights created by the optimizer.

`...` For forward/backward compatability.

`loss_scale_factor`
Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.

`gradient_accumulation_steps`
Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps` steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

Usage

```
opt <- optimizer_rmsprop(learning_rate=0.1)
```

Reference

- Hinton, 2012

See Also

- `https://keras.io/api/optimizers/rmsprop#rmsprop-class`

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`

optimizer_adagrad()
optimizer_adam()
optimizer_adam_w()
optimizer_adamax()
optimizer_ftrl()
optimizer_lamb()
optimizer_lion()
optimizer_loss_scale()
optimizer_nadam()
optimizer_sgd()

---

optimizer_sgd *Gradient descent (with momentum) optimizer.*

Description

Update rule for parameter w with gradient g when momentum is 0:

```
w <- w - learning_rate * g
```

Update rule when momentum is larger than 0:

```
velocity <- momentum * velocity - learning_rate * g
w <- w + velocity
```

When nesterov=TRUE, this rule becomes:

```
velocity <- momentum * velocity - learning_rate * g
w <- w + momentum * velocity - learning_rate * g
```

Usage

```
optimizer_sgd(
  learning_rate = 0.01,
  momentum = 0,
  nesterov = FALSE,
  weight_decay = NULL,
  clipnorm = NULL,
  clipvalue = NULL,
  global_clipnorm = NULL,
  use_ema = FALSE,
  ema_momentum = 0.99,
  ema_overwrite_frequency = NULL,
  name = "SGD",
  ...,
  loss_scale_factor = NULL,
  gradient_accumulation_steps = NULL
)
```

Arguments

`learning_rate` A float, a `learning_rate_schedule_*` instance, or a callable that takes no arguments and returns the actual value to use. The learning rate. Defaults to `0.01`.

`momentum` float hyperparameter >= 0 that accelerates gradient descent in the relevant direction and dampens oscillations. 0 is vanilla gradient descent. Defaults to `0.0`.

`nesterov` boolean. Whether to apply Nesterov momentum. Defaults to `FALSE`.

`weight_decay` Float. If set, weight decay is applied.

`clipnorm` Float. If set, the gradient of each weight is individually clipped so that its norm is no higher than this value.

`clipvalue` Float. If set, the gradient of each weight is clipped to be no higher than this value.

`global_clipnorm` Float. If set, the gradient of all weights is clipped so that their global norm is no higher than this value.

`use_ema` Boolean, defaults to `FALSE`. If `TRUE`, exponential moving average (EMA) is applied. EMA consists of computing an exponential moving average of the weights of the model (as the weight values change after each training batch), and periodically overwriting the weights with their moving average.

`ema_momentum` Float, defaults to 0.99. Only used if `use_ema=TRUE`. This is the momentum to use when computing the EMA of the model's weights: `new_average = ema_momentum * old_average + (1 - ema_momentum) * current_variable_value`.

`ema_overwrite_frequency` Int or NULL, defaults to NULL. Only used if `use_ema=TRUE`. Every `ema_overwrite_frequency` steps of iterations, we overwrite the model variable by its moving average. If NULL, the optimizer does not overwrite model variables in the middle of training, and you need to explicitly overwrite the variables at the end of training by calling `optimizer$finalize_variable_values()` (which updates the model variables in-place). When using the built-in `fit()` training loop, this happens automatically after the last epoch, and you don't need to do anything.

`name` String. The name to use for momentum accumulator weights created by the optimizer.

`...` For forward/backward compatability.

`loss_scale_factor` Float or `NULL`. If a float, the scale factor will be multiplied the loss before computing gradients, and the inverse of the scale factor will be multiplied by the gradients before updating variables. Useful for preventing underflow during mixed precision training. Alternately, `optimizer_loss_scale()` will automatically set a loss scale factor.

`gradient_accumulation_steps` Int or `NULL`. If an int, model and optimizer variables will not be updated at every step; instead they will be updated every `gradient_accumulation_steps` steps, using the average value of the gradients since the last update. This is known as "gradient accumulation". This can be useful when your batch size is very small, in order to reduce gradient noise at each update step. EMA frequency will look at "accumulated" iterations value (optimizer steps // gradient_accumulation_steps). Learning rate schedules will look at "real" iterations value (optimizer steps).

Value

an `Optimizer` instance

See Also

- https://keras.io/api/optimizers/sgd#sgd-class

Other optimizers:
`optimizer_adadelta()`
`optimizer_adafactor()`
`optimizer_adagrad()`
`optimizer_adam()`
`optimizer_adam_w()`
`optimizer_adamax()`
`optimizer_ftrl()`
`optimizer_lamb()`
`optimizer_lion()`
`optimizer_loss_scale()`
`optimizer_nadam()`
`optimizer_rmsprop()`

`op_abs` *Compute the absolute value element-wise.*

Description

Compute the absolute value element-wise.

Usage

```
op_abs(x)
```

Arguments

`x`	Input tensor

Value

An array containing the absolute value of each element in `x`.

Example

```
x <- op_convert_to_tensor(c(-1.2, 1.2))
op_abs(x)

## tf.Tensor([1.2 1.2], shape=(2), dtype=float64)
```

See Also

Other numpy ops:
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()

op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()

op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()

op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()

op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()

op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()

op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()

op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
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op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()

```
op_zeros()
op_zeros_like()
```

op_add *Add arguments element-wise.*

Description

Add arguments element-wise.

Usage

```
op_add(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

The tensor containing the element-wise sum of x1 and x2.

Examples

```
x1 <- op_convert_to_tensor(c(1, 4))
x2 <- op_convert_to_tensor(c(5, 6))
op_add(x1, x2)

## tf.Tensor([ 6. 10.], shape=(2), dtype=float64)


# alias for x1 + x2
x1 + x2

## tf.Tensor([ 6. 10.], shape=(2), dtype=float64)
```

op_add also broadcasts shapes:

```
x1 <- op_convert_to_tensor(array(c(5, 5, 4, 6), dim =c(2, 2)))
x2 <- op_convert_to_tensor(c(5, 6))
op_add(x1, x2)
```

```
## tf.Tensor(
## [[10. 10.]
##  [10. 12.]], shape=(2, 2), dtype=float64)
```

Note that this function is automatically called when using the R operator + with tensors.

```
x <- op_ones(c(3))
op_add(x, x)

## tf.Tensor([2. 2. 2.], shape=(3), dtype=float32)
```

```
x + x

## tf.Tensor([2. 2. 2.], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#add-function

Other numpy ops:
op_abs()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()

op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
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op_isinf()
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op_logdet()
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op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
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op_tanh()
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op_triu()
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op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_arcsinh()
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op_diagonal()
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op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_empty()
op_equal()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
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op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_all *Test whether all array elements along a given axis evaluate to* TRUE.

Description

Test whether all array elements along a given axis evaluate to TRUE.

Usage

```
op_all(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	An integer or tuple of integers that represent the axis along which a logical AND reduction is performed. The default (axis = NULL) is to perform a logical AND over all the dimensions of the input array. axis may be negative, in which case it counts for the last to the first axis.
keepdims	If TRUE, axes which are reduced are left in the result as dimensions with size one. With this option, the result will broadcast correctly against the input array. Defaults to FALSE.

Value

The tensor containing the logical AND reduction over the axis.

Examples

```
x <- op_convert_to_tensor(c(TRUE, FALSE))
op_all(x)

## tf.Tensor(False, shape=(), dtype=bool)


(x <- op_convert_to_tensor(array(c(TRUE, FALSE, TRUE, TRUE, TRUE, TRUE), dim = c(3, 2))))

## tf.Tensor(
## [[ True  True]
##  [False  True]
##  [ True  True]], shape=(3, 2), dtype=bool)


op_all(x, axis = 1)

## tf.Tensor([False  True], shape=(2), dtype=bool)
```

keepdims = TRUE outputs a tensor with dimensions reduced to one.

```
op_all(x, keepdims = TRUE)

## tf.Tensor([[False]], shape=(1, 1), dtype=bool)
```

See Also

- https://keras.io/api/ops/numpy#all-function

Other numpy ops:
op_abs()
op_add()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()

op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
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op_sqrt()
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op_squeeze()
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op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
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op_transpose()
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op_tril()
op_triu()
op_trunc()
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op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()

op_add()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
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op_fft()
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op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
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op_swapaxes()
op_switch()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_any *Test whether any array element along a given axis evaluates to* TRUE.

Description

Test whether any array element along a given axis evaluates to TRUE.

Usage

```
op_any(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	An integer or tuple of integers that represent the axis along which a logical OR reduction is performed. The default (axis = NULL) is to perform a logical OR over all the dimensions of the input array. axis may be negative, in which case it counts for the last to the first axis.
keepdims	If TRUE, axes which are reduced are left in the result as dimensions with size one. With this option, the result will broadcast correctly against the input array. Defaults to FALSE.

Value

The tensor containing the logical OR reduction over the `axis`.

Examples

```
x <- op_array(c(TRUE, FALSE))
op_any(x)

## tf.Tensor(True, shape=(), dtype=bool)


(x <- op_reshape(c(FALSE, FALSE, FALSE,
                   TRUE, FALSE, FALSE),
                 c(2, 3)))

## tf.Tensor(
## [[False False False]
##  [ True False False]], shape=(2, 3), dtype=bool)


op_any(x, axis = 1)

## tf.Tensor([ True False False], shape=(3), dtype=bool)


op_any(x, axis = 2)

## tf.Tensor([False  True], shape=(2), dtype=bool)


op_any(x, axis = -1)

## tf.Tensor([False  True], shape=(2), dtype=bool)
```

`keepdims = TRUE` outputs a tensor with dimensions reduced to one.

```
op_any(x, keepdims = TRUE)

## tf.Tensor([[ True]], shape=(1, 1), dtype=bool)


op_any(x, 1, keepdims = TRUE)

## tf.Tensor([[ True False False]], shape=(1, 3), dtype=bool)
```

See Also

- https://keras.io/api/ops/numpy#any-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
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op_get_item()
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op_logical_xor()
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op_matmul()
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op_tanh()
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Other ops:
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op_left_shift()

op_less()
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op_logaddexp()
op_logdet()
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op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
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op_rms_normalization()
op_roll()
op_rot90()
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op_saturate_cast()
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op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_append *Append tensor* x2 *to the end of tensor* x1.

Description

Append tensor x2 to the end of tensor x1.

Usage

```
op_append(x1, x2, axis = NULL)
```

Arguments

x1	First input tensor.
x2	Second input tensor.
axis	Axis along which tensor x2 is appended to tensor x1. If NULL, both tensors are flattened before use.

Value

A tensor with the values of x2 appended to x1.

Examples

```
x1 <- op_convert_to_tensor(c(1, 2, 3))
x2 <- op_convert_to_tensor(rbind(c(4, 5, 6), c(7, 8, 9)))
op_append(x1, x2)

## tf.Tensor([1. 2. 3. 4. 5. 6. 7. 8. 9.], shape=(9), dtype=float64)
```

When axis is specified, x1 and x2 must have compatible shapes.

```
x1 <- op_convert_to_tensor(rbind(c(1, 2, 3), c(4, 5, 6)))
x2 <- op_convert_to_tensor(rbind(c(7, 8, 9)))
op_append(x1, x2, axis = 1)

## tf.Tensor(
## [[1. 2. 3.]
##  [4. 5. 6.]
##  [7. 8. 9.]], shape=(3, 3), dtype=float64)


x3 <- op_convert_to_tensor(c(7, 8, 9))
try(op_append(x1, x3, axis = 1))

## Error in py_call_impl(callable, call_args$unnamed, call_args$named) :
##  tensorflow.python.framework.errors_impl.InvalidArgumentError: {{function_node __wrapped__ConcatV
```

See Also

- https://keras.io/api/ops/numpy#append-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
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op_log1p()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
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op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_negative()
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op_tanh()
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op_tile()
op_trace()
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op_triu()
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Other ops:
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op_custom_gradient()
op_depthwise_conv()
op_det()
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op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arange *Return evenly spaced values within a given interval.*

Description

arange can be called with a varying number of positional arguments:

- arange(end): Values are generated within the half-open interval [1, end] (in other words, the interval including start and end).
- arange(start, end): Values are generated within the interval [start, end].
- arange(start, end, step): Values are generated within the interval [start, end], with spacing between values given by step.

Usage

```
op_arange(start, end, step = 1L, dtype = NULL, include_end = TRUE)
```

Arguments

start	Integer or real, representing the start of the interval. The interval includes this value.
end	Integer or real, representing the end of the interval. If include_end is FALSE, the interval does not include this value, except in some cases where step is not an integer and floating point round-off affects the length of out. Defaults to NULL.
step	Integer or real, represent the spacing between values. For any output out, this is the distance between two adjacent values, out[i+1] - out[i]. The default step size is 1. If step is specified as a position argument, start must also be given.
dtype	The type of the output array. If dtype is not given, infer the data type from the other input arguments.
include_end	TRUE or FALSE. If FALSE, then end is not included in the output sequence.

Value

Tensor of evenly spaced values. For floating point arguments, the length of the result is ceiling((end - start)/step). Because of floating point overflow, this rule may result in the last element of out being greater than end.

Examples

```
op_arange(3L)

## tf.Tensor([1 2 3], shape=(3), dtype=int32)


op_arange(3) # float

## tf.Tensor([1. 2. 3.], shape=(3), dtype=float32)


op_arange(3, dtype = 'int32') #int
```

```
## tf.Tensor([1 2 3], shape=(3), dtype=int32)
```

```
op_arange(3L, 7L)
```

```
## tf.Tensor([3 4 5 6 7], shape=(5), dtype=int32)
```

```
op_arange(3L, 7L, 2L)
```

```
## tf.Tensor([3 5 7], shape=(3), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#arange-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()

op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()

op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
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op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()

op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()

op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
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op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arccos *Trigonometric inverse cosine, element-wise.*

Description

The inverse of cos so that, if y = cos(x), then x = arccos(y).

Usage

```
op_arccos(x)
```

Arguments

x Input tensor.

Value

Tensor of the angle of the ray intersecting the unit circle at the given x-coordinate in radians [0, pi].

Examples

```
x <- op_convert_to_tensor(c(1, -1))
op_arccos(x)

## tf.Tensor([0.         3.14159265], shape=(2), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#arccos-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()

op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()

op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()

op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_signbit()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arccosh *Inverse hyperbolic cosine, element-wise.*

Description

Inverse hyperbolic cosine, element-wise.

Usage

```
op_arccosh(x)
```

Arguments

x Input tensor.

Value

Output tensor of same shape as x.

Examples

```
x <- op_convert_to_tensor(c(10, 100))
op_arccosh(x)

## tf.Tensor([2.99322285 5.29829237], shape=(2), dtype=float64)
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()

op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()

op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()

op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()

op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arcsin *Inverse sine, element-wise.*

Description

Inverse sine, element-wise.

Usage

```
op_arcsin(x)
```

Arguments

x Input tensor.

Value

Tensor of the inverse sine of each element in x, in radians and in the closed interval [-pi/2, pi/2].

Examples

```
x <- op_convert_to_tensor(c(1, -1, 0))
op_arcsin(x)

## tf.Tensor([ 1.57079633 -1.57079633  0.        ], shape=(3), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#arcsin-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average()
op_average_pool()
op_batch_normalization()
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op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()

op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arcsinh *Inverse hyperbolic sine, element-wise.*

Description

Inverse hyperbolic sine, element-wise.

Usage

```
op_arcsinh(x)
```

Arguments

x Input tensor.

Value

Output tensor of same shape as x.

Examples

```
x <- op_convert_to_tensor(c(1, -1, 0))
op_arcsinh(x)

## tf.Tensor([ 0.88137359 -0.88137359  0.        ], shape=(3), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#arcsinh-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()

op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()

op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()

op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_any()
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op_arccos()
op_arccosh()
op_arcsin()
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op_arctanh()
op_argmax()
op_argmin()

op_argpartition()
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op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
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op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
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op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
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op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
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op_equal()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()

op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()

op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()

op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arctan *Trigonometric inverse tangent, element-wise.*

Description

Trigonometric inverse tangent, element-wise.

Usage

```
op_arctan(x)
```

Arguments

x	Input tensor.

Value

Tensor of the inverse tangent of each element in x, in the interval [-pi/2, pi/2].

Examples

```
x <- op_convert_to_tensor(c(0, 1))
op_arctan(x)

## tf.Tensor([0.         0.78539816], shape=(2), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#arctan-function

Other numpy ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()

op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
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op_isinf()
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op_left_shift()
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op_logical_xor()
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op_lstsq()
op_matmul()
op_max()
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op_mean()
op_median()
op_meshgrid()
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op_tri()

op_tril()
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Other ops:
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_softmax()
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op_trace()
op_transpose()
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op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_arctan2 *Element-wise arc tangent of* x1/x2 *choosing the quadrant correctly.*

Description

The quadrant (i.e., branch) is chosen so that arctan2(x1, x2) is the signed angle in radians between the ray ending at the origin and passing through the point (1, 0), and the ray ending at the origin and passing through the point (x2, x1). (Note the role reversal: the "y-coordinate" is the first function parameter, the "x-coordinate" is the second.) By IEEE convention, this function is defined for `x2 = +/-0` and for either or both of `x1` and `x2 = +/-inf`.

Usage

```
op_arctan2(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Tensor of angles in radians, in the range `[-pi, pi]`.

Examples

Consider four points in different quadrants:

```
x <- op_array(c(-1, 1, 1, -1))
y <- op_array(c(-1, -1, 1, 1))
op_arctan2(y, x) * 180 / pi
```

```
## tf.Tensor([-135.  -45.   45.  135.], shape=(4), dtype=float32)
```

Note the order of the parameters. `arctan2` is defined also when x2 = 0 and at several other points, obtaining values in the range `[-pi, pi]`:

```
op_arctan2(
    op_array(c(1, -1)),
    op_array(c(0, 0))
)
```

```
## tf.Tensor([ 1.5707964 -1.5707964], shape=(2), dtype=float32)
```

```
op_arctan2(
    op_array(c(0, 0, Inf)),
    op_array(c(+0, -0, Inf))
)
```

```
## tf.Tensor([0.        3.1415927 0.7853982], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#arctan2-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_not_equal()
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op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
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op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
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Other ops:
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op_binary_crossentropy()
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op_arctanh *Inverse hyperbolic tangent, element-wise.*

Description

Inverse hyperbolic tangent, element-wise.

Usage

```
op_arctanh(x)
```

Arguments

x	Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#arctanh-function

Other numpy ops:
op_abs()
op_add()
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op_argmax()
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op_bitwise_or()
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op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()

op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor()
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op_full()
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op_get_item()
op_greater()
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op_log1p()
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op_logaddexp()
op_logdet()
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op_logical_xor()
op_logspace()
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op_median()
op_meshgrid()
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op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_sin()
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op_size()
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op_split()
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op_square()
op_squeeze()
op_stack()
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op_subtract()
op_sum()
op_swapaxes()
op_take()
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op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_argmax()
op_argmin()

op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()

op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()

op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()

op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_argmax *Returns the indices of the maximum values along an axis.*

Description

Returns the indices of the maximum values along an axis.

Usage

```
op_argmax(x, axis = NULL, keepdims = FALSE, zero_indexed = FALSE)
```

Arguments

x	Input tensor.
axis	By default, the index is into the flattened tensor, otherwise along the specified axis.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one. Defaults to FALSE.
zero_indexed	If TRUE, the returned indices are zero-based (0 encodes to first position); if FALSE (default), the returned indices are one-based (1 encodes to first position).

Value

Tensor of indices. It has the same shape as x, with the dimension along axis removed. Note that the returned integer is 1-based (i.e., if the argmax is in the first index position, the returned value will be 1)

Examples

```
x <- op_array(rbind(c(11, 12, 10),
                    c(12, 11, 10)))
x
```

```
## tf.Tensor(
## [[11. 12. 10.]
##  [12. 11. 10.]], shape=(2, 3), dtype=float64)
```

```
op_argmax(x)
```

```
## tf.Tensor(2, shape=(), dtype=int32)
```

```
op_argmax(x, axis = 1)
```

```
## tf.Tensor([2 1 1], shape=(3), dtype=int32)
```

```
op_argmax(x, axis = 2)
```

```
## tf.Tensor([2 1], shape=(2), dtype=int32)
```

Note

This is similar to R `max.col(x)` for the case of a 2-d array (a matrix), or for an nd-array, `apply(x, axis, which.max)`

See Also

- https://keras.io/api/ops/numpy#argmax-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()

op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()

op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
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op_left_shift()
op_less()
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op_linspace()
op_log()
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op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
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op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_ones()
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op_outer()
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op_power()
op_prod()
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op_real()
op_reciprocal()

op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
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op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()

op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()

op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_log()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()

op_max_pool()
op_maximum()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
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op_ndim()
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op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
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op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
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op_reciprocal()
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op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
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op_rsqrt()
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op_scan()
op_scatter()

op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()

op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_argmin *Returns the indices of the minimum values along an axis.*

Description

Returns the indices of the minimum values along an axis.

Usage

```
op_argmin(x, axis = NULL, keepdims = FALSE, zero_indexed = FALSE)
```

Arguments

x	Input tensor.
axis	By default, the index is into the flattened tensor, otherwise along the specified axis.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one. Defaults to FALSE.
zero_indexed	If TRUE, the returned indices are zero-based (0 encodes to first position); if FALSE (default), the returned indices are one-based (1 encodes to first position).

Value

Tensor of indices. It has the same shape as x, with the dimension along axis removed.

Examples

```
x <- op_arange(6L) |> op_reshape(c(2, 3)) |> op_add(10)
x

## tf.Tensor(
## [[11. 12. 13.]
##  [14. 15. 16.]], shape=(2, 3), dtype=float32)


op_argmin(x)

## tf.Tensor(1, shape=(), dtype=int32)


op_argmin(x, axis = 1)

## tf.Tensor([1 1 1], shape=(3), dtype=int32)


op_argmin(x, axis = 2)

## tf.Tensor([1 1], shape=(2), dtype=int32)
```

Note

This is similar to an R expression `apply(x, axis, which.min)`, where `x` is a R array.

See Also

- https://keras.io/api/ops/numpy#argmin-function

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argpartition()`

op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()

op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()

op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
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op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:

op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
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op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()

op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_empty()
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op_erfinv()
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op_expand_dims()
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op_extract_sequences()
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op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()

op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()

op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()

op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_silu()
op_sin()
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op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()

op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_argpartition *Performs an indirect partition along the given axis.*

Description

It returns an array of indices of the same shape as x that index data along the given axis in partitioned order.

```
x <- op_convert_to_tensor(c(9, 3, 6, 2, 8, 5, 7, 1, 10, 4))
x@r[op_argpartition(x, 3)]
```

```
## tf.Tensor([ 1.  2.  3. 10.  9.  8.  7.  6.  5.  4.], shape=(10), dtype=float64)
```

```
x@r[op_argpartition(x, 5)]
```

```
## tf.Tensor([ 1.  2.  3.  4.  5. 10.  9.  8.  7.  6.], shape=(10), dtype=float64)
```

```
x@r[op_argpartition(x, 7)]
```

```
## tf.Tensor([ 1.  2.  3.  4.  5.  6.  7. 10.  9.  8.], shape=(10), dtype=float64)
```

Usage

```
op_argpartition(x, kth, axis = -1L, zero_indexed = FALSE)
```

Arguments

`x`	Array to sort.
`kth`	Element index to partition by. The k-th element will be in its final sorted position and all smaller elements will be moved before it and all larger elements behind it. The order of all elements in the partitions is undefined. If provided with a sequence of k-th it will partition all of them into their sorted position at once.
`axis`	Axis along which to sort. The default is `-1` (the last axis). If `NULL`, the flattened array is used.
`zero_indexed`	If `TRUE`, the returned indices are zero-based (`0` encodes to first position); if `FALSE` (default), the returned indices are one-based (`1` encodes to first position).

Value

Array of indices that partition `x` along the specified `axis`.

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argsort()`
`op_array()`
`op_average()`
`op_bincount()`
`op_bitwise_and()`
`op_bitwise_invert()`
`op_bitwise_left_shift()`
`op_bitwise_not()`
`op_bitwise_or()`
`op_bitwise_right_shift()`
`op_bitwise_xor()`

op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
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op_isnan()
op_left_shift()

op_less()
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op_linspace()
op_log()
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op_min()
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op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_ravel()
op_real()
op_reciprocal()
op_repeat()
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op_right_shift()
op_roll()
op_rot90()
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op_select()
op_sign()
op_signbit()
op_sin()
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op_size()
op_sort()
op_split()
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op_stack()
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op_swapaxes()
op_take()
op_take_along_axis()
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op_tile()
op_trace()
op_transpose()
op_tri()
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op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argsort()
op_array()
op_associative_scan()
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op_binary_crossentropy()
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op_bitwise_xor()
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op_cumprod()
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op_custom_gradient()
op_depthwise_conv()
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op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
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op_irfft()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
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op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
op_power()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
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op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_argsort *Returns the indices that would sort a tensor.*

Description

Returns the indices that would sort a tensor.

Usage

```
op_argsort(x, axis = -1L, zero_indexed = FALSE)
```

Arguments

x	Input tensor.
axis	Axis along which to sort. Defaults to -1 (the last axis). If NULL, the flattened tensor is used.
zero_indexed	If TRUE, the returned indices are zero-based (0 encodes to first position); if FALSE (default), the returned indices are one-based (1 encodes to first position).

Value

Tensor of indices that sort x along the specified axis.

Examples

One dimensional array:

```
x <- op_array(c(3, 1, 2)) + .1
op_argsort(x)
```

```
## tf.Tensor([2 3 1], shape=(3), dtype=int32)
```

```
x@r[op_argsort(x)] == op_sort(x)
```

```
## tf.Tensor([ True  True  True], shape=(3), dtype=bool)
```

Two-dimensional array:

```
x <- op_array(rbind(c(0, 3),
                    c(3, 2),
                    c(4, 5))) + .1
(i <- op_argsort(x, axis = 1))
```

```
## tf.Tensor(
## [[1 2]
##  [2 1]
##  [3 3]], shape=(3, 2), dtype=int32)
```

```
x@r[i@r[, 1], ] # sort x-rows using first col of x
```

```
## tf.Tensor(
## [[0.1 3.1]
##  [3.1 2.1]
##  [4.1 5.1]], shape=(3, 2), dtype=float64)
```

```
x@r[i@r[, 2], ] # sort x-rows using second col of x
```

```
## tf.Tensor(
## [[3.1 2.1]
##  [0.1 3.1]
##  [4.1 5.1]], shape=(3, 2), dtype=float64)
```

```
(i <- op_argsort(x, axis = 2))
```

```
## tf.Tensor(
## [[1 2]
##  [2 1]
##  [1 2]], shape=(3, 2), dtype=int32)
```

```
x@r[, i@r[2,]] # sort x-cols using second row of x
```

```
## tf.Tensor(
## [[3.1 0.1]
##  [2.1 3.1]
##  [5.1 4.1]], shape=(3, 2), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#argsort-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
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op_isinf()
op_isnan()
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op_lstsq()
op_matmul()
op_max()
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op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_negative()
op_nonzero()
op_not_equal()
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op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
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op_right_shift()
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op_round()
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op_sum()
op_swapaxes()
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op_tan()

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op_tensordot()
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op_arcsinh()
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op_arctan2()
op_arctanh()
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op_argmin()
op_argpartition()
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op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_cumsum()
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op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_array *Create a tensor.*

Description

Create a tensor.

Usage

```
op_array(x, dtype = NULL)
```

Arguments

x	Input tensor.
dtype	The desired data-type for the tensor.

Value

A tensor.

Examples

```
op_array(c(1, 2, 3))

## tf.Tensor([1. 2. 3.], shape=(3), dtype=float32)


op_array(c(1, 2, 3), dtype = "float32")

## tf.Tensor([1. 2. 3.], shape=(3), dtype=float32)


op_array(c(1, 2, 3), dtype = "int32")

## tf.Tensor([1 2 3], shape=(3), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#array-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()

op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
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op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_arcsin()
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op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_image_resize()
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op_image_rgb_to_hsv()
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op_log_sigmoid()
op_log_softmax()
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op_logical_or()

op_logical_xor()
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op_meshgrid()
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op_minimum()
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op_moments()
op_moveaxis()
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op_ones_like()
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op_roll()
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op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_associative_scan *Performs a scan with an associative binary operation, in parallel.*

Description

This operation his similar to op_scan(), with the key difference that op_associative_scan() is a parallel implementation with potentially significant performance benefits, especially when jit compiled. The catch is that it can only be used when f is a binary associative operation (i.e. it must verify f(a, f(b, c)) == f(f(a, b), c)).

For an introduction to associative scans, refer to this paper: Blelloch, Guy E. 1990. Prefix Sums and Their Applications.

Usage

```
op_associative_scan(f, elems, reverse = FALSE, axis = 1L)
```

Arguments

f	A callable implementing an associative binary operation with signature `r = f(a, b)`. Function `f` must be associative, i.e., it must satisfy the equation `f(a, f(b, c)) == f(f(a, b), c)`. The inputs and result are (possibly nested tree structures of) array(s) matching `elems`. Each array has a dimension in place of the `axis` dimension. `f` should be applied elementwise over the `axis` dimension. The result `r` has the same shape (and structure) as the two inputs `a` and `b`.
elems	A (possibly nested tree structure of) array(s), each with an `axis` dimension of size `num_elems`.
reverse	A boolean stating if the scan should be reversed with respect to the `axis` dimension.
axis	an integer identifying the axis over which the scan should occur.

Value

A (possibly nested tree structure of) array(s) of the same shape and structure as `elems`, in which the `k`'th element of `axis` is the result of recursively applying `f` to combine the first `k` elements of `elems` along `axis`. For example, given `elems = list(a, b, c, ...)`, the result would be `list(a, f(a, b), f(f(a, b), c), ...)`.

Examples

```
sum_fn <- function(x, y) x + y
xs <- op_arange(5L)
op_associative_scan(sum_fn, xs)

## tf.Tensor([ 1  3  6 10 15], shape=(5), dtype=int32)


sum_fn <- function(x, y) {
  str(list(x = x, y = y))
  map2(x, y, \(.x, .y) .x + .y)
}

xs <- list(op_array(1:2),
           op_array(1:2),
           op_array(1:2))
ys <- op_associative_scan(sum_fn, xs, axis = 1)

## List of 2
##  $ x:List of 3
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([1], dtype=int32)>
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([1], dtype=int32)>
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([1], dtype=int32)>
##  $ y:List of 3
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([2], dtype=int32)>
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([2], dtype=int32)>
```

```
##   ..$ :<tf.Tensor: shape=(1), dtype=int32, numpy=array([2], dtype=int32)>
```

```
ys
```

```
## [[1]]
## tf.Tensor([1 3], shape=(2), dtype=int32)
##
## [[2]]
## tf.Tensor([1 3], shape=(2), dtype=int32)
##
## [[3]]
## tf.Tensor([1 3], shape=(2), dtype=int32)
```

See Also

Other core ops:
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()

op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
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op_log_sigmoid()
op_log_softmax()
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op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
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op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_average — *Compute the weighted average along the specified axis.*

Description

Compute the weighted average along the specified axis.

Usage

```
op_average(x, axis = NULL, weights = NULL)
```

Arguments

`x`	Input tensor.
`axis`	Integer along which to average `x`. The default, `axis = NULL`, will average over all of the elements of the input tensor. If axis is negative it counts from the last to the first axis.
`weights`	Tensor of weights associated with the values in `x`. Each value in `x` contributes to the average according to its associated weight. The weights array can either be 1-D (in which case its length must be the size of a along the given axis) or of the same shape as `x`. If `weights = NULL` (default), then all data in `x` are assumed to have a weight equal to one. The 1-D calculation is: `avg = sum(a * weights) / sum(weights)`. The only constraint on weights is that `sum(weights)` must not be 0.

Value

Return the average along the specified axis.

Examples

```
data <- op_arange(1, 5, dtype = "int32")
data

## tf.Tensor([1 2 3 4 5], shape=(5), dtype=int32)


op_average(data)

## tf.Tensor(3.0, shape=(), dtype=float32)


op_average(
  op_arange(1, 11),
  weights = op_arange(10, 0, -1)
)

## tf.Tensor(4.0, shape=(), dtype=float32)


data <- op_arange(6) |> op_reshape(c(3, 2))
data

## tf.Tensor(
## [[1. 2.]
##  [3. 4.]
##  [5. 6.]], shape=(3, 2), dtype=float32)


op_average(
  data,
  axis = 2,
  weights = op_array(c(1/4, 3/4))
)

## tf.Tensor([1.75 3.75 5.75], shape=(3), dtype=float32)


# Error: Axis must be specified when shapes of x and weights differ.
try(op_average(
  data,
  weights = op_array(c(1/4, 3/4))
))

## Error in op_average(data, weights = op_array(c(1/4, 3/4))) :
##   Axis must be specified when shapes of x and weights differ.
```

See Also

- https://keras.io/api/ops/numpy#average-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_bincount()
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op_ceil()
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op_conj()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
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op_hstack()
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op_tanh()
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op_tile()
op_trace()
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Other ops:
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op_argsort()
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op_associative_scan()
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op_solve_triangular()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_average_pool *Average pooling operation.*

Description

Average pooling operation.

Usage

```
op_average_pool(
  inputs,
  pool_size,
  strides = NULL,
  padding = "valid",
  data_format = NULL
)
```

Arguments

`inputs`	Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format = "channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format = "channels_first"`. Pooling happens over the spatial dimensions only.
`pool_size`	int or tuple/list of integers of size `len(inputs_spatial_shape)`, specifying the size of the pooling window for each spatial dimension of the input tensor. If `pool_size` is int, then every spatial dimension shares the same `pool_size`.
`strides`	int or tuple/list of integers of size `len(inputs_spatial_shape)`. The stride of the sliding window for each spatial dimension of the input tensor. If `strides` is int, then every spatial dimension shares the same `strides`.
`padding`	string, either `"valid"` or `"same"`. `"valid"` means no padding is applied, and `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when `strides = 1`.
`data_format`	A string, either `"channels_last"` or `"channels_first"`. `data_format` determines the ordering of the dimensions in the inputs. If `data_format = "channels_last"`, `inputs` is of shape `(batch_size, ..., channels)` while if `data_format = "channels_first"`, `inputs` is of shape `(batch_size, channels, ...)`.

Value

A tensor of rank N+2, the result of the average pooling operation.

See Also

- https://keras.io/api/ops/nn#averagepool-function

Other nn ops:
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()

op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
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op_binary_crossentropy()
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op_custom_gradient()

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op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_batch_normalization

Normalizes `x` *by* `mean` *and* `variance`*.*

Description

This op is typically used by the batch normalization step in a neural network. It normalizes the input tensor along the given axis.

Usage

```
op_batch_normalization(
  x,
  mean,
  variance,
  axis,
  offset = NULL,
  scale = NULL,
  epsilon = 0.001
)
```

Arguments

x	Input tensor.
mean	A mean vector of the same length as the `axis` dimension of the input thensor.
variance	A variance vector of the same length as the `axis` dimension of the input tensor.

axis	Integer, the axis that should be normalized.
offset	An offset vector of the same length as the axis dimension of the input tensor. If not NULL, offset is added to the normalized tensor. Defaults to NULL.
scale	A scale vector of the same length as the axis dimension of the input tensor. If not NULL, the normalized tensor is multiplied by scale. Defaults to NULL.
epsilon	Small float added to variance to avoid dividing by zero. Defaults to 1e-3.

Value

The normalized tensor.

Examples

```
x <- op_convert_to_tensor(rbind(c(0.1, 0.2, 0.3),
                                c(0.4, 0.5, 0.6),
                                c(0.7, 0.8, 0.9)))
op_batch_normalization(
  x,
  mean = c(0.4, 0.5, 0.6),
  variance = c(0.67, 0.67, 0.67),
  axis = -1
)

## tf.Tensor(
## [[-0.36623513 -0.36623513 -0.36623513]
##  [ 0.          0.          0.        ]
##  [ 0.36623513  0.36623513  0.36623513]], shape=(3, 3), dtype=float64)
```

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/ops/batch_normalization

Other nn ops:
op_average_pool()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
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op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
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op_istft()
op_leaky_relu()
op_left_shift()
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op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_logical_and()
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op_lstsq()
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op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_binary_crossentropy
Computes binary cross-entropy loss between target and output tensor.

Description

The binary cross-entropy loss is commonly used in binary classification tasks where each input sample belongs to one of the two classes. It measures the dissimilarity between the target and output probabilities or logits.

Usage

```
op_binary_crossentropy(target, output, from_logits = FALSE)
```

Arguments

target	The target tensor representing the true binary labels. Its shape should match the shape of the `output` tensor.
output	The output tensor representing the predicted probabilities or logits. Its shape should match the shape of the `target` tensor.
from_logits	(optional) Whether `output` is a tensor of logits or probabilities. Set it to `TRUE` if `output` represents logits; otherwise, set it to `FALSE` if `output` represents probabilities. Defaults to `FALSE`.

Value

Integer tensor: The computed binary cross-entropy loss between `target` and `output`.

Examples

```
target <- op_array(c(0, 1, 1, 0))
output <- op_array(c(0.1, 0.9, 0.8, 0.2))
op_binary_crossentropy(target, output)

## tf.Tensor([0.10536055 0.10536055 0.22314353 0.22314353], shape=(4), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#binarycrossentropy-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
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op_cond()
op_conj()
op_conv()
op_conv_transpose()
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op_convert_to_tensor()
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op_cos()

op_cosh()
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op_cumprod()
op_cumsum()
op_custom_gradient()
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op_det()
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op_diagonal()
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op_divide()
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op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_bincount *Count the number of occurrences of each value in a tensor of integers.*

Description

Count the number of occurrences of each value in a tensor of integers.

Usage

```
op_bincount(x, weights = NULL, minlength = 0L, sparse = FALSE)
```

Arguments

x	Input tensor. It must be of dimension 1, and it must only contain non-negative integer(s).
weights	Weight tensor. It must have the same length as x. The default value is NULL. If specified, x is weighted by it, i.e. if n = x[i], out[n] += weight[i] instead of the default behavior out[n] += 1.

minlength	An integer. The default value is 0. If specified, there will be at least this number of bins in the output tensor. If greater than `max(x) + 1`, each value of the output at an index higher than `max(x)` is set to 0.
sparse	Whether to return a sparse tensor; for backends that support sparse tensors.

Value

1D tensor where each element gives the number of occurrence(s) of its index value in x. Its length is the maximum between `max(x) + 1` and `minlength`.

Examples

```
(x <- op_array(c(1, 2, 2, 3), dtype = "uint8"))

## tf.Tensor([1 2 2 3], shape=(4), dtype=uint8)


op_bincount(x)

## tf.Tensor([0 1 2 1], shape=(4), dtype=int32)


(weights <- x / 2)

## tf.Tensor([0.5 1.  1.  1.5], shape=(4), dtype=float32)


op_bincount(x, weights = weights)

## tf.Tensor([0.  0.5 2.  1.5], shape=(4), dtype=float32)


minlength <- as.integer(op_max(x) + 1 + 2) # 6
op_bincount(x, minlength = minlength)

## tf.Tensor([0 1 2 1 0 0], shape=(6), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#bincount-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
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op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
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op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
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op_einsum()
op_elu()
op_empty()
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op_expm1()
op_extract_sequences()
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op_fft()
op_fft2()
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op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
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op_hard_shrink()
op_hard_sigmoid()
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op_hard_tanh()
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op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_irfft()
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op_left_shift()
op_less()
op_less_equal()
op_linspace()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
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op_logical_and()
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op_logspace()
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op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_maximum()
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op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
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op_right_shift()
op_rms_normalization()
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op_where()
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---

op_bitwise_and *Compute the bit-wise AND of two arrays element-wise.*

Description

Computes the bit-wise AND of the underlying binary representation of the integers in the input arrays. This ufunc implements the C/Python operator &.

Usage

```
op_bitwise_and(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
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op_bitwise_xor()
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op_count_nonzero()
op_cross()

op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()

op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()

op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()

op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()

op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

---

op_bitwise_invert *Compute bit-wise inversion, or bit-wise NOT, element-wise.*

Description

Computes the bit-wise NOT of the underlying binary representation of the integers in the input arrays. This ufunc implements the C/Python operator ~.

Usage

```
op_bitwise_invert(x)
```

Arguments

x	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()

op_bitwise_and()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()

op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()

op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()

op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_bitwise_left_shift *Shift the bits of an integer to the left.*

Description

Bits are shifted to the left by appending y 0s at the right of x. Since the internal representation of numbers is in binary format, this operation is equivalent to multiplying x by 2**y.

Usage

```
op_bitwise_left_shift(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()

op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()

op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()

op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()

op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()

op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_bitwise_not — *Compute bit-wise inversion, or bit-wise NOT, element-wise.*

Description

Computes the bit-wise NOT of the underlying binary representation of the integers in the input arrays. This ufunc implements the C/Python operator ~.

Usage

```
op_bitwise_not(x)
```

Arguments

x	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()

op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()

op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()

op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()

op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()

op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()

op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()

op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()

op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_bitwise_or *Compute the bit-wise OR of two arrays element-wise.*

Description

Computes the bit-wise OR of the underlying binary representation of the integers in the input arrays. This ufunc implements the C/Python operator `|`.

Usage

```
op_bitwise_or(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()

op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()

op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_bitwise_right_shift

Shift the bits of an integer to the right.

Description

Bits are shifted to the right y. Because the internal representation of numbers is in binary format, this operation is equivalent to dividing x by 2**y.

Usage

```
op_bitwise_right_shift(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()

op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()

op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()

op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()

op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
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op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()

op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_bitwise_xor` *Compute the bit-wise XOR of two arrays element-wise.*

Description

Computes the bit-wise XOR of the underlying binary representation of the integers in the input arrays. This ufunc implements the C/Python operator `^`.

Usage

```
op_bitwise_xor(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()

op_isinf()
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op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_matmul()
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op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()

op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
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op_binary_crossentropy()
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op_convert_to_tensor()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()

op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
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op_dot_product_attention()
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op_extract_sequences()
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op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()

op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_is_tensor()
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op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
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op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
op_power()
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op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()

op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()

op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_broadcast_to *Broadcast a tensor to a new shape.*

Description

Broadcast a tensor to a new shape.

Usage

```
op_broadcast_to(x, shape)
```

Arguments

x	The tensor to broadcast.
shape	The shape of the desired tensor.

Value

A tensor with the desired shape.

Examples

```
x <- op_array(c(1, 2, 3))
op_broadcast_to(x, shape = c(3, 3))

## tf.Tensor(
## [[1. 2. 3.]
##  [1. 2. 3.]
##  [1. 2. 3.]], shape=(3, 3), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#broadcastto-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
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op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
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op_sign()
op_signbit()
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op_sinh()
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op_split()
op_sqrt()
op_square()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
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op_zeros_like()

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op_dot_product_attention()
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op_expand_dims()

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op_fft2()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
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op_hard_tanh()
op_histogram()
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op_image_rgb_to_hsv()
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op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

- op_prod()
- op_psnr()
- op_qr()
- op_quantile()
- op_ravel()
- op_real()
- op_rearrange()
- op_reciprocal()
- op_relu()
- op_relu6()
- op_repeat()
- op_reshape()
- op_rfft()
- op_right_shift()
- op_rms_normalization()
- op_roll()
- op_rot90()
- op_round()
- op_rsqrt()
- op_saturate_cast()
- op_scan()
- op_scatter()
- op_scatter_update()
- op_searchsorted()
- op_segment_max()
- op_segment_sum()
- op_select()
- op_selu()
- op_separable_conv()
- op_shape()
- op_sigmoid()
- op_sign()
- op_signbit()
- op_silu()
- op_sin()
- op_sinh()
- op_size()
- op_slice()
- op_slice_update()
- op_slogdet()
- op_soft_shrink()
- op_softmax()
- op_softplus()
- op_softsign()
- op_solve()
- op_solve_triangular()
- op_sort()
- op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_cast	*Cast a tensor to the desired dtype.*

Description

Cast a tensor to the desired dtype.

Usage

```
op_cast(x, dtype)
```

Arguments

x	A tensor or variable.
dtype	The target type.

Value

A tensor of the specified dtype.

Examples

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_cast(x, dtype = "float16")

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float16)
```

See Also

- https://keras.io/api/ops/core#cast-function

Other core ops:
op_associative_scan()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()

op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
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op_floor()
op_floor_divide()
op_fori_loop()

op_full()
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op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
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op_image_crop()
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op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_softsign()
op_solve()
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op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
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op_squareplus()
op_squeeze()
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op_stft()
op_stop_gradient()
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op_take_along_axis()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_transpose()
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op_tril()
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op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_categorical_crossentropy
Computes categorical cross-entropy loss between target and output tensor.

Description

The categorical cross-entropy loss is commonly used in multi-class classification tasks where each input sample can belong to one of multiple classes. It measures the dissimilarity between the target and output probabilities or logits.

Usage

```
op_categorical_crossentropy(target, output, from_logits = FALSE, axis = -1L)
```

Arguments

`target`	The target tensor representing the true categorical labels. Its shape should match the shape of the `output` tensor except for the last dimension.
`output`	The output tensor representing the predicted probabilities or logits. Its shape should match the shape of the `target` tensor except for the last dimension.
`from_logits`	(optional) Whether `output` is a tensor of logits or probabilities. Set it to `TRUE` if `output` represents logits; otherwise, set it to `FALSE` if `output` represents probabilities. Defaults to `FALSE`.
`axis`	(optional) The axis along which the categorical cross-entropy is computed. Defaults to `-1`, which corresponds to the last dimension of the tensors.

Value

Integer tensor: The computed categorical cross-entropy loss between `target` and `output`.

Examples

```
target <- op_array(rbind(c(1, 0, 0),
                         c(0, 1, 0),
                         c(0, 0, 1)))
output <- op_array(rbind(c(0.9, 0.05, 0.05),
                         c(0.1, 0.8, 0.1),
                         c(0.2, 0.3, 0.5)))
op_categorical_crossentropy(target, output)

## tf.Tensor([0.10536052 0.22314355 0.69314718], shape=(3), dtype=float64)
```

See Also

- https://keras.io/api/ops/nn#categoricalcrossentropy-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()

op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()

op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()

op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()

op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ceil *Return the ceiling of the input, element-wise.*

Description

The ceil of the scalar x is the smallest integer i, such that i >= x.

Usage

```
op_ceil(x)
```

Arguments

x	Input tensor.

Value

The ceiling of each element in x, with float dtype.

See Also

- https://keras.io/api/ops/numpy#ceil-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()

op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
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op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()

op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_celu *Continuously-differentiable exponential linear unit.*

Description

It is defined as:
`f(x) = alpha * (exp(x / alpha) - 1) for x < 0`, `f(x) = x for x >= 0`.

Usage

```
op_celu(x, alpha = 1)
```

Arguments

x	Input tensor.
alpha	The value for the CELU formulation. Defaults to `1.0`.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_celu(x)

## tf.Tensor([-0.63212055  0.          1.        ], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()

op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_cholesky()

op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()

op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_log_sigmoid()
op_log_softmax()
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op_logical_not()
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op_logical_xor()
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op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()

op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
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op_rsqrt()
op_saturate_cast()
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op_scatter()
op_scatter_update()
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op_segment_max()
op_segment_sum()
op_select()
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op_separable_conv()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()

op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_cholesky   *Computes the Cholesky decomposition of a positive semi-definite matrix.*

Description

Computes the Cholesky decomposition of a positive semi-definite matrix.

Usage

```
op_cholesky(x)
```

Arguments

x	Input tensor of shape `(..., M, M)`.

Value

A tensor of shape `(..., M, M)` representing the lower triangular Cholesky factor of `x`.

See Also

Other linear algebra ops:
op_det()
op_eig()
op_eigh()
op_inv()
op_lstsq()
op_lu_factor()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()

op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()

op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()

op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

---

op_clip *Clip (limit) the values in a tensor.*

Description

Given an interval, values outside the interval are clipped to the interval edges. For example, if an interval of `[0, 1]` is specified, values smaller than 0 become 0, and values larger than 1 become 1.

Usage

```
op_clip(x, x_min, x_max)
```

Arguments

`x`	Input tensor.
`x_min`	Minimum value.
`x_max`	Maximum value.

Value

The clipped tensor.

See Also

- https://keras.io/api/ops/numpy#clip-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()

op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()

op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
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op_equal()
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op_erfinv()
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op_fft2()
op_flip()
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op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_concatenate *Join a sequence of tensors along an existing axis.*

Description

Join a sequence of tensors along an existing axis.

Usage

```
op_concatenate(xs, axis = 1L)
```

Arguments

xs	The sequence of tensors to concatenate.
axis	The axis along which the tensors will be joined. Defaults to `0`.

Value

The concatenated tensor.

See Also

- https://keras.io/api/ops/numpy#concatenate-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
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op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
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op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
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op_reciprocal()
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op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_size()
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op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
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op_arcsin()
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op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
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op_cholesky()
op_clip()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_cond *Conditionally applies* `true_fn` *or* `false_fn`.

Description

Conditionally applies `true_fn` or `false_fn`.

Usage

```
op_cond(pred, true_fn, false_fn)
```

Arguments

`pred`	Boolean scalar type
`true_fn`	Callable returning the output for the `pred` == `TRUE` case.
`false_fn`	Callable returning the output for the `pred` == `FALSE` case.

Value

The output of either `true_fn` or `false_fn` depending on pred.

Examples

```
fn <- tensorflow::tf_function(function(x) {
  op_cond(x > 0,
    true_fn = \() x + 1,
    false_fn = \() x - 1)
})

fn(tensorflow::as_tensor(1))

## tf.Tensor(2.0, shape=(), dtype=float64)


fn(tensorflow::as_tensor(-1))

## tf.Tensor(-2.0, shape=(), dtype=float64)


#
# Conditional side-effect (print only, no return value).
file <- tempfile(fileext = ".txt")
fn <- tensorflow::tf_function(function(epochs) {
  op_fori_loop(
    0, epochs,
    body_fun = \(epoch, state) {
      op_cond(epoch %% 20 == 0,
              \() {
                tensorflow::tf$print(
                  "epoch:", epoch,
                  output_stream = paste0("file://", file))
                NULL
```

```
              },
              \() {NULL})
        state
      },
      init_val = tensorflow::as_tensor(0, "float32"))
})

fn(tensorflow::as_tensor(100, "float32"))

## tf.Tensor(0.0, shape=(), dtype=float32)


readLines(file)

## [1] "epoch: 0"  "epoch: 20" "epoch: 40" "epoch: 60" "epoch: 80"


# cleanup
unlink(file)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()

op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
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op_moveaxis()
op_multi_hot()
op_multiply()
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op_ndim()
op_negative()
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op_norm()
op_normalize()
op_not_equal()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_conj *Returns the complex conjugate, element-wise.*

Description

The complex conjugate of a complex number is obtained by changing the sign of its imaginary part.

Usage

```
op_conj(x)
```

Arguments

x	Input tensor.

Value

The complex conjugate of each element in x.

See Also

- https://keras.io/api/ops/numpy#conjugate-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
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op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
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op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
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op_scatter_update()
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op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_conv *General N-D convolution.*

Description

This ops supports 1D, 2D and 3D convolution.

Usage

```
op_conv(
  inputs,
  kernel,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L
)
```

Arguments

`inputs`	Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format = "channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format = "channels_first"`.
`kernel`	Tensor of rank N+2. `kernel` has shape `(kernel_spatial_shape, num_input_channels, num_output_` `num_input_channels` should match the number of channels in `inputs`.
`strides`	int or int tuple/list of `len(inputs_spatial_shape)`, specifying the strides of the convolution along each spatial dimension. If `strides` is int, then every spatial dimension shares the same `strides`.
`padding`	string, either `"valid"` or `"same"`. `"valid"` means no padding is applied, and `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when `strides = 1`.
`data_format`	A string, either `"channels_last"` or `"channels_first"`. `data_format` determines the ordering of the dimensions in the inputs. If `data_format = "channels_last"`, `inputs` is of shape `(batch_size, ..., channels)` while if `data_format = "channels_first"`, `inputs` is of shape `(batch_size, channels, ...)`.
`dilation_rate`	int or int tuple/list of `len(inputs_spatial_shape)`, specifying the dilation rate to use for dilated convolution. If `dilation_rate` is int, then every spatial dimension shares the same `dilation_rate`.

Value

A tensor of rank N+2, the result of the conv operation.

See Also

- https://keras.io/api/ops/nn#conv-function

Other nn ops:
`op_average_pool()`
`op_batch_normalization()`
`op_binary_crossentropy()`

op_categorical_crossentropy()
op_celu()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average_pool()
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op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
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op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()

op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_isinf()
op_isnan()
op_istft()
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op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

- op_threshold()
- op_tile()
- op_top_k()
- op_trace()
- op_transpose()
- op_tri()
- op_tril()
- op_triu()
- op_trunc()
- op_unravel_index()
- op_unstack()
- op_var()
- op_vdot()
- op_vectorize()
- op_vectorized_map()
- op_vstack()
- op_where()
- op_while_loop()
- op_zeros()
- op_zeros_like()

---

op_convert_to_numpy *Convert a tensor to an R or NumPy array.*

Description

Convert a tensor to an R or NumPy array.

Usage

```
op_convert_to_numpy(x)

op_convert_to_array(x)
```

Arguments

x	A tensor.

Value

A NumPy array or R array.

See Also

- https://keras.io/api/ops/core#converttonumpy-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()

op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()

op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()

op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
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op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()

op_nonzero()
op_norm()
op_normalize()
op_not_equal()
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op_saturate_cast()
op_scan()
op_scatter()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()

op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
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op_sum()
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op_take()
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op_tanh_shrink()
op_tensordot()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()

op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_convert_to_tensor *Convert an array to a tensor.*

Description

Native tensors for the current backend or left unchanged unless the dtype, sparse or ragged arguments are set.

Usage

```
op_convert_to_tensor(x, dtype = NULL, sparse = NULL, ragged = NULL)
```

Arguments

x	An R or NumPy array (can be nested) or a backend tensor.
dtype	The target type. If NULL, the type of x is used.
sparse	Whether to keep sparse tensors. FALSE will cause sparse tensors to be densified. The default value of NULL means that sparse tensors are kept only if the backend supports them.
ragged	Whether to keep ragged tensors. FALSE will cause ragged tensors to be densified. The default value of NULL means that ragged tensors are kept only if the backend supports them.

Value

A backend tensor of the specified dtype and sparseness.

Examples

```
x <- array(c(1, 2, 3))
y <- op_convert_to_tensor(x)
y

## tf.Tensor([1. 2. 3.], shape=(3), dtype=float64)


op_convert_to_tensor(c(1, 3, 2, 0), "int32")

## tf.Tensor([1 3 2 0], shape=(4), dtype=int32)
```

See Also

- op_array()
- https://keras.io/api/ops/core#converttotensor-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()

op_dtype()
op_eig()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_log()
op_log10()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
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op_logspace()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()

- op_negative()
- op_nonzero()
- op_norm()
- op_normalize()
- op_not_equal()
- op_one_hot()
- op_ones()
- op_ones_like()
- op_outer()
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- op_qr()
- op_quantile()
- op_ravel()
- op_real()
- op_rearrange()
- op_reciprocal()
- op_relu()
- op_relu6()
- op_repeat()
- op_reshape()
- op_rfft()
- op_right_shift()
- op_rms_normalization()
- op_roll()
- op_rot90()
- op_round()
- op_rsqrt()
- op_saturate_cast()
- op_scan()
- op_scatter()
- op_scatter_update()
- op_searchsorted()
- op_segment_max()
- op_segment_sum()
- op_select()
- op_selu()
- op_separable_conv()
- op_shape()
- op_sigmoid()
- op_sign()
- op_signbit()
- op_silu()
- op_sin()
- op_sinh()

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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_conv_transpose *General N-D convolution transpose.*

Description

Also known as de-convolution. This ops supports 1D, 2D and 3D convolution.

Usage

```
op_conv_transpose(
  inputs,
  kernel,
  strides,
  padding = "valid",
  output_padding = NULL,
  data_format = NULL,
  dilation_rate = 1L
)
```

Arguments

inputs	Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format = "channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format = "channels_first"`.
kernel	Tensor of rank N+2. `kernel` has shape `[kernel_spatial_shape, num_output_channels, num_input_` `num_input_channels` should match the number of channels in `inputs`.
strides	int or int tuple/list of `len(inputs_spatial_shape)`, specifying the strides of the convolution along each spatial dimension. If `strides` is int, then every spatial dimension shares the same `strides`.
padding	string, either `"valid"` or `"same"`. `"valid"` means no padding is applied, and `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when `strides = 1`.
output_padding	int or int tuple/list of `len(inputs_spatial_shape)`, specifying the amount of padding along the height and width of the output tensor. Can be a single integer to specify the same value for all spatial dimensions. The amount of output padding along a given dimension must be lower than the stride along that same dimension. If set to `NULL` (default), the output shape is inferred.

data_format A string, either "channels_last" or "channels_first". data_format determines the ordering of the dimensions in the inputs. If data_format = "channels_last", inputs is of shape (batch_size, ..., channels) while if data_format = "channels_first", inputs is of shape (batch_size, channels, ...).

dilation_rate int or int tuple/list of len(inputs_spatial_shape), specifying the dilation rate to use for dilated convolution. If dilation_rate is int, then every spatial dimension shares the same dilation_rate.

Value

A tensor of rank N+2, the result of the conv operation.

See Also

- https://keras.io/api/ops/nn#convtranspose-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()

op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
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op_arcsinh()
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op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
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op_celu()
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op_clip()
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op_cond()
op_conj()
op_conv()
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op_copy()
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op_cosh()
op_count_nonzero()
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op_get_item()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_log_softmax()
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op_meshgrid()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
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op_multiply()
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op_pad()
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op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()

op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
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op_segment_max()
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op_select()
op_selu()
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op_shape()
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op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()

op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_copy *Returns a copy of* x.

Description

Returns a copy of x.

Usage

```
op_copy(x)
```

Arguments

x	Input tensor.

Value

A copy of x.

See Also

- https://keras.io/api/ops/numpy#copy-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_correlate()

op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_size()
op_sort()

op_split()
op_sqrt()
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op_swapaxes()
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Other ops:
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op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
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op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
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op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
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op_qr()
op_quantile()
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op_saturate_cast()
op_scan()
op_scatter()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()

op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
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op_squareplus()
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op_take()
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op_tanh_shrink()
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op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_correlate *Compute the cross-correlation of two 1-dimensional tensors.*

Description

Compute the cross-correlation of two 1-dimensional tensors.

Usage

```
op_correlate(x1, x2, mode = "valid")
```

Arguments

x1	First 1-dimensional input tensor of length M.
x2	Second 1-dimensional input tensor of length N.
mode	Either "valid", "same" or "full". By default the mode is set to "valid", which returns an output of length max(M, N) - min(M, N) + 1. "same" returns an output of length max(M, N). "full" mode returns the convolution at each point of overlap, with an output length of N+M-1.

Value

Output tensor, cross-correlation of x1 and x2.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()

op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()

op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_cos *Cosine, element-wise.*

Description

Cosine, element-wise.

Usage

```
op_cos(x)
```

Arguments

x	Input tensor.

Value

The corresponding cosine values.

See Also

- https://keras.io/api/ops/numpy#cos-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()

op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()

op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()

op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()

op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()

op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()

op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_cosh *Hyperbolic cosine, element-wise.*

Description

Hyperbolic cosine, element-wise.

Usage

```
op_cosh(x)
```

Arguments

x	Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#cosh-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()

op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()

op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()

op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
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op_convert_to_tensor()
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op_cos()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
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op_custom_gradient()
op_depthwise_conv()
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op_greater()
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op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()

op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
op_maximum()
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op_meshgrid()

op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_norm()
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op_tanh_shrink()
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op_trace()

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---

op_count_nonzero *Counts the number of non-zero values in* x *along the given* axis.

Description

If no axis is specified then all non-zeros in the tensor are counted.

Usage

```
op_count_nonzero(x, axis = NULL)
```

Arguments

x	Input tensor.
axis	Axis or a tuple of axes along which to count the number of non-zeros. Defaults to NULL.

Value

An integer or a tensor of integers.

Examples

```
x <- op_array(rbind(c(0, 1, 7, 0),
                    c(3, 0, 2, 19)))
op_count_nonzero(x)

## tf.Tensor(5, shape=(), dtype=int32)
```

```
op_count_nonzero(x, axis = 1)

## tf.Tensor([1 1 2 1], shape=(4), dtype=int32)


op_count_nonzero(x, axis = 2)

## tf.Tensor([2 3], shape=(2), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#countnonzero-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
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op_bitwise_and()
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op_softsign()
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op_sparsemax()
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op_vectorized_map()
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op_where()
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op_zeros()
op_zeros_like()

---

op_cross *Returns the cross product of two (arrays of) vectors.*

Description

The cross product of x1 and x2 in R^3 is a vector perpendicular to both x1 and x2. If x1 and x2 are arrays of vectors, the vectors are defined by the last axis of x1 and x2 by default, and these axes can have dimensions 2 or 3.

Where the dimension of either x1 or x2 is 2, the third component of the input vector is assumed to be zero and the cross product calculated accordingly.

In cases where both input vectors have dimension 2, the z-component of the cross product is returned.

Usage

```
op_cross(x1, x2, axisa = -1L, axisb = -1L, axisc = -1L, axis = NULL)
```

Arguments

x1	Components of the first vector(s).
x2	Components of the second vector(s).
axisa	Axis of x1 that defines the vector(s). Defaults to -1.
axisb	Axis of x2 that defines the vector(s). Defaults to -1.
axisc	Axis of the result containing the cross product vector(s). Ignored if both input vectors have dimension 2, as the return is scalar. By default, the last axis.
axis	If defined, the axis of x1, x2 and the result that defines the vector(s) and cross product(s). Overrides axisa, axisb and axisc.

Value

Vector cross product(s).

Note

Torch backend does not support two dimensional vectors, or the arguments axisa, axisb and axisc. Use axis instead.

See Also

- https://keras.io/api/ops/numpy#cross-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
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op_get_item()
op_greater()
op_greater_equal()
op_histogram()
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op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ctc_decode *Decodes the output of a CTC model.*

Description

Decodes the output of a CTC model.

Usage

```
op_ctc_decode(
  inputs,
  sequence_lengths,
  strategy = "greedy",
  beam_width = 100L,
  top_paths = 1L,
  merge_repeated = TRUE,
  mask_index = 1L
)
```

Arguments

`inputs`	A tensor of shape `(batch_size, max_length, num_classes)` containing the logits (the output of the model). They should *not* be normalized via softmax.
`sequence_lengths`	A tensor of shape `(batch_size)` containing the sequence lengths for the batch.
`strategy`	A string for the decoding strategy. Supported values are `"greedy"` and `"beam_search"`.
`beam_width`	An integer scalar beam width used in beam search. Defaults to `100`.
`top_paths`	An integer scalar, the number of top paths to return. Defaults to `1`.
`merge_repeated`	A boolean scalar, whether to merge repeated labels in the output. Defaults to `TRUE`.
`mask_index`	An integer scalar, the (1-based) index of the mask character in the vocabulary. Defaults to `1`.

Value

A list containing:

- The tensor representing the list of decoded sequences. If `strategy="greedy"`, the shape is `(1, batch_size, max_length)`. If `strategy="beam_search"`, the shape is `(top_paths, batch_size, max_length)`. Note that: `-1` indicates the blank label.
- If `strategy="greedy"`, a tensor of shape `(batch_size, 1)` representing the negative of the sum of the probability logits for each sequence. If `strategy="beam_search"`, a tensor of shape `(batch_size, top_paths)` representing the log probability for each sequence.

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()

op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()

op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()

op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ctc_loss *CTC (Connectionist Temporal Classification) loss.*

Description

CTC (Connectionist Temporal Classification) loss.

Usage

```
op_ctc_loss(target, output, target_length, output_length, mask_index = 1L)
```

Arguments

target	A tensor of shape (batch_size, max_length) containing the true labels in integer format.
output	A tensor of shape (batch_size, max_length, num_classes) containing logits (the output of your model).
target_length	A tensor of shape (batch_size) containing the true label lengths.
output_length	A tensor of shape (batch_size) containing the output lengths.
mask_index	The index of the mask character in the vocabulary. Defaults to 1 (the first element in vocabulary).

Value

A tensor, shape (batch_size), of loss values.

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()

op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()

op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()

op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()

op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()

op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_cumprod *Return the cumulative product of elements along a given axis.*

Description

Return the cumulative product of elements along a given axis.

Usage

```
op_cumprod(x, axis = NULL, dtype = NULL)
```

Arguments

x	Input tensor.
axis	Axis along which the cumulative product is computed. By default the input is flattened.
dtype	dtype of returned tensor. Defaults to x$dtype.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#cumprod-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()

op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
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op_bitwise_left_shift()
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op_bitwise_right_shift()
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op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
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op_diagonal()
op_diff()
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op_divide()
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op_dot()
op_dot_product_attention()
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op_einsum()
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op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
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op_not_equal()
op_one_hot()
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op_outer()
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op_polar()
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op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
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op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
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op_squeeze()
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op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_cumsum *Returns the cumulative sum of elements along a given axis.*

Description

Returns the cumulative sum of elements along a given axis.

Usage

```
op_cumsum(x, axis = NULL, dtype = NULL)
```

Arguments

x	Input tensor.
axis	Axis along which the cumulative sum is computed. By default the input is flattened.
dtype	dtype of returned tensor. Defaults to x$dtype.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#cumsum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
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op_left_shift()
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op_log1p()
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op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
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op_multiply()
op_nan_to_num()

op_ndim()
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op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
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op_rot90()
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op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
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op_image_rgb_to_hsv()
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op_log_softmax()
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op_segment_max()
op_segment_sum()
op_select()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_std()
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op_stop_gradient()
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op_svd()
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op_tanh_shrink()
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op_top_k()
op_trace()
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op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_custom_gradient` *Decorator to define a function with a custom gradient.*

Description

This decorator allows fine grained control over the gradients of a sequence for operations. This may be useful for multiple reasons, including providing a more efficient or numerically stable gradient for a sequence of operations.

Usage

```
op_custom_gradient(f)
```

Arguments

f Function `f(...)` that returns a tuple `(output, grad_fn)` where:

- `...` is a sequence of unnamed arguments, each a tensor input or nested structure of tensor inputs to the function.
- `output` is a (potentially nested structure of) tensor outputs of applying operations in forward_fn `f()` to `...`.
- `grad_fn` is a function with the signature `grad_fn(..., upstream)` which returns a list of tensors the same size as (flattened) `...`: the derivatives of tensors in `output` with respect to the tensors in `...`. `upstream` is a tensor or sequence of tensors holding the initial value gradients for each tensor in `output`.

Value

A function `h(...)` which returns the same value as `f(...)[[1]]` and whose gradient is determined by `f(...)[[2]]`.

Example

Backend-agnostic example.

```
log1pexp <- op_custom_gradient(\(x) {

    e <- op_exp(x)

    grad <- function(..., upstream = NULL) {
      upstream <- upstream %||% ..1
      op_multiply(upstream, 1.0 - 1.0 / op_add(1, e))
    }

    tuple(op_log(1 + e), grad)

})

if(config_backend() == "tensorflow") {
  tf <- tensorflow::tf
  x <- op_convert_to_tensor(100.0)
  with(tf$GradientTape() %as% tape, {
    tape$watch(x)
    y <- log1pexp(x)
  })
  dy_dx <- tape$gradient(y, x)
  stopifnot(as.numeric(dy_dx) == 1)
}
```

Note

Note that the `grad` function that returns gradient computation requires `...` as well as an `upstream` named argument, depending on the backend being set. With the JAX and TensorFlow backends, it requires only one argument, whereas it might use the `upstream` argument in the case of the PyTorch backend.

When working with TensorFlow/JAX backend, `grad(upstream)` is sufficient. With PyTorch, the `grad` function requires `...` as well as `upstream`, e.g. `grad <- \(..., upstream)`. Follow the example above to use `op_custom_gradient()` in a way that is compatible with all backends.

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/ops/custom_gradient

Other core ops:
`op_associative_scan()`
`op_cast()`
`op_cond()`
`op_convert_to_numpy()`
`op_convert_to_tensor()`
`op_dtype()`
`op_fori_loop()`
`op_is_tensor()`
`op_map()`
`op_rearrange()`
`op_scan()`
`op_scatter()`
`op_scatter_update()`
`op_searchsorted()`
`op_shape()`
`op_slice()`
`op_slice_update()`
`op_stop_gradient()`
`op_subset()`
`op_switch()`
`op_unstack()`
`op_vectorized_map()`
`op_while_loop()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
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op_bitwise_invert()
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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_depthwise_conv()
op_det()

op_diag()
op_diagflat()
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op_divide()
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op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
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op_ones()
op_ones_like()
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op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()

---

op_depthwise_conv *General N-D depthwise convolution.*

Description

This ops supports 1D and 2D depthwise convolution.

Usage

```
op_depthwise_conv(
  inputs,
  kernel,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L
)
```

Arguments

`inputs`	Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format = "channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format = "channels_first"`.
`kernel`	Tensor of rank N+2. `kernel` has shape `[kernel_spatial_shape, num_input_channels, num_channel` `num_input_channels` should match the number of channels in `inputs`.
`strides`	int or int tuple/list of `len(inputs_spatial_shape)`, specifying the strides of the convolution along each spatial dimension. If `strides` is int, then every spatial dimension shares the same `strides`.

padding	string, either "valid" or "same". "valid" means no padding is applied, and "same" results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when strides = 1.
data_format	A string, either "channels_last" or "channels_first". data_format determines the ordering of the dimensions in the inputs. If data_format = "channels_last", inputs is of shape (batch_size, ..., channels) while if data_format = "channels_first", inputs is of shape (batch_size, channels, ...).
dilation_rate	int or int tuple/list of len(inputs_spatial_shape), specifying the dilation rate to use for dilated convolution. If dilation_rate is int, then every spatial dimension shares the same dilation_rate.

Value

A tensor of rank N+2, the result of the depthwise conv operation.

See Also

- https://keras.io/api/ops/nn#depthwiseconv-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()

op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
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op_array()
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op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_concatenate()
op_cond()
op_conj()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
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op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
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op_histogram()
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op_ifft2()
op_imag()
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op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_less()
op_less_equal()
op_linspace()
op_log()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
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op_meshgrid()
op_min()
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op_mod()
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op_moveaxis()
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op_ones()
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op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_slice_update()
op_slogdet()
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op_sum()
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op_swapaxes()
op_switch()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_det *Computes the determinant of a square tensor.*

Description

Computes the determinant of a square tensor.

Usage

```
op_det(x)
```

Arguments

x	Input tensor of shape `(..., M, M)`.

Value

A tensor of shape `(...)` representing the determinant of `x`.

See Also

Other linear algebra ops:
`op_cholesky()`
`op_eig()`
`op_eigh()`
`op_inv()`
`op_lstsq()`
`op_lu_factor()`
`op_norm()`
`op_slogdet()`
`op_solve_triangular()`
`op_svd()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`

op_associative_scan()
op_average()
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op_binary_crossentropy()
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op_celu()
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op_image_resize()
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op_image_rgb_to_hsv()

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op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_diag *Extract a diagonal or construct a diagonal array.*

Description

Extract a diagonal or construct a diagonal array.

Usage

```
op_diag(x, k = 0L)
```

Arguments

x	Input tensor. If x is 2-D, returns the k-th diagonal of x. If x is 1-D, return a 2-D tensor with x on the k-th diagonal.
k	The diagonal to consider. Defaults to 0. Use k > 0 for diagonals above the main diagonal, and k < 0 for diagonals below the main diagonal.

Value

The extracted diagonal or constructed diagonal tensor.

Examples

```
x <- op_arange(9L) |> op_reshape(c(3, 3))
x

## tf.Tensor(
## [[1 2 3]
##  [4 5 6]
##  [7 8 9]], shape=(3, 3), dtype=int32)


op_diag(x)

## tf.Tensor([1 5 9], shape=(3), dtype=int32)
```

```
op_diag(x, k = 1)

## tf.Tensor([2 6], shape=(2), dtype=int32)


op_diag(x, k = -1)

## tf.Tensor([4 8], shape=(2), dtype=int32)


op_diag(op_diag(x))

## tf.Tensor(
## [[1 0 0]
##  [0 5 0]
##  [0 0 9]], shape=(3, 3), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#diag-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_diagflat *Create a two-dimensional array with the flattened input diagonal.*

Description

the k-th diagonal.

Usage

```
op_diagflat(x, k = 0L)
```

Arguments

x	Input tensor to be flattened and placed on the diagonal.
k	The diagonal to place the flattened input. Defaults to 0. Use k > 0 for diagonals above the main diagonal, and k < 0 for diagonals below the main diagonal.

Value

A 2-D tensor with the flattened input on the specified diagonal.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()

op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()

op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
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op_sqrt()
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op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()

op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
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op_arccos()
op_arccosh()
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op_arcsinh()
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op_bitwise_xor()
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op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
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op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagonal()
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op_divide_no_nan()
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op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_log_sigmoid()
op_log_softmax()
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op_logdet()
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op_logical_xor()
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op_minimum()
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op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()

op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
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op_triu()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_diagonal *Return specified diagonals.*

Description

If x is 2-D, returns the diagonal of x with the given offset, i.e., the collection of elements of the form x[i, i+offset].

If x has more than two dimensions, the axes specified by axis1 and axis2 are used to determine the 2-D sub-array whose diagonal is returned.

The shape of the resulting array can be determined by removing axis1 and axis2 and appending an index to the right equal to the size of the resulting diagonals.

Usage

```
op_diagonal(x, offset = 0L, axis1 = 1L, axis2 = 2L)
```

Arguments

`x`	Input tensor.
`offset`	Offset of the diagonal from the main diagonal. Can be positive or negative. Defaults to `0` (main diagonal).
`axis1`	Axis to be used as the first axis of the 2-D sub-arrays. Defaults to `1` (first axis).
`axis2`	Axis to be used as the second axis of the 2-D sub-arrays. Defaults to `2` (second axis).

Value

Tensor of diagonals.

Examples

```
x <- op_arange(4L) |> op_reshape(c(2, 2))
x

## tf.Tensor(
## [[1 2]
##  [3 4]], shape=(2, 2), dtype=int32)


op_diagonal(x)

## tf.Tensor([1 4], shape=(2), dtype=int32)


op_diagonal(x, offset = 1)

## tf.Tensor([2], shape=(1), dtype=int32)


x <- op_array(1:8) |> op_reshape(c(2, 2, 2))
x

## tf.Tensor(
## [[[1 2]
##   [3 4]]
##
##  [[5 6]
##   [7 8]]], shape=(2, 2, 2), dtype=int32)
```

```
x |> op_diagonal(0)

## tf.Tensor(
## [[1 7]
##  [2 8]], shape=(2, 2), dtype=int32)
```

```
x |> op_diagonal(0, 1, 2) # same as above, the default

## tf.Tensor(
## [[1 7]
##  [2 8]], shape=(2, 2), dtype=int32)
```

```
x |> op_diagonal(0, 2, 3)

## tf.Tensor(
## [[1 4]
##  [5 8]], shape=(2, 2), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#diagonal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()

op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()

op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()

op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()

op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
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op_outer()
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op_qr()
op_quantile()
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op_searchsorted()
op_segment_max()
op_segment_sum()

op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_svd()
op_swapaxes()
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op_take()
op_take_along_axis()
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op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()

op_trace()
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op_triu()
op_trunc()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_diff *Calculate the n-th discrete difference along the given axis.*

Description

The first difference is given by `out[i] = a[i+1] - a[i]` along the given axis, higher differences are calculated by using `diff` recursively.

Usage

```
op_diff(a, n = 1L, axis = -1L)
```

Arguments

a	Input tensor.
n	The number of times values are differenced. Defaults to 1.
axis	Axis to compute discrete difference(s) along. Defaults to -1 (last axis).

Value

Tensor of diagonals.

Examples

```
x <- op_array(c(1, 2, 4, 7, 0))
op_diff(x)

## tf.Tensor([ 1.  2.  3. -7.], shape=(4), dtype=float32)
```

```
op_diff(x, n = 2)

## tf.Tensor([  1.   1. -10.], shape=(3), dtype=float32)


x <- op_array(rbind(c(1, 3, 6, 10),
                    c(0, 5, 6, 8)))
op_diff(x)

## tf.Tensor(
## [[2. 3. 4.]
##  [5. 1. 2.]], shape=(2, 3), dtype=float64)


op_diff(x, axis = 1)

## tf.Tensor([[-1.  2.  0. -2.]], shape=(1, 4), dtype=float64)
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_not()
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op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
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op_ones_like()
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op_ravel()
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op_repeat()
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op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()

op_select()
op_sign()
op_signbit()
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op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
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op_stack()
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op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
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op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average_pool()
op_batch_normalization()
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op_bitwise_and()
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op_clip()
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op_cond()
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op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
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op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_hard_tanh()
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op_image_gaussian_blur()

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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_unstack()
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---

op_digitize *Returns the indices of the bins to which each value in x belongs.*

Description

Returns the indices of the bins to which each value in x belongs.

Usage

```
op_digitize(x, bins, zero_indexed = FALSE)
```

Arguments

x	Input array to be binned.
bins	Array of bins. It has to be one-dimensional and monotonically increasing.
zero_indexed	If TRUE, the returned indices are zero-based (0 encodes to first bin); if FALSE (default), the returned indices are one-based (1 encodes the first bin).

Value

Output array of indices, of same shape as x.

Examples

```
x <- op_array(c(-1,    0, 1,    3, 3.5,      4.5,  1.6,    8))
bins <- array(c(    0,       3,         4.5,            7))
op_digitize(x, bins)

## tf.Tensor([1 2 2 3 3 4 2 5], shape=(8), dtype=int32)
```

See Also

- https://keras.io/api/ops/numpy#digitize-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
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op_arccosh()
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op_broadcast_to()
op_ceil()
op_clip()
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op_cosh()
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op_diff()

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op_sum()
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op_hard_silu()
op_hard_tanh()
op_histogram()
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op_image_affine_transform()
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op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_irfft()
op_is_tensor()
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op_maximum()
op_mean()
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op_meshgrid()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_not_equal()
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op_pad()
op_polar()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
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op_roll()
op_rot90()
op_round()
op_rsqrt()
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op_scan()
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op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
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op_sinh()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
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op_subset()
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op_where()
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op_zeros()
op_zeros_like()

---

op_divide *Divide arguments element-wise.*

Description

Note that this function is automatically called when using the R operator * with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)

op_divide(x, 2)

## tf.Tensor([0.5 1.  1.5 2. ], shape=(4), dtype=float32)

x / 2

## tf.Tensor([0.5 1.  1.5 2. ], shape=(4), dtype=float32)
```

Usage

```
op_divide(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, the quotient x1/x2, element-wise.

Example

```
op_divide(3, 2)

## tf.Tensor(1.5, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#divide-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
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op_argmax()
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op_argpartition()
op_argsort()
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op_average()
op_bincount()
op_bitwise_and()
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op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
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op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
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op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
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op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_divide_no_nan *Safe element-wise division which returns 0 where the denominator is 0.*

Description

Safe element-wise division which returns 0 where the denominator is 0.

Usage

```
op_divide_no_nan(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

The quotient x1/x2, element-wise, with zero where x2 is zero.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()

op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_any()
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op_arccos()
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op_arcsin()
op_arcsinh()
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op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_or()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
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op_cosh()
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op_cross()
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op_cumsum()
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op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
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op_einsum()

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op_hard_silu()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_less()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
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op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

---

op_dot *Dot product of two tensors.*

Description

- If both x1 and x2 are 1-D tensors, it is inner product of vectors (without complex conjugation).
- If both x1 and x2 are 2-D tensors, it is matrix multiplication.
- If either x1 or x2 is 0-D (scalar), it is equivalent to x1 * x2.
- If x1 is an N-D tensor and x2 is a 1-D tensor, it is a sum product over the last axis of x1 and x2.
- If x1 is an N-D tensor and x2 is an M-D tensor (where M >= 2), it is a sum product over the last axis of x1 and the second-to-last axis of x2: dot(x1, x2)[i,j,k,m] = sum(a[i,j,:] * b[k,:,m]).

Usage

```
op_dot(x1, x2)
```

Arguments

x1	First argument.
x2	Second argument.

Value

Dot product of x1 and x2.

Note

Torch backend does not accept 0-D tensors as arguments.

See Also

- https://keras.io/api/ops/numpy#dot-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()

op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()

op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()

op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
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op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()

op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()

op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()

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op_saturate_cast()
op_scan()
op_scatter()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
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op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
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op_stop_gradient()
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op_tril()
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op_unstack()
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op_where()
op_while_loop()
op_zeros()
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---

op_dot_product_attention *Scaled dot product attention function.*

Description

Computes the attention function on Q (query), K (key), and V(value): attention(Q, K, V) = softmax(Q * K / sqrt(d)) * V. If we define logits as the output of Q * K and the probs as the output of softmax.

Throughout this function, we utilize the following notation to represent the shape of array:

- B: batch size

- S: length of the key/value
- T: length of the query
- N: number of attention heads
- H: dimensions of each attention head
- K: number of key/value heads
- G: number of groups, which equals to `N // K`

Usage

```
op_dot_product_attention(
  query,
  key,
  value,
  bias = NULL,
  mask = NULL,
  scale = NULL,
  is_causal = FALSE,
  flash_attention = NULL
)
```

Arguments

`query`	The query array with the shape of `(B, T, N, H)`.
`key`	The key array with the shape of `(B, S, K, H)`. When `K` equals `N`, multi-headed attention (MHA) is performed. Otherwise, grouped query attention (GQA) is performed if `N` is a multiple of `K`. and multi-query attention (MQA) is performed if `K==1` (a special case of GQA).
`value`	The value array with the same shape of `key`.
`bias`	Optional bias array to be added to logits. The shape must be broadcastable to `(B, N, T, S)`.
`mask`	Optional mask array used to filter out logits. It is a boolean mask where `TRUE` indicates the element should take part in attention. For an additive mask, users should pass it to bias. The shape must be broadcastable to `(B, N, T, S)`.
`scale`	Optional scale for the logits. If `NULL`, the scale will be set to `1.0 / sqrt(H)`.
`is_causal`	Whether to apply causal mask.
`flash_attention`	Whether to use flash attention. If `NULL`, it will attempt to use flash attention if the required conditions are met. Typically, the inputs must be in float16 and bfloat16 dtype and the input layout requirements may vary depending on the backend.

Value

An array of the attention output with the same shape of `query`.

Examples

```
query = random_normal(c(2, 4, 8, 16))
key = random_normal(c(2, 6, 8, 16))
value = random_normal(c(2, 6, 8, 16))
op_dot_product_attention(query, key, value) |> op_shape()

## shape(2, 4, 8, 16)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()

op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()

op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_dtype *Return the dtype of the tensor input as a standardized string.*

Description

Note that due to the standardization, the dtype will not compare equal to the backend-specific version of the dtype.

Usage

```
op_dtype(x)
```

Arguments

x A tensor. This function will try to access the `dtype` attribute of the input tensor.

Value

A string indicating the dtype of the input tensor, e.g. `"float32"`.

Examples

```
x <- op_zeros(c(8, 12))
op_dtype(x)

## [1] "float32"
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()

op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_eig *Computes the eigenvalues and eigenvectors of a square matrix.*

Description

Computes the eigenvalues and eigenvectors of a square matrix.

Usage

```
op_eig(x)
```

Arguments

x	Input tensor of shape `(..., M, M)`.

Value

A list of two tensors: a tensor of shape `(..., M)` containing eigenvalues and a tensor of shape `(..., M, M)` containing eigenvectors.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eigh()

op_inv()
op_lstsq()
op_lu_factor()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_eigh *Computes the eigenvalues and eigenvectors of a complex Hermitian.*

Description

Computes the eigenvalues and eigenvectors of a complex Hermitian.

Usage

```
op_eigh(x)
```

Arguments

x Input tensor of shape (..., M, M).

Value

A list of two tensors: a tensor of shape (..., M) containing eigenvalues and a tensor of shape (..., M, M) containing eigenvectors.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_inv()
op_lstsq()
op_lu_factor()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_einsum()
op_elu()
op_empty()
op_equal()

op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
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op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
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op_nan_to_num()
op_ndim()
op_negative()
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op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_take_along_axis()
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op_tanh()
op_tanh_shrink()
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op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_einsum` *Evaluates the Einstein summation convention on the operands.*

Description

Evaluates the Einstein summation convention on the operands.

Usage

```
op_einsum(subscripts, ...)
```

Arguments

`subscripts`	Specifies the subscripts for summation as comma separated list of subscript labels. An implicit (classical Einstein summation) calculation is performed unless the explicit indicator `->` is included as well as subscript labels of the precise output form.
`...`	The operands to compute the Einstein sum of.

Value

The calculation based on the Einstein summation convention.

Examples

```
a <- op_arange(25) |> op_reshape(c(5, 5))
b <- op_arange(5)
c <- op_arange(6) |> op_reshape(c(2, 3))
```

Trace of a matrix:

```
op_einsum("ii", a)
op_trace(a)

## tf.Tensor(65.0, shape=(), dtype=float32)
## tf.Tensor(65.0, shape=(), dtype=float32)
```

Extract the diagonal:

```
op_einsum("ii -> i", a)
op_diag(a)

## tf.Tensor([ 1.  7. 13. 19. 25.], shape=(5), dtype=float32)
## tf.Tensor([ 1.  7. 13. 19. 25.], shape=(5), dtype=float32)
```

Sum over an axis:

```
op_einsum("ij -> i", a)
op_sum(a, axis = 2)
```

```
## tf.Tensor([ 15.  40.  65.  90. 115.], shape=(5), dtype=float32)
## tf.Tensor([ 15.  40.  65.  90. 115.], shape=(5), dtype=float32)
```

For higher dimensional tensors summing a single axis can be done with ellipsis:

```
op_einsum("...j -> ...", a)
op_sum(a, axis = -1)
```

```
## tf.Tensor([ 15.  40.  65.  90. 115.], shape=(5), dtype=float32)
## tf.Tensor([ 15.  40.  65.  90. 115.], shape=(5), dtype=float32)
```

Compute a matrix transpose or reorder any number of axes:

```
op_einsum("ji", c) # return c unchanged
```

```
## tf.Tensor(
## [[1. 2. 3.]
##  [4. 5. 6.]], shape=(2, 3), dtype=float32)
```

```
op_einsum("ij -> ji", c) # transpose
op_transpose(c)          # same as above
```

```
## tf.Tensor(
## [[1. 4.]
##  [2. 5.]
##  [3. 6.]], shape=(3, 2), dtype=float32)
## tf.Tensor(
## [[1. 4.]
##  [2. 5.]
##  [3. 6.]], shape=(3, 2), dtype=float32)
```

Matrix vector multiplication:

```
op_einsum("ij, j", a, b)
op_einsum("...j, j", a, b)
a %*% b
op_matmul(a, b)
```

```
## tf.Tensor([ 55. 130. 205. 280. 355.], shape=(5), dtype=float32)
## tf.Tensor([ 55. 130. 205. 280. 355.], shape=(5), dtype=float32)
## tf.Tensor([ 55. 130. 205. 280. 355.], shape=(5), dtype=float32)
## tf.Tensor([ 55. 130. 205. 280. 355.], shape=(5), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#einsum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_empty()
op_equal()
op_exp()
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op_expand_dims()
op_expm1()
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op_floor()
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op_full_like()
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op_median()
op_meshgrid()
op_min()
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op_quantile()
op_ravel()
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op_square()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_vdot()
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op_vstack()
op_where()
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op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
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op_convert_to_tensor()
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op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_less()
op_less_equal()
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op_log()
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op_log1p()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
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op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_elu *Exponential Linear Unit activation function.*

Description

It is defined as:
`f(x) = alpha * (exp(x) - 1.) for x < 0`, `f(x) = x for x >= 0`.

Usage

```
op_elu(x, alpha = 1)
```

Arguments

x	Input tensor.
alpha	A scalar, slope of positive section. Defaults to `1.0`.

Value

A tensor with the same shape as `x`.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_elu(x)

## tf.Tensor([-0.63212055  0.          1.        ], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#elu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()

op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
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op_all()
op_any()
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op_arccos()
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op_arctan()
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op_argmax()
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op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_categorical_crossentropy()
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op_norm()

op_normalize()
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op_ones()
op_ones_like()
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op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_empty *Return a tensor of given shape and type filled with uninitialized data.*

Description

Return a tensor of given shape and type filled with uninitialized data.

Usage

```
op_empty(shape, dtype = NULL)
```

Arguments

shape	Shape of the empty tensor.
dtype	Desired data type of the empty tensor.

Value

The empty tensor.

See Also

- https://keras.io/api/ops/numpy#empty-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()

op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()

op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()

op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()

op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()

op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_equal *Returns* (x1 == x2) *element-wise.*

Description

Note that this function is automatically called when using the R operator == with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_equal(x, 2)

## tf.Tensor([False  True False False], shape=(4), dtype=bool)


x == 2

## tf.Tensor([False  True False False], shape=(4), dtype=bool)
```

Usage

```
op_equal(x1, x2)
```

Arguments

x1	Tensor to compare.
x2	Tensor to compare.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#equal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()

op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_erf *Computes the error function of* x*, element-wise.*

Description

Computes the error function of x, element-wise.

Usage

```
op_erf(x)
```

Arguments

x	Input tensor.

Value

A tensor with the same dtype as x.

Examples

```
x <- op_array(c(-3, -2, -1, 0, 1))
op_erf(x)

## tf.Tensor([-0.99997777 -0.9953222  -0.84270084  0.         0.84270084], shape=(5), dtype=float32)


# array([-0.99998 , -0.99532, -0.842701,  0.,  0.842701], dtype=float32)
```

See Also

Other math ops:
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()

op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()

op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()

op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()

op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()

op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()

op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_erfinv *Computes the inverse error function of* x*, element-wise.*

Description

Computes the inverse error function of x, element-wise.

Usage

```
op_erfinv(x)
```

Arguments

`x`	Input tensor.

Value

A tensor with the same dtype as `x`.

Examples

```
x <- op_array(c(-0.5, -0.2, -0.1, 0.0, 0.3))
op_erfinv(x)

## tf.Tensor([-0.4769363  -0.17914344 -0.088856   0.         0.27246267], shape=(5), dtype=float32)
```

See Also

Other math ops:
`op_erf()`
`op_extract_sequences()`
`op_fft()`
`op_fft2()`
`op_ifft2()`
`op_in_top_k()`
`op_irfft()`
`op_istft()`
`op_logsumexp()`
`op_qr()`
`op_rfft()`
`op_rsqrt()`
`op_segment_max()`
`op_segment_sum()`
`op_solve()`
`op_stft()`
`op_top_k()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()

op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
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op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()

op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()

op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_exp *Calculate the exponential of all elements in the input tensor.*

Description

Calculate the exponential of all elements in the input tensor.

Usage

```
op_exp(x)
```

Arguments

x	Input tensor.

Value

Output tensor, element-wise exponential of x.

See Also

- https://keras.io/api/ops/numpy#exp-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()

op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()

op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()

op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_exp2 *Calculate the base-2 exponential of all elements in the input tensor.*

Description

Calculate the base-2 exponential of all elements in the input tensor.

Usage

```
op_exp2(x)
```

Arguments

x Input tensor.

Value

Output tensor, element-wise base-2 exponential of x.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()

op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()

op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()

op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()

op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()

op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()

op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()

op_zeros()
op_zeros_like()

---

op_expand_dims   *Expand the shape of a tensor.*

Description

Insert a new axis at the axis position in the expanded tensor shape.

Usage

```
op_expand_dims(x, axis)
```

Arguments

x	Input tensor.
axis	Position in the expanded axes where the new axis (or axes) is placed.

Value

Output tensor with the number of dimensions increased.

See Also

- https://keras.io/api/ops/numpy#expanddims-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()

op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()

op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
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op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
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op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
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op_arctan2()
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op_hard_tanh()
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op_hstack()

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op_image_rgb_to_hsv()
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op_is_tensor()
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op_isinf()
op_isnan()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_median()
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op_multiply()
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op_not_equal()
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op_ones()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()

op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()

op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_expm1 *Calculate* `exp(x) - 1` *for all elements in the tensor.*

Description

Calculate `exp(x) - 1` for all elements in the tensor.

Usage

```
op_expm1(x)
```

Arguments

x	Input values.

Value

Output tensor, element-wise exponential minus one.

See Also

- https://keras.io/api/ops/numpy#expm1-function

Other numpy ops:
op_abs()

op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()

op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
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op_any()
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op_arcsin()
op_arcsinh()
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op_argmax()
op_argmin()
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op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
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op_conv_transpose()
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op_diagonal()
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op_dot()
op_dot_product_attention()
op_dtype()
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op_equal()
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op_exp()
op_exp2()
op_expand_dims()
op_extract_sequences()
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op_fft()

op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
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op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()

op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
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op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
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op_median()
op_meshgrid()
op_min()
op_minimum()
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op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()

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op_relu()
op_relu6()
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op_right_shift()
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op_scatter()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
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op_signbit()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
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op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
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op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_extract_sequences   *Expands the dimension of last axis into sequences of* sequence_length.

Description

Slides a window of size sequence_length over the last axis of the input with a stride of sequence_stride, replacing the last axis with [num_sequences, sequence_length] sequences.

If the dimension along the last axis is N, the number of sequences can be computed by:
num_sequences = 1 + (N - sequence_length) // sequence_stride

Usage

```
op_extract_sequences(x, sequence_length, sequence_stride)
```

Arguments

x	Input tensor.
sequence_length	An integer representing the sequences length.
sequence_stride	An integer representing the sequences hop size.

Value

A tensor of sequences with shape [..., num_sequences, sequence_length].

Examples

```
x <- op_convert_to_tensor(1:6)
op_extract_sequences(x, 3, 2)

## tf.Tensor(
## [[1 2 3]
##  [3 4 5]], shape=(2, 3), dtype=int32)
```

See Also

- https://keras.io/api/ops/core#extractsequences-function

Other math ops:
op_erf()
op_erfinv()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()

op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()

op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()

op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()

op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
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op_norm()
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op_not_equal()
op_one_hot()
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op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()

op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()

op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_eye *Return a 2-D tensor with ones on the diagonal and zeros elsewhere.*

Description

Return a 2-D tensor with ones on the diagonal and zeros elsewhere.

Usage

```
op_eye(N, M = NULL, k = 0L, dtype = NULL)
```

Arguments

`N`	Number of rows in the output.
`M`	Number of columns in the output. If `NULL`, defaults to `N`.
`k`	Index of the diagonal: 0 (the default) refers to the main diagonal, a positive value refers to an upper diagonal, and a negative value to a lower diagonal.
`dtype`	Data type of the returned tensor.

Value

Tensor with ones on the k-th diagonal and zeros elsewhere.

See Also

- `https://keras.io/api/ops/numpy#eye-function`

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_average()`
`op_bincount()`
`op_bitwise_and()`
`op_bitwise_invert()`
`op_bitwise_left_shift()`
`op_bitwise_not()`
`op_bitwise_or()`
`op_bitwise_right_shift()`
`op_bitwise_xor()`
`op_broadcast_to()`
`op_ceil()`
`op_clip()`
`op_concatenate()`
`op_conj()`

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
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op_isnan()
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op_less()
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op_log1p()

op_log2()
op_logaddexp()
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op_matmul()
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op_moveaxis()
op_multiply()
op_nan_to_num()
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op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
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op_select()
op_sign()
op_signbit()
op_sin()
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op_size()

op_sort()
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op_tensordot()
op_tile()
op_trace()
op_transpose()
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op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
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Other ops:
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op_add()
op_all()
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op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
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op_associative_scan()
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op_custom_gradient()
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op_divide()
op_divide_no_nan()

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op_erfinv()
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op_hard_tanh()
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op_hstack()
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op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_qr()
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op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_squareplus()
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op_svd()
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op_take_along_axis()
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op_tanh()
op_tanh_shrink()
op_tensordot()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_fft *Computes the Fast Fourier Transform along last axis of input.*

Description

Computes the Fast Fourier Transform along last axis of input.

Usage

```
op_fft(x)
```

Arguments

x	list of the real and imaginary parts of the input tensor. Both tensors provided should be of floating type.

Value

A list containing two tensors - the real and imaginary parts of the output tensor.

Examples

```
x = c(op_array(c(1., 2.)),
      op_array(c(0., 1.)))
op_fft(x)


## [[1]]
## tf.Tensor([ 3. -1.], shape=(2), dtype=float32)
##
## [[2]]
## tf.Tensor([ 1. -1.], shape=(2), dtype=float32)
```

See Also

- https://keras.io/api/ops/fft#fft-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
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op_leaky_relu()
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op_ones()

op_ones_like()
op_outer()
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op_quantile()
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op_roll()
op_rot90()
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op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_squareplus()
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op_tanh_shrink()
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op_zeros()
op_zeros_like()

op_fft2 *Computes the 2D Fast Fourier Transform along the last two axes of input.*

Description

Computes the 2D Fast Fourier Transform along the last two axes of input.

Usage

```
op_fft2(x)
```

Arguments

x	list of the real and imaginary parts of the input tensor. Both tensors provided should be of floating type.

Value

A list containing two tensors - the real and imaginary parts of the output.

Examples

```
x <- c(op_array(rbind(c(1, 2),
                      c(2, 1))),
       op_array(rbind(c(0, 1),
                      c(1, 0))))
op_fft2(x)


## [[1]]
## tf.Tensor(
## [[ 6.  0.]
##  [ 0. -2.]], shape=(2, 2), dtype=float64)
##
## [[2]]
## tf.Tensor(
## [[ 2.  0.]
##  [ 0. -2.]], shape=(2, 2), dtype=float64)
```

See Also

- https://keras.io/api/ops/fft#fft2-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
op_maximum()
op_mean()
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op_meshgrid()
op_min()
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op_mod()
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op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_repeat()
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op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
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op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_flip	*Reverse the order of elements in the tensor along the given axis.*

Description

The shape of the tensor is preserved, but the elements are reordered.

Usage

```
op_flip(x, axis = NULL)
```

Arguments

x	Input tensor.
axis	Axis or axes along which to flip the tensor. The default, `axis = NULL`, will flip over all of the axes of the input tensor.

Value

Output tensor with entries of `axis` reversed.

See Also

- https://keras.io/api/ops/numpy#flip-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()

op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
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op_floor()
op_floor_divide()
op_full()
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op_get_item()
op_greater()
op_greater_equal()
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op_hstack()
op_identity()
op_imag()

op_inner()
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op_power()
op_prod()
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op_ravel()
op_real()
op_reciprocal()
op_repeat()

op_reshape()
op_right_shift()
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op_rot90()
op_round()
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op_signbit()
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op_subtract()
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op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
op_all()
op_any()
op_append()

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op_arccosh()
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op_cumsum()
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op_diag()
op_diagflat()
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op_diff()
op_digitize()
op_divide()
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op_hard_tanh()
op_histogram()
op_hstack()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_isnan()
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op_log10()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
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op_logical_xor()
op_logspace()
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op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
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op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
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op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
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op_psnr()
op_qr()
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op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_floor *Return the floor of the input, element-wise.*

Description

The floor of the scalar x is the largest integer i, such that i <= x.

Usage

```
op_floor(x)
```

Arguments

x Input tensor.

Value

Output tensor, element-wise floor of x.

See Also

- https://keras.io/api/ops/numpy#floor-function

Other numpy ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()

op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
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op_isclose()
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op_log10()
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op_logical_or()
op_logical_xor()
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op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()

op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
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op_pad()
op_power()
op_prod()
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op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
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op_select()
op_sign()
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op_sinh()
op_size()
op_sort()
op_split()
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op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
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op_vdot()
op_vectorize()
op_vstack()
op_where()
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op_zeros_like()

Other ops:
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op_arcsinh()
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op_extract_sequences()
op_eye()
op_fft()

op_fft2()
op_flip()
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op_full()
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op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_imag()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()

op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()

op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_floor_divide *Returns the largest integer smaller or equal to the division of inputs.*

Description

Note that this function is automatically called when using the R operator `%/%` with a tensor.

```
(x <- op_arange(10))

## tf.Tensor([ 1.  2.  3.  4.  5.  6.  7.  8.  9. 10.], shape=(10), dtype=float32)

op_floor_divide(x, 2)

## tf.Tensor([0. 1. 1. 2. 2. 3. 3. 4. 4. 5.], shape=(10), dtype=float32)

x %/% 2

## tf.Tensor([0. 1. 1. 2. 2. 3. 3. 4. 4. 5.], shape=(10), dtype=float32)
```

Usage

```
op_floor_divide(x1, x2)
```

Arguments

x1	Numerator.
x2	Denominator.

Value

Output tensor, y <- floor(x1/x2)

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()

op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()

op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()

op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()

op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
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op_relu()
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op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_fori_loop *For loop implementation.*

Description

For loop implementation.

Usage

```
op_fori_loop(lower, upper, body_fun, init_val)
```

Arguments

lower	The initial value of the loop variable.
upper	The upper bound of the loop variable.
body_fun	A callable that represents the loop body. Must take two arguments: the loop variable and the loop state. The loop state should be updated and returned by this function.
init_val	The initial value of the loop state.

Value

The final state after the loop.

Examples

```
lower <- 0L
upper <- 10L
body_fun <- function(i, state) state + i
init_state <- 0L
final_state <- op_fori_loop(lower, upper, body_fun, init_state)
final_state

## tf.Tensor(45, shape=(), dtype=int32)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()

op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()

op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()

op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
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op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()

op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_full *Return a new tensor of given shape and type, filled with* fill_value.

Description

Return a new tensor of given shape and type, filled with fill_value.

Usage

```
op_full(shape, fill_value, dtype = NULL)
```

Arguments

shape	Shape of the new tensor.
fill_value	Fill value.
dtype	Desired data type of the tensor.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#full-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()

op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
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op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
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op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_argmax()
op_argmin()
op_argpartition()
op_argsort()
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op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
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op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()

op_floor()
op_floor_divide()
op_fori_loop()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
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op_sign()
op_signbit()
op_silu()
op_sin()
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op_size()
op_slice()
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op_slogdet()
op_soft_shrink()
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op_solve_triangular()
op_sort()
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op_sparse_plus()
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op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_full_like *Return a full tensor with the same shape and type as the given tensor.*

Description

Return a full tensor with the same shape and type as the given tensor.

Usage

```
op_full_like(x, fill_value, dtype = NULL)
```

Arguments

x	Input tensor.
fill_value	Fill value.
dtype	Overrides data type of the result.

Value

Tensor of fill_value with the same shape and type as x.

See Also

- https://keras.io/api/ops/numpy#fulllike-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()

op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()

op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()

op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
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op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_arccosh()
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op_argmin()
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op_argsort()
op_array()
op_associative_scan()

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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_hard_silu()
op_hard_tanh()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()

op_inner()
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op_isinf()
op_isnan()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_moveaxis()
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op_multiply()
op_nan_to_num()
op_ndim()
op_negative()

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op_ones_like()
op_outer()
op_pad()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()

op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()

op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_gelu *Gaussian Error Linear Unit (GELU) activation function.*

Description

If approximate is TRUE, it is defined as: f(x) = 0.5 * x * (1 + tanh(sqrt(2 / pi) * (x + 0.044715 * x^3)))

Or if approximate is FALSE, it is defined as: f(x) = x * P(X <= x) = 0.5 * x * (1 + erf(x / sqrt(2))), where P(X) ~ N(0, 1).

Usage

```
op_gelu(x, approximate = TRUE)
```

Arguments

x	Input tensor.
approximate	Approximate version of GELU activation. Defaults to TRUE.

Value

A tensor with the same shape as x.

Examples

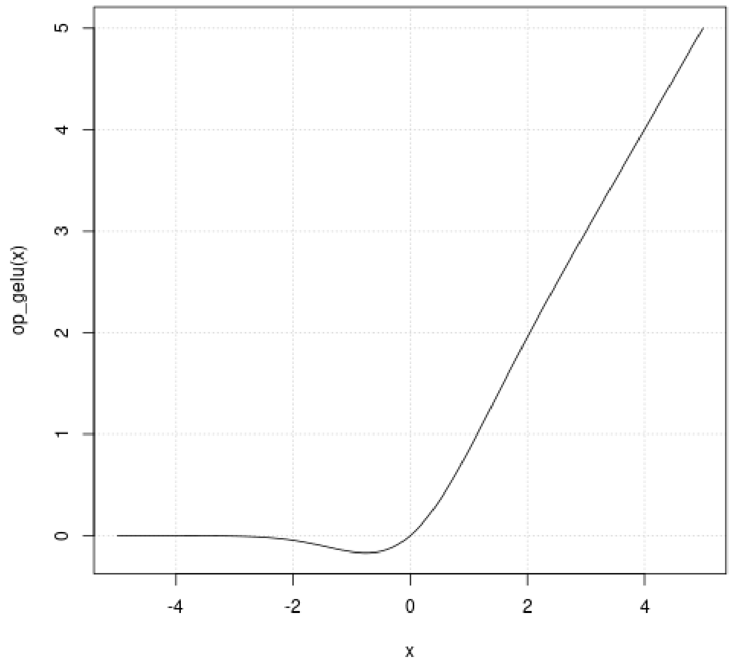
```
x <- op_array(c(-1., 0., 1.))
op_gelu(x)

## tf.Tensor([-0.15880796  0.          0.841192  ], shape=(3), dtype=float32)


op_gelu(x, FALSE)

## tf.Tensor([-0.15865526  0.          0.8413447 ], shape=(3), dtype=float32)


x <- seq(-5, 5, .1)
plot(x, op_gelu(x),
     type = "l", #, frame.plot = FALSE,
     panel.first = grid())
```



See Also

- https://keras.io/api/ops/nn#gelu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()

op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

- op_eigh()
- op_einsum()
- op_elu()
- op_empty()
- op_equal()
- op_erf()
- op_erfinv()
- op_exp()
- op_exp2()
- op_expand_dims()
- op_expm1()
- op_extract_sequences()
- op_eye()
- op_fft()
- op_fft2()
- op_flip()
- op_floor()
- op_floor_divide()
- op_fori_loop()
- op_full()
- op_full_like()
- op_get_item()
- op_glu()
- op_greater()
- op_greater_equal()
- op_hard_shrink()
- op_hard_sigmoid()
- op_hard_silu()
- op_hard_tanh()
- op_histogram()
- op_hstack()
- op_identity()
- op_ifft2()
- op_imag()
- op_image_affine_transform()
- op_image_crop()
- op_image_extract_patches()
- op_image_gaussian_blur()
- op_image_hsv_to_rgb()
- op_image_map_coordinates()
- op_image_pad()
- op_image_perspective_transform()
- op_image_resize()
- op_image_rgb_to_grayscale()
- op_image_rgb_to_hsv()
- op_in_top_k()
- op_inner()
- op_inv()

op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_log_softmax()
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op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
op_maximum()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()

op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_get_item *Return* x[key].

Description

Return x[key].

Usage

```
op_get_item(x, key)
```

Arguments

x	A dictionary-like object
key	Generally, a string, but most object with a __hash__ method are acceptable.

Value

key.

Note

Generally, calling x[[key]] or x$key is preferable.

See Also

- https://keras.io/api/ops/numpy#getitem-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
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op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
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op_full_like()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
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op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
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op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
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op_size()
op_sort()
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op_sqrt()
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op_swapaxes()
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op_tan()
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op_tile()
op_trace()
op_transpose()
op_tri()
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op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
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Other ops:
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op_add()
op_all()
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op_append()
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op_arcsin()
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op_convert_to_tensor()
op_copy()

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---

op_glu *Gated Linear Unit (GLU) activation function.*

Description

It is defined as:

`f(x) = a * sigmoid(b)` where `x` is split into `a` and `b` along the given axis.

Usage

```
op_glu(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	The axis along which to split the input tensor. Defaults to -1.

Value

A tensor with the same shape as half of the input.

Examples

```
x <- op_array(c(-1., 0., 1. , 1.))
op_glu(x)

## tf.Tensor([-0.7310586  0.        ], shape=(2), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()

op_softmax()
op_softplus()
op_softsign()
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op_ravel()
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op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()

op_squeeze()
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op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_greater   *Return the truth value of* `x1 > x2` *element-wise.*

Description

Note that this function is automatically called when using the R operator > with a tensor.

```
(x <- op_arange(4))
```

```
## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)
```

```
op_greater(x, 2)
```

```
## tf.Tensor([False False  True  True], shape=(4), dtype=bool)
```

```
x > 2
```

```
## tf.Tensor([False False  True  True], shape=(4), dtype=bool)
```

Usage

```
op_greater(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#greater-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
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op_broadcast_to()
op_ceil()
op_clip()
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op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_greater_equal *Return the truth value of* x1 >= x2 *element-wise.*

Description

Note that this function is automatically called when using the R operator >= with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_greater_equal(x, 2)

## tf.Tensor([False  True  True  True], shape=(4), dtype=bool)


x >= 2

## tf.Tensor([False  True  True  True], shape=(4), dtype=bool)
```

Usage

```
op_greater_equal(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#greaterequal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()

op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
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op_extract_sequences()
op_eye()
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op_hard_tanh()
op_histogram()
op_hstack()
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op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_left_shift()
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op_less_equal()
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op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_minimum()
op_mod()
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op_multiply()
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op_segment_sum()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_sum()
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op_take_along_axis()
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op_tanh()
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op_tensordot()
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op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_hard_shrink *Hard Shrink activation function.*

Description

The Hard Shrink function is a thresholding operation defined as:

`f(x) = x` if `|x| > threshold`, `f(x) = 0` otherwise.

Usage

```
op_hard_shrink(x, threshold = 0.5)
```

Arguments

x	Input tensor.
threshold	Threshold value. Defaults to 0.5.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-0.5, 0., 1.))
op_hard_shrink(x)

## tf.Tensor([0. 0. 1.], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()

op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()

op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()

op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()

op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_hard_sigmoid *Hard sigmoid activation function.*

Description

It is defined as:
`0 if x < -2.5`, `1 if x > 2.5`, `(0.2 * x) + 0.5 if -2.5 <= x <= 2.5`.

Usage

```
op_hard_sigmoid(x)
```

Arguments

x	Input tensor.

Value

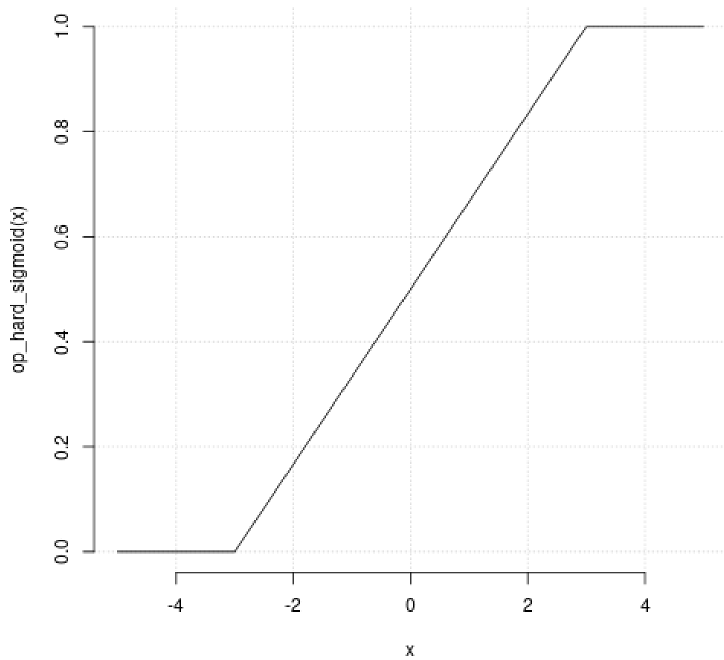
A tensor with the same shape as `x`.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_hard_sigmoid(x)

## tf.Tensor([0.33333334 0.5        0.6666667 ], shape=(3), dtype=float32)
```

```
x <- as.array(seq(-5, 5, .1))
plot(x, op_hard_sigmoid(x),
     type = 'l', panel.first = grid(), frame.plot = FALSE)
```



See Also

- https://keras.io/api/ops/nn#hardsigmoid-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_silu()

op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
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op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
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op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
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op_eigh()
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op_extract_sequences()
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op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_hard_silu *Hard SiLU activation function, also known as Hard Swish.*

Description

It is defined as:

- `0` if `if x < -3`
- x if x > 3
- x * (x + 3) / 6 if `-3 <= x <= 3`

It's a faster, piecewise linear approximation of the silu activation.

Usage

```
op_hard_silu(x)

op_hard_swish(x)
```

Arguments

x	Input tensor.

Value

A tensor with the same shape as x.

Examples

```
x <- op_convert_to_tensor(c(-3.0, -1.0, 0.0, 1.0, 3.0))
op_hard_silu(x)

## tf.Tensor([-0.         -0.33333333  0.          0.66666667  3.        ], shape=(5), dtype=float64)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:

op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()

op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()

op_hard_sigmoid()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_irfft()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()

op_lu_factor()
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op_matmul()
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op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
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op_not_equal()
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op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
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op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()

op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_slogdet()
op_soft_shrink()
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op_softplus()
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op_solve()
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op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()

op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_hard_tanh *Applies the HardTanh function element-wise.*

Description

It is defined as:
`f(x) = -1 for x < -1`, `f(x) = x for -1 <= x <= 1`, `f(x) = 1 for x > 1`.

Usage

```
op_hard_tanh(x)
```

Arguments

x Input tensor.

Value

Output tensor of same shape as `x` where values are clamped between -1 and 1.

Examples

```
x <- op_array(c(-2., -1., 0., 1., 2.))
op_hard_tanh(x)

## tf.Tensor([-1. -1.  0.  1.  1.], shape=(5), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_leaky_relu()
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op_linspace()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()

op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
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op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
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op_saturate_cast()
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op_scatter()
op_scatter_update()
op_searchsorted()
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op_segment_sum()
op_select()
op_selu()
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op_shape()
op_sigmoid()
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op_signbit()
op_silu()
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op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
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op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_histogram *Computes a histogram of the data tensor* x.

Description

Computes a histogram of the data tensor x.

Usage

```
op_histogram(x, bins = 10L, range = NULL)
```

Arguments

x	Input tensor.
bins	An integer representing the number of histogram bins. Defaults to 10.
range	A pair of numbers representing the lower and upper range of the bins. If not specified, it will use the min and max of x.

Value

A list of two tensors containing:

- A tensor representing the counts of elements in each bin.
- A tensor representing the bin edges.

Examples

```
input_tensor <- random_uniform(8)
c(counts, edges) %<-% op_histogram(input_tensor)

counts

#> tf.Tensor([2. 1. 1. 1. 0. 1. 0. 0. 0. 2.], shape=(10), dtype=float32)


edges

#> tf.Tensor(
#> [0.01647806 0.10867032 0.20086257 0.29305482 0.38524708 0.47743934
#>  0.5696316  0.66182387 0.7540161  0.84620833 0.9384006 ], shape=(11), dtype=float32)
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()

op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()

op_greater()
op_greater_equal()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
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op_logdet()
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op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
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op_mean()
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op_meshgrid()
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op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()

op_quantile()
op_ravel()
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op_reciprocal()
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op_tanh()
op_tensordot()
op_tile()
op_trace()
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op_tri()
op_tril()
op_triu()
op_trunc()
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op_vectorize()
op_vstack()
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Other ops:

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op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()

op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()

op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()

op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_negative()
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op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()

op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()

op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_hstack *Stack tensors in sequence horizontally (column wise).*

Description

This is equivalent to concatenation along the first axis for 1-D tensors, and along the second axis for all other tensors.

Usage

```
op_hstack(xs, ...)
```

Arguments

xs, ...	list of tensors.

Value

The tensor formed by stacking the given tensors.

See Also

- https://keras.io/api/ops/numpy#hstack-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_identity()
op_imag()
op_inner()
op_isclose()
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op_isnan()
op_left_shift()
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op_less_equal()
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op_logical_xor()
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op_matmul()
op_max()
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op_median()
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op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_power()
op_prod()
op_quantile()
op_ravel()
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op_reciprocal()
op_repeat()
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op_right_shift()
op_roll()
op_rot90()
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op_select()
op_sign()
op_signbit()
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op_sinh()
op_size()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
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op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
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op_tril()
op_triu()
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Other ops:
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op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
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op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
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op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
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op_mod()
op_moments()
op_moveaxis()
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op_multiply()
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op_not_equal()
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op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
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op_saturate_cast()
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op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
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op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_identity *Return the identity tensor.*

Description

The identity tensor is a square tensor with ones on the main diagonal and zeros elsewhere.

Usage

```
op_identity(n, dtype = NULL)
```

Arguments

n	Number of rows (and columns) in the `n x n` output tensor.
dtype	Data type of the output tensor.

Value

The identity tensor.

See Also

- https://keras.io/api/ops/numpy#identity-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()

op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()

op_signbit()
op_sin()
op_sinh()
op_size()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
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op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
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op_tril()
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op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ifft2 *Computes the 2D Inverse Fast Fourier Transform along the last two axes of*

Description

input.

Usage

```
op_ifft2(x)
```

Arguments

x	Tuple of the real and imaginary parts of the input tensor. Both tensors in the tuple should be of floating type.

Value

A tuple containing two tensors - the real and imaginary parts of the output.

Examples

```
x <- list(op_array(rbind(c(1, 2), c(2, 1))),
          op_array(rbind(c(0, 1), c(1, 0))))
op_ifft2(x)

## [[1]]
## tf.Tensor(
## [[ 1.5  0. ]
##  [ 0.  -0.5]], shape=(2, 2), dtype=float64)
##
## [[2]]
```

```
## tf.Tensor(
## [[ 0.5 -0. ]
##  [-0.  -0.5]], shape=(2, 2), dtype=float64)
```

See Also

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()

op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()

op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_imag *Return the imaginary part of the complex argument.*

Description

Return the imaginary part of the complex argument.

Usage

```
op_imag(x)
```

Arguments

x	Input tensor.

Value

The imaginary component of the complex argument.

See Also

- https://keras.io/api/ops/numpy#imag-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()

op_hstack()
op_identity()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
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op_mean()
op_median()
op_meshgrid()
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op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
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op_negative()
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op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()

op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
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op_squeeze()
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op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_xor()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
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op_empty()
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op_erfinv()
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op_expand_dims()
op_expm1()
op_extract_sequences()
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op_fft2()
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op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()

op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_linspace()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()

op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_relu6()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_affine_transform
Applies the given transform(s) to the image(s).

Description

Applies the given transform(s) to the image(s).

Usage

```
op_image_affine_transform(
  images,
  transform,
  interpolation = "bilinear",
  fill_mode = "constant",
  fill_value = 0L,
  data_format = NULL
)
```

Arguments

images	Input image or batch of images. Must be 3D or 4D.

transform
: Projective transform matrix/matrices. A vector of length 8 or tensor of size N x 8. If one row of transform is `[a0, a1, a2, b0, b1, b2, c0, c1]`, then it maps the output point `(x, y)` to a transformed input point `(x', y') = ((a0 x + a1 y + a2) / k, (b0 x + b1 y` where `k = c0 x + c1 y + 1`. The transform is inverted compared to the transform mapping input points to output points. Note that gradients are not backpropagated into transformation parameters. Note that `c0` and `c1` are only effective when using TensorFlow backend and will be considered as `0` when using other backends.

interpolation
: Interpolation method. Available methods are `"nearest"`, and `"bilinear"`. Defaults to `"bilinear"`.

fill_mode
: Points outside the boundaries of the input are filled according to the given mode. Available methods are `"constant"`, `"nearest"`, `"wrap"` and `"reflect"`. Defaults to `"constant"`.

  - `"reflect"`: `(d c b a | a b c d | d c b a)` The input is extended by reflecting about the edge of the last pixel.
  - `"constant"`: `(k k k k | a b c d | k k k k)` The input is extended by filling all values beyond the edge with the same constant value k specified by `fill_value`.
  - `"wrap"`: `(a b c d | a b c d | a b c d)` The input is extended by wrapping around to the opposite edge.
  - `"nearest"`: `(a a a a | a b c d | d d d d)` The input is extended by the nearest pixel.

fill_value
: Value used for points outside the boundaries of the input if `fill_mode = "constant"`. Defaults to `0`.

data_format
: A string specifying the data format of the input tensor. It can be either `"channels_last"` or `"channels_first"`. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)`, while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`.

  If not specified, the value will default to `config_image_data_format()`.

Value

Applied affine transform image or batch of images.

Examples

```
x <- random_uniform(c(2, 64, 80, 3)) # batch of 2 RGB images
transform <- op_array(rbind(c(1.5, 0, -20, 0, 1.5, -16, 0, 0),  # zoom
                            c(1, 0, -20, 0, 1, -16, 0, 0)))  # translation))
y <- op_image_affine_transform(x, transform)
shape(y)

## shape(2, 64, 80, 3)


# (2, 64, 80, 3)
```

```
x <- random_uniform(c(64, 80, 3)) # single RGB image
transform <- op_array(c(1.0, 0.5, -20, 0.5, 1.0, -16, 0, 0))  # shear
y <- op_image_affine_transform(x, transform)
shape(y)

## shape(64, 80, 3)


# (64, 80, 3)

x <- random_uniform(c(2, 3, 64, 80)) # batch of 2 RGB images
transform <- op_array(rbind(
  c(1.5, 0,-20, 0, 1.5,-16, 0, 0),  # zoom
  c(1, 0,-20, 0, 1,-16, 0, 0)  # translation
))
y <- op_image_affine_transform(x, transform, data_format = "channels_first")
shape(y)

## shape(2, 3, 64, 80)


# (2, 3, 64, 80)
```

See Also

- https://keras.io/api/ops/image#affinetransform-function

Other image ops:
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()

op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_crop()
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op_image_gaussian_blur()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()

op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
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op_max_pool()
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op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()

op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_segment_sum()
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op_separable_conv()
op_shape()
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op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
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op_stop_gradient()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_crop *Crop* images *to a specified* height *and* width.

Description

Crop images to a specified height and width.

Usage

```
op_image_crop(
  images,
  top_cropping = NULL,
```

```
  left_cropping = NULL,
  bottom_cropping = NULL,
  right_cropping = NULL,
  target_height = NULL,
  target_width = NULL,
  data_format = NULL
)
```

Arguments

`images`	Input image or batch of images. Must be 3D or 4D.
`top_cropping`	Number of columns to crop from the top.
`left_cropping`	Number of columns to crop from the left.
`bottom_cropping`	Number of columns to crop from the bottom.
`right_cropping`	Number of columns to crop from the right.
`target_height`	Height of the output images.
`target_width`	Width of the output images.
`data_format`	A string specifying the data format of the input tensor. It can be either `"channels_last"` or `"channels_first"`. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)`, while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. If not specified, the value will default to `config_image_data_format()`.

Value

Cropped image or batch of images.

Examples

```
images <- op_reshape(op_arange(1, 28, dtype="float32"), c(3, 3, 3))
images[, , 1] # print the first channel of the images

cropped_images <- op_image_crop(images, 0, 0, 2, 2)
cropped_images[, , 1] # print the first channel of the cropped images
```

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/ops/image/crop_images

Other image ops:
`op_image_affine_transform()`
`op_image_extract_patches()`
`op_image_gaussian_blur()`
`op_image_hsv_to_rgb()`
`op_image_map_coordinates()`
`op_image_pad()`
`op_image_perspective_transform()`

op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()

op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
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op_cond()
op_conj()
op_conv()
op_conv_transpose()
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op_cos()
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op_cross()
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op_cumsum()
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op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
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op_erf()
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op_exp()
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op_extract_sequences()
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op_floor_divide()
op_fori_loop()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_image_extract_patches
Extracts patches from the image(s).

Description

Extracts patches from the image(s).

Usage

```
op_image_extract_patches(
  images,
  size,
  strides = NULL,
  dilation_rate = 1L,
  padding = "valid",
  data_format = "channels_last"
)
```

Arguments

`images`	Input image or batch of images. Must be 3D or 4D.
`size`	Patch size int or list (patch_height, patch_width)
`strides`	strides along height and width. If not specified, or if `NULL`, it defaults to the same value as `size`.
`dilation_rate`	This is the input stride, specifying how far two consecutive patch samples are in the input. For value other than 1, strides must be 1. NOTE: `strides` > 1 is not supported in conjunction with `dilation_rate` > 1
`padding`	The type of padding algorithm to use: `"same"` or `"valid"`.
`data_format`	A string specifying the data format of the input tensor. It can be either `"channels_last"` or `"channels_first"`. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)`, while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. If not specified, the value will default to `config_image_data_format()`.

Value

Extracted patches 3D (if not batched) or 4D (if batched)

Examples

```
image <- random_uniform(c(2, 20, 20, 3), dtype = "float32") # batch of 2 RGB images
patches <- op_image_extract_patches(image, c(5, 5))
shape(patches)
```

```
## shape(2, 4, 4, 75)


# (2, 4, 4, 75)
image <- random_uniform(c(20, 20, 3), dtype = "float32") # 1 RGB image
patches <- op_image_extract_patches(image, c(3, 3), c(1, 1))
shape(patches)

## shape(18, 18, 27)


# (18, 18, 27)
```

See Also

- https://keras.io/api/ops/image#extractpatches-function

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_less_equal()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()

op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
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op_saturate_cast()

op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_gaussian_blur
Applies a Gaussian blur to the image(s).

Description

Applies a Gaussian blur to the image(s).

Usage

```
op_image_gaussian_blur(
  images,
  kernel_size = list(3L, 3L),
  sigma = list(1, 1),
  data_format = NULL
)
```

Arguments

images	Input image or batch of images. Must be 3D or 4D.
kernel_size	A tuple of two integers, specifying the height and width of the Gaussian kernel.

sigma
: A tuple of two floats, specifying the standard deviation of the Gaussian kernel along height and width.

data_format
: A string specifying the data format of the input tensor. It can be either "channels_last" or "channels_first". "channels_last" corresponds to inputs with shape (batch, height, width, channels), while "channels_first" corresponds to inputs with shape (batch, channels, height, width). If not specified, the value will default to keras.config.image_data_format.

Value

Blurred image or batch of images.

Examples

```
x <- op_ones(c(2, 64, 80, 3))  # batch of 2 RGB images
y <- op_image_gaussian_blur(x)
op_shape(y)

## shape(2, 64, 80, 3)


x <- op_ones(c(64, 80, 3))  # single RGB image
y <- op_image_gaussian_blur(x)
op_shape(y)

## shape(64, 80, 3)


x <- op_ones(c(2, 3, 64, 80))  # batch of 2 RGB images, channels_first
y <- op_image_gaussian_blur(x, data_format = "channels_first")
op_shape(y)

## shape(2, 3, 64, 80)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
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op_arctan()
op_arctan2()
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op_cos()
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op_cross()
op_ctc_decode()
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op_divide_no_nan()
op_dot()
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op_expand_dims()
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op_greater()
op_greater_equal()
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op_hstack()
op_identity()
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op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_is_tensor()
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op_left_shift()

op_less()
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op_log_softmax()
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op_reciprocal()
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op_separable_conv()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
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op_split()
op_sqrt()
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op_squareplus()
op_squeeze()
op_stack()
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op_svd()
op_swapaxes()
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op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
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op_top_k()
op_trace()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_hsv_to_rgb   *Convert HSV images to RGB.*

Description

images must be of float dtype, and the output is only well defined if the values in images are in [0, 1].

Usage

```
op_image_hsv_to_rgb(images, data_format = NULL)
```

Arguments

images	Input image or batch of images. Must be 3D or 4D.
data_format	A string specifying the data format of the input tensor. It can be either "channels_last" or "channels_first". "channels_last" corresponds to inputs with shape (batch, height, width, channels), while "channels_first" corresponds to inputs with shape (batch, channels, height, width). If not specified, the value will default to config_image_data_format().

Value

RGB image or batch of RGB images.

Examples

```
x <- random_uniform(c(2, 4, 4, 3))
y <- op_image_hsv_to_rgb(x)
shape(y)


## shape(2, 4, 4, 3)



x <- random_uniform(c(4, 4, 3)) # Single HSV image
y <- op_image_hsv_to_rgb(x)
shape(y)


## shape(4, 4, 3)



x <- random_uniform(c(2, 3, 4, 4))
y <- op_image_hsv_to_rgb(x, data_format="channels_first")
shape(y)


## shape(2, 3, 4, 4)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_einsum()
op_elu()
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op_image_resize()

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op_image_rgb_to_hsv()
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op_sparse_categorical_crossentropy()
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op_swapaxes()
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op_take_along_axis()
op_tan()
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op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
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op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_map_coordinates

Map the input array to new coordinates by interpolation.

Description

Note that interpolation near boundaries differs from the scipy function, because we fixed an outstanding bug scipy/issues/2640.

Usage

```
op_image_map_coordinates(
  inputs,
  coordinates,
  order,
  fill_mode = "constant",
  fill_value = 0L
)
```

Arguments

inputs	The input array.
coordinates	The coordinates at which inputs is evaluated.
order	The order of the spline interpolation. The order must be 0 or 1. 0 indicates the nearest neighbor and 1 indicates the linear interpolation.
fill_mode	Points outside the boundaries of the inputs are filled according to the given mode. Available methods are "constant", "nearest", "wrap" and "mirror" and "reflect". Defaults to "constant". • "constant": (k k k k | a b c d | k k k k) inputs is extended by filling all values beyond the edge with the same constant value k specified by fill_value. • "nearest": (a a a a | a b c d | d d d d) inputs is extended by the nearest pixel. • "wrap": (a b c d | a b c d | a b c d) inputs is extended by wrapping around to the opposite edge.

- `"mirror"`: `(c d c b | a b c d | c b a b)` inputs is extended by mirroring about the edge.
- `"reflect"`: `(d c b a | a b c d | d c b a)` inputs is extended by reflecting about the edge of the last pixel.

`fill_value` Value used for points outside the boundaries of the inputs if `fill_mode = "constant"`. Defaults to `0`.

Value

Output input or batch of inputs.

See Also

Other image ops:
`op_image_affine_transform()`
`op_image_crop()`
`op_image_extract_patches()`
`op_image_gaussian_blur()`
`op_image_hsv_to_rgb()`
`op_image_pad()`
`op_image_perspective_transform()`
`op_image_resize()`
`op_image_rgb_to_grayscale()`
`op_image_rgb_to_hsv()`

Other image utils:
`image_array_save()`
`image_from_array()`
`image_load()`
`image_smart_resize()`
`image_to_array()`
`op_image_affine_transform()`
`op_image_crop()`
`op_image_extract_patches()`
`op_image_gaussian_blur()`
`op_image_hsv_to_rgb()`
`op_image_pad()`
`op_image_perspective_transform()`
`op_image_resize()`
`op_image_rgb_to_grayscale()`
`op_image_rgb_to_hsv()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_categorical_crossentropy()
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op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()

op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()

op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
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op_image_perspective_transform()
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op_in_top_k()
op_inner()
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op_is_tensor()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
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op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
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op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_pad *Pad* images *with zeros to the specified* height *and* width.

Description

Pad images with zeros to the specified height and width.

Usage

```
op_image_pad(
  images,
  top_padding = NULL,
  left_padding = NULL,
  bottom_padding = NULL,
  right_padding = NULL,
  target_height = NULL,
  target_width = NULL,
  data_format = NULL
)
```

Arguments

images	Input image or batch of images. Must be 3D or 4D.
top_padding	Number of rows of zeros to add on top.
left_padding	Number of columns of zeros to add on the left.

bottom_padding	Number of rows of zeros to add at the bottom.
right_padding	Number of columns of zeros to add on the right.
target_height	Height of output images.
target_width	Width of output images.
data_format	A string specifying the data format of the input tensor. It can be either "channels_last" or "channels_first". "channels_last" corresponds to inputs with shape (batch, height, width, channels), while "channels_first" corresponds to inputs with shape (batch, channels, height, width). If not specified, the value will default to config_image_data_format().

Value

Padded image or batch of images.

Examples

```
images <- random_uniform(c(15, 25, 3))
padded_images <- op_image_pad(
    images, 2, 3, target_height = 20, target_width = 30
)
shape(padded_images)

## shape(20, 30, 3)


batch_images <- random_uniform(c(2, 15, 25, 3))
padded_batch <- op_image_pad(batch_images, 2, 3,
                             target_height = 20,
                             target_width = 30)
shape(padded_batch)

## shape(2, 20, 30, 3)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
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op_image_extract_patches()
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op_image_resize()
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op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
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op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_not()
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op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
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op_log()
op_log10()
op_log1p()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
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op_logspace()
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op_moments()
op_moveaxis()
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op_multiply()
op_nan_to_num()
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op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
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op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
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op_squareplus()
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op_take_along_axis()
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op_tanh_shrink()
op_tensordot()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_image_perspective_transform
Applies a perspective transformation to the image(s).

Description

Applies a perspective transformation to the image(s).

Usage

```
op_image_perspective_transform(
  images,
  start_points,
  end_points,
  interpolation = "bilinear",
  fill_value = 0L,
  data_format = NULL
)
```

Arguments

`images`	Input image or batch of images. Must be 3D or 4D.
`start_points`	A tensor of shape `(N, 4, 2)` or `(4, 2)`, representing the source points in the original image that define the transformation.
`end_points`	A tensor of shape `(N, 4, 2)` or `(4, 2)`, representing the target points in the output image after transformation.
`interpolation`	Interpolation method. Available methods are `"nearest"`, and `"bilinear"`. Defaults to `"bilinear"`.
`fill_value`	Value used for points outside the boundaries of the input if extrapolation is needed. Defaults to `0`.
`data_format`	A string specifying the data format of the input tensor. It can be either `"channels_last"` or `"channels_first"`. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)`, while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. If not specified, the value will default to `keras.config.image_data_format`.

Value

Applied perspective transform image or batch of images.

Examples

```
# Batch of 2 RGB images (channels_last)
x <- op_ones(c(2, 64, 80, 3))
start_points <- op_stack(list(
  rbind(c(0, 0), c(0, 64), c(80, 0), c(80, 64)),
  rbind(c(0, 0), c(0, 64), c(80, 0), c(80, 64))
```

```
))
end_points <- op_stack(list(
  rbind(c(3, 5), c(7, 64), c(76, -10), c(84, 61)),
  rbind(c(8, 10), c(10, 61), c(65, 3), c(88, 43))
))
y <- op_image_perspective_transform(x, start_points, end_points)
op_shape(y)

## shape(2, 64, 80, 3)


# Single RGB image (channels_last)
x <- op_ones(c(64, 80, 3))
start_points <- rbind(c(0, 0), c(0, 64), c(80, 0), c(80, 64))
end_points <- rbind(c(3, 5), c(7, 64), c(76, -10), c(84, 61))
y <- op_image_perspective_transform(x, start_points, end_points)
op_shape(y)

## shape(64, 80, 3)


# Batch of 2 RGB images (channels_first)
x <- op_ones(c(2, 3, 64, 80))
start_points <- op_stack(list(
  rbind(c(0, 0), c(0, 64), c(80, 0), c(80, 64)),
  rbind(c(0, 0), c(0, 64), c(80, 0), c(80, 64))
))
end_points <- op_stack(list(
  rbind(c(3, 5), c(7, 64), c(76, -10), c(84, 61)),
  rbind(c(8, 10), c(10, 61), c(65, 3), c(88, 43))
))
y <- op_image_perspective_transform(
  x, start_points, end_points,
  data_format = "channels_first"
)
op_shape(y)

## shape(2, 3, 64, 80)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()

op_image_map_coordinates()
op_image_pad()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()

op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()

op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_imag()
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op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_real()
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op_select()
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op_separable_conv()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()

op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
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op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
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op_tanh_shrink()
op_tensordot()
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op_trace()
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op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()

op_zeros_like()

---

op_image_resize *Resize images to size using the specified interpolation method.*

Description

Resize images to size using the specified interpolation method.

Usage

```
op_image_resize(
  images,
  size,
  interpolation = "bilinear",
  antialias = FALSE,
  crop_to_aspect_ratio = FALSE,
  pad_to_aspect_ratio = FALSE,
  fill_mode = "constant",
  fill_value = 0,
  data_format = NULL
)
```

Arguments

- `images` Input image or batch of images. Must be 3D or 4D.
- `size` Size of output image in `(height, width)` format.
- `interpolation` Interpolation method. Available methods are `"nearest"`, `"bilinear"`, and `"bicubic"`. Defaults to `"bilinear"`.
- `antialias` Whether to use an antialiasing filter when downsampling an image. Defaults to `FALSE`.
- `crop_to_aspect_ratio` If `TRUE`, resize the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be cropped so as to return the largest possible window in the image (of size `(height, width)`) that matches the target aspect ratio. By default (`crop_to_aspect_ratio=FALSE`), aspect ratio may not be preserved.
- `pad_to_aspect_ratio` If `TRUE`, pad the images without aspect ratio distortion. When the original aspect ratio differs from the target aspect ratio, the output image will be evenly padded on the short side.
- `fill_mode` When using `pad_to_aspect_ratio=TRUE`, padded areas are filled according to the given mode. Only `"constant"` is supported at this time (fill with constant value, equal to `fill_value`).

fill_value
: Float. Padding value to use when pad_to_aspect_ratio=TRUE.

data_format
: A string specifying the data format of the input tensor. It can be either "channels_last" or "channels_first". "channels_last" corresponds to inputs with shape (batch, height, width, channels), while "channels_first" corresponds to inputs with shape (batch, channels, height, width). If not specified, the value will default to config_image_data_format().

Value

Resized image or batch of images.

Examples

```
x <- random_uniform(c(2, 4, 4, 3)) # batch of 2 RGB images
y <- op_image_resize(x, c(2, 2))
shape(y)

## shape(2, 2, 2, 3)


x <- random_uniform(c(4, 4, 3)) # single RGB image
y <- op_image_resize(x, c(2, 2))
shape(y)

## shape(2, 2, 3)


x <- random_uniform(c(2, 3, 4, 4)) # batch of 2 RGB images
y <- op_image_resize(x, c(2, 2), data_format = "channels_first")
shape(y)

## shape(2, 3, 2, 2)
```

See Also

- https://keras.io/api/ops/image#resize-function

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()

op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()

op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()

op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
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op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
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op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()

op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()

op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_image_rgb_to_grayscale
Convert RGB images to grayscale.

Description

This function converts RGB images to grayscale images. It supports both 3D and 4D tensors, where the last dimension represents channels.

Usage

```
op_image_rgb_to_grayscale(images, data_format = NULL)
```

Arguments

`images`	Input image or batch of images. Must be 3D or 4D.
`data_format`	A string specifying the data format of the input tensor. It can be either `"channels_last"` or `"channels_first"`. `"channels_last"` corresponds to inputs with shape `(batch, height, width, channels)`, while `"channels_first"` corresponds to inputs with shape `(batch, channels, height, width)`. If not specified, the value will default to `config_image_data_format()`.

Value

Grayscale image or batch of grayscale images.

Examples

```
x <- random_uniform(c(2, 4, 4, 3))
y <- op_image_rgb_to_grayscale(x)
shape(y)

## shape(2, 4, 4, 1)


x <- random_uniform(c(4, 4, 3)) # Single RGB image
y = op_image_rgb_to_grayscale(x)
shape(y)

## shape(4, 4, 1)


x <- random_uniform(c(2, 3, 4, 4))
y <- op_image_rgb_to_grayscale(x, data_format="channels_first")
shape(y)

## shape(2, 1, 4, 4)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_hsv()

Other image utils:
image_array_save()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_hsv()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()

op_image_resize()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
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op_outer()
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op_polar()
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op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
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op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_image_rgb_to_hsv *Convert RGB images to HSV.*

Description

images must be of float dtype, and the output is only well defined if the values in images are in [0, 1].

All HSV values are in [0, 1]. A hue of 0 corresponds to pure red, 1/3 is pure green, and 2/3 is pure blue.

Usage

```
op_image_rgb_to_hsv(images, data_format = NULL)
```

Arguments

images	Input image or batch of images. Must be 3D or 4D.
data_format	A string specifying the data format of the input tensor. It can be either "channels_last" or "channels_first". "channels_last" corresponds to inputs with shape (batch, height, width, channels), while "channels_first" corresponds to inputs with shape (batch, channels, height, width). If not specified, the value will default to config_image_data_format().

Value

HSV image or batch of HSV images.

Examples

```
x <- random_uniform(c(2, 4, 4, 3))
y <- op_image_rgb_to_hsv(x)
shape(y)

## shape(2, 4, 4, 3)
```

```
x <- random_uniform(c(4, 4, 3)) # Single RGB image
y <- op_image_rgb_to_hsv(x)
shape(y)

## shape(4, 4, 3)


x <- random_uniform(c(2, 3, 4, 4))
y <- op_image_rgb_to_hsv(x, data_format = "channels_first")
shape(y)

## shape(2, 3, 4, 4)
```

See Also

Other image ops:
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

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Other ops:
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op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
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op_bitwise_xor()
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op_floor_divide()
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op_full_like()
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op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
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op_identity()
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op_log_softmax()
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op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_inner *Return the inner product of two tensors.*

Description

Ordinary inner product of vectors for 1-D tensors (without complex conjugation), in higher dimensions a sum product over the last axes.

Multidimensional arrays are treated as vectors by flattening all but their last axes. The resulting dot product is performed over their last axes.

Usage

```
op_inner(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor. The last dimension of x1 and x2 must match.

Value

Output tensor. The shape of the output is determined by broadcasting the shapes of x1 and x2 after removing their last axes.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()

op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
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Other ops:
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op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_or()
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op_bitwise_xor()

op_broadcast_to()
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op_celu()
op_cholesky()
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op_get_item()
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op_hard_silu()
op_hard_tanh()
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op_ifft2()
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op_log_softmax()
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op_multi_hot()
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op_ndim()
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op_segment_sum()
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op_soft_shrink()
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op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()

op_sparsemax()
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op_stft()
op_stop_gradient()
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op_svd()
op_swapaxes()
op_switch()
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op_take_along_axis()
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op_tanh()
op_tanh_shrink()
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op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_inv *Computes the inverse of a square tensor.*

Description

Computes the inverse of a square tensor.

Usage

```
op_inv(x)
```

Arguments

x	Input tensor of shape `(..., M, M)`.

Value

A tensor of shape `(..., M, M)` representing the inverse of `x`.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_eigh()
op_lstsq()
op_lu_factor()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()

op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()

op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_in_top_k *Checks if the targets are in the top-k predictions.*

Description

Checks if the targets are in the top-k predictions.

Usage

```
op_in_top_k(targets, predictions, k)
```

Arguments

targets	A tensor of true labels.
predictions	A tensor of predicted labels.
k	An integer representing the number of predictions to consider.

Value

A boolean tensor of the same shape as `targets`, where each element indicates whether the corresponding target is in the top-k predictions.

Examples

```
targets <- op_array(c(2, 5, 3), "int32")
predictions <- op_array(dtype = "float32", rbind(
  c(0.1, 0.4, 0.6, 0.9, 0.5),
  c(0.1, 0.7, 0.9, 0.8, 0.3),
  c(0.1, 0.6, 0.9, 0.9, 0.5)
))
op_in_top_k(targets, predictions, k = 3L)

## tf.Tensor([ True False  True], shape=(3), dtype=bool)
```

See Also

- https://keras.io/api/ops/core#intopk-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
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op_argpartition()
op_argsort()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
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op_bitwise_not()
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op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
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op_conj()
op_conv()
op_conv_transpose()
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op_convert_to_tensor()
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op_cumsum()
op_custom_gradient()
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op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_hard_silu()
op_hard_tanh()
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op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
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op_image_rgb_to_hsv()
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op_isnan()
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op_sparse_plus()
op_sparsemax()
op_split()
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op_square()
op_squareplus()
op_squeeze()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
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op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_irfft` *Inverse real-valued Fast Fourier transform along the last axis.*

Description

Computes the inverse 1D Discrete Fourier Transform of a real-valued signal over the inner-most dimension of input.

The inner-most dimension of the input is assumed to be the result of RFFT: the `fft_length / 2 + 1` unique components of the DFT of a real-valued signal. If `fft_length` is not provided, it is computed from the size of the inner-most dimension of the input (`fft_length = 2 * (inner - 1)`). If the FFT length used to compute is odd, it should be provided since it cannot be inferred properly.

Along the axis IRFFT is computed on, if `fft_length / 2 + 1` is smaller than the corresponding dimension of the input, the dimension is cropped. If it is larger, the dimension is padded with zeros.

Usage

```
op_irfft(x, fft_length = NULL)
```

Arguments

`x`	List of the real and imaginary parts of the input tensor. Both tensors in the list should be of floating type.
`fft_length`	An integer representing the number of the fft length. If not specified, it is inferred from the length of the last axis of `x`. Defaults to `NULL`.

Value

A tensor containing the inverse real-valued Fast Fourier Transform along the last axis of `x`.

Examples

```
real <- op_array(c(0, 1, 2, 3, 4))
imag <- op_array(c(0, 1, 2, 3, 4))
op_irfft(c(real, imag))

#> tf.Tensor(
#> [ 2.         -2.0606601   0.5        -0.35355338  0.          0.06066012
#>  -0.5         0.35355338], shape=(8), dtype=float32)


all.equal(op_irfft(op_rfft(real, 5), 5), real)

#> [1] TRUE
```

See Also

- https://keras.io/api/ops/fft#irfft-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_is_tensor()
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op_isfinite()

op_isinf()
op_isnan()
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op_leaky_relu()
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op_less_equal()
op_linspace()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
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op_lu_factor()
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op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
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op_reciprocal()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
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op_saturate_cast()
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op_select()
op_selu()
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op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_isclose *Return whether two tensors are element-wise almost equal.*

Description

Return whether two tensors are element-wise almost equal.

Usage

```
op_isclose(x1, x2, rtol = 1e-05, atol = 1e-08, equal_nan = FALSE)
```

Arguments

x1	First input tensor.
x2	Second input tensor.
rtol	Relative tolerance.
atol	Absolute tolerance.
equal_nan	If TRUE, element-wise NaNs are considered equal.

Value

Output boolean tensor.

See Also

- https://keras.io/api/ops/numpy#isclose-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
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op_less_equal()
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op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()

op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()

op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()

op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_isfinite *Return whether a tensor is finite, element-wise.*

Description

Real values are finite when they are not NaN, not positive infinity, and not negative infinity. Complex values are finite when both their real and imaginary parts are finite.

Usage

```
op_isfinite(x)
```

Arguments

x	Input tensor.

Value

Output boolean tensor.

See Also

- https://keras.io/api/ops/numpy#isfinite-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_isinf *Test element-wise for positive or negative infinity.*

Description

Test element-wise for positive or negative infinity.

Usage

```
op_isinf(x)
```

Arguments

x	Input tensor.

Value

Output boolean tensor.

See Also

- https://keras.io/api/ops/numpy#isinf-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()

op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()

op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()

op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()

op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()

op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()

op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()

op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_isnan *Test element-wise for NaN and return result as a boolean tensor.*

Description

Test element-wise for NaN and return result as a boolean tensor.

Usage

```
op_isnan(x)
```

Arguments

x	Input tensor.

Value

Output boolean tensor.

See Also

- https://keras.io/api/ops/numpy#isnan-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()

op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
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op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
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op_exp()
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op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()

op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()

op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
op_maximum()
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op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
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op_right_shift()

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op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_istft *Inverse Short-Time Fourier Transform along the last axis of the input.*

Description

To reconstruct an original waveform, the parameters should be the same in `stft`.

Usage

```
op_istft(
  x,
  sequence_length,
  sequence_stride,
  fft_length,
  length = NULL,
  window = "hann",
```

```
  center = TRUE
)
```

Arguments

x
: Tuple of the real and imaginary parts of the input tensor. Both tensors in the list should be of floating type.

sequence_length
: An integer representing the sequence length.

sequence_stride
: An integer representing the sequence hop size.

fft_length
: An integer representing the size of the FFT that produced stft. Should be of type int32.

length
: An integer representing the output is clipped to exactly length. If not specified, no padding or clipping take place. Defaults to NULL.

window
: A string, a tensor of the window or NULL. If window is a string, available values are "hann" and "hamming". If window is a tensor, it will be used directly as the window and its length must be sequence_length. If window is NULL, no windowing is used. Defaults to "hann".

center
: Whether x was padded on both sides so that the t-th sequence is centered at time t * sequence_stride. Defaults to TRUE.

Value

A tensor containing the inverse Short-Time Fourier Transform along the last axis of x.

Examples

```
x <- op_convert_to_tensor(c(0, 1, 2, 3, 4))
op_istft(op_stft(x, 1, 1, 1), 1, 1, 1)

## tf.Tensor([], shape=(0), dtype=float64)


# array([0.0, 1.0, 2.0, 3.0, 4.0])
```

See Also

- https://keras.io/api/ops/fft#istft-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()

op_irfft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()

op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()

op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()

op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()

op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_is_tensor *Check whether the given object is a tensor.*

Description

Check whether the given object is a tensor.

Usage

```
op_is_tensor(x)
```

Arguments

x	A variable.

Value

TRUE if x is a tensor, otherwise FALSE.

Note

This checks for backend specific tensors so passing a TensorFlow tensor would return FALSE if your backend is PyTorch or JAX.

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()

op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
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op_log_softmax()
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op_lstsq()
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op_map()
op_matmul()
op_max()

op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()

op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()

op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_leaky_relu *Leaky version of a Rectified Linear Unit activation function.*

Description

It allows a small gradient when the unit is not active, it is defined as:
`f(x) = alpha * x for x < 0` or `f(x) = x for x >= 0`.

Usage

```
op_leaky_relu(x, negative_slope = 0.2)
```

Arguments

x	Input tensor.
negative_slope	Slope of the activation function at x < 0. Defaults to `0.2`.

Value

A tensor with the same shape as `x`.

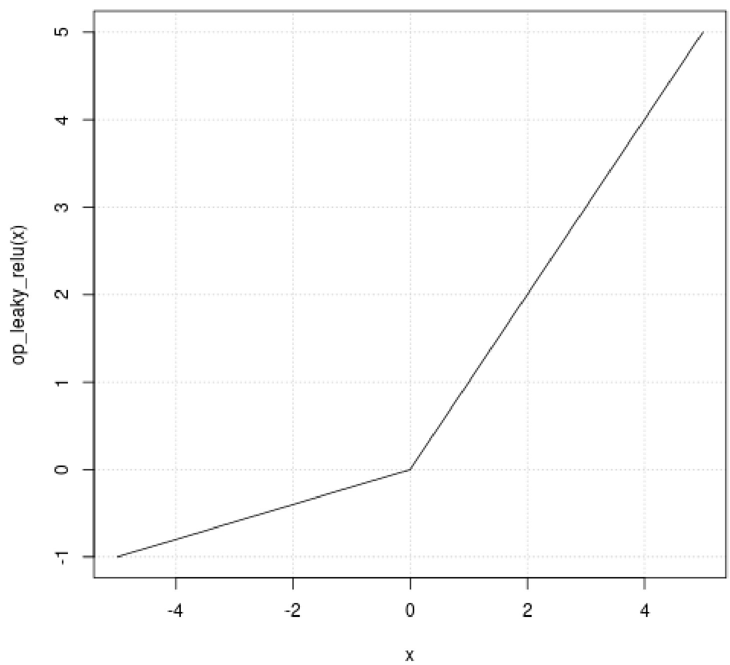
Examples

```
x <- op_array(c(-1., 0., 1.))
op_leaky_relu(x)

## tf.Tensor([-0.2  0.   1. ], shape=(3), dtype=float32)


# array([-0.2,  0. ,  1. ], shape=(3,), dtype=float64)

x <- seq(-5, 5, .1)
plot(x, op_leaky_relu(x),
     type = 'l', panel.first = grid())
```



See Also

- https://keras.io/api/ops/nn#leakyrelu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()

op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()

op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()

op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_ravel()
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op_segment_sum()
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op_selu()
op_separable_conv()
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op_signbit()
op_silu()
op_sin()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()

op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_left_shift *Shift the bits of an integer to the left.*

Description

Bits are shifted to the left by appending `y` 0s at the right of `x`. Since the internal representation of numbers is in binary format, this operation is equivalent to multiplying `x` by `2^y`.

Usage

```
op_left_shift(x, y)
```

Arguments

x	Input integer tensor.
y	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()

op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()

op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()

op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()

op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()

op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()

op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_less   *Return the truth value of* `x1 < x2` *element-wise.*

Description

Note that this function is automatically called when using the R operator < with a tensor.

```
(x <- op_arange(4))
```

```
## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)
```

```
op_less(x, 2)
```

```
## tf.Tensor([ True False False False], shape=(4), dtype=bool)
```

```
x < 2
```

```
## tf.Tensor([ True False False False], shape=(4), dtype=bool)
```

Usage

```
op_less(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#less-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor()
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op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()

op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
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op_mod()
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op_multiply()
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op_ndim()
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op_signbit()
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op_swapaxes()
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op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_arctan2()
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op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()

op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()

op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
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op_max()
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op_mean()
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op_meshgrid()
op_min()
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op_multi_hot()
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op_roll()
op_rot90()
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op_rsqrt()
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op_scan()

- op_scatter()
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- op_softmax()
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- op_sort()
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op_threshold()
op_tile()
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op_trace()
op_transpose()
op_tri()
op_tril()
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op_unstack()
op_var()
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op_zeros()
op_zeros_like()

---

op_less_equal *Return the truth value of* x1 <= x2 *element-wise.*

Description

Note that this function is automatically called when using the R operator <= with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_less_equal(x, 2)

## tf.Tensor([ True  True False False], shape=(4), dtype=bool)


x <= 2

## tf.Tensor([ True  True False False], shape=(4), dtype=bool)
```

Usage

```
op_less_equal(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#lessequal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
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op_ceil()
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op_conj()

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op_cos()
op_cosh()
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op_cross()
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op_cumprod()
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op_image_rgb_to_grayscale()
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op_in_top_k()
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op_log_softmax()
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op_moveaxis()
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op_multiply()
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op_size()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
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op_squareplus()
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op_tanh_shrink()
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op_trace()
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op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
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op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_linspace *Return evenly spaced numbers over a specified interval.*

Description

Returns num evenly spaced samples, calculated over the interval [start, stop].

The endpoint of the interval can optionally be excluded.

Usage

```
op_linspace(
  start,
  stop,
  num = 50L,
  endpoint = TRUE,
  retstep = FALSE,
  dtype = NULL,
  axis = 1L
)
```

Arguments

start	The starting value of the sequence.
stop	The end value of the sequence, unless endpoint is set to FALSE. In that case, the sequence consists of all but the last of num + 1 evenly spaced samples, so that stop is excluded. Note that the step size changes when endpoint is FALSE.
num	Number of samples to generate. Defaults to 50. Must be non-negative.
endpoint	If TRUE, stop is the last sample. Otherwise, it is not included. Defaults to TRUE.
retstep	If TRUE, return (samples, step), where step is the spacing between samples.
dtype	The type of the output tensor.
axis	The axis in the result to store the samples. Relevant only if start or stop are array-like. Defaults to 1, the first axis.

Value

A tensor of evenly spaced numbers. If retstep is TRUE, returns (samples, step)

Note

Torch backend does not support axis argument.

See Also

- https://keras.io/api/ops/numpy#linspace-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
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op_full()
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op_get_item()
op_greater()
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op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_log *Natural logarithm, element-wise.*

Description

Natural logarithm, element-wise.

Usage

```
op_log(x)
```

Arguments

x	Input tensor.

Value

Output tensor, element-wise natural logarithm of x.

See Also

- https://keras.io/api/ops/numpy#log-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()

op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()

op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()

op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()

op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()

op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()

op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_log10 *Return the base 10 logarithm of the input tensor, element-wise.*

Description

Return the base 10 logarithm of the input tensor, element-wise.

Usage

```
op_log10(x)
```

Arguments

x	Input tensor.

Value

Output tensor, element-wise base 10 logarithm of x.

See Also

- https://keras.io/api/ops/numpy#log10-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_log1p *Returns the natural logarithm of one plus the x, element-wise.*

Description

Calculates log(1 + x).

Usage

```
op_log1p(x)
```

Arguments

x Input tensor.

Value

Output tensor, element-wise natural logarithm of 1 + x.

See Also

- https://keras.io/api/ops/numpy#log1p-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()

op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()

op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()

op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()

op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

---

op_log2 *Base-2 logarithm of* x*, element-wise.*

Description

Base-2 logarithm of x, element-wise.

Usage

```
op_log2(x)
```

Arguments

x	Input tensor.

Value

Output tensor, element-wise base-2 logarithm of x.

See Also

- https://keras.io/api/ops/numpy#log2-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()

op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_ones()
op_ones_like()
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op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()

op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
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op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
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op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
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op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
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op_celu()
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op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()

op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()

op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()

op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()

op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logaddexp *Logarithm of the sum of exponentiations of the inputs.*

Description

Calculates `log(exp(x1) + exp(x2))`.

Usage

```
op_logaddexp(x1, x2)
```

Arguments

x1	Input tensor.
x2	Input tensor.

Value

Output tensor, element-wise logarithm of the sum of exponentiations of the inputs.

See Also

- https://keras.io/api/ops/numpy#logaddexp-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
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op_convert_to_tensor()
op_copy()
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op_count_nonzero()
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op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logdet()
op_logical_and()
op_logical_not()
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op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
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op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logdet *Computes log of the determinant of a hermitian positive definite matrix.*

Description

Computes log of the determinant of a hermitian positive definite matrix.

Usage

```
op_logdet(x)
```

Arguments

x	Input matrix. It must 2D and square.

Value

The natural log of the determinant of matrix.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()

op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()

op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()

op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()

op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()

op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logical_and *Computes the element-wise logical AND of the given input tensors.*

Description

Zeros are treated as FALSE and non-zeros are treated as TRUE.

Usage

```
op_logical_and(x1, x2)
```

Arguments

x1	Input tensor.
x2	Input tensor.

Details

Note that this function is automatically called when using the R operator & with a tensor.

Value

Output tensor, element-wise logical AND of the inputs.

See Also

- https://keras.io/api/ops/numpy#logicaland-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()

op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()

op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()

op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()

op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()

op_logdet()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()

op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()

op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logical_not *Computes the element-wise NOT of the given input tensor.*

Description

Zeros are treated as FALSE and non-zeros are treated as TRUE.

Note that this function is automatically called when using the R operator ! with a tensor.

Usage

```
op_logical_not(x)
```

Arguments

x Input tensor.

Value

Output tensor, element-wise logical NOT of the input.

See Also

- https://keras.io/api/ops/numpy#logicalnot-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()

op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()

op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()

op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()

op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()

op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

---

op_logical_or *Computes the element-wise logical OR of the given input tensors.*

Description

Zeros are treated as FALSE and non-zeros are treated as TRUE.

Note that this function is automatically called when using the R operator | with a tensor.

Usage

```
op_logical_or(x1, x2)
```

Arguments

x1	Input tensor.
x2	Input tensor.

Value

Output tensor, element-wise logical OR of the inputs.

See Also

- https://keras.io/api/ops/numpy#logicalor-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()

op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_vdot()
op_vectorize()
op_vstack()
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op_zeros_like()

Other ops:
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op_arcsinh()
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op_argpartition()
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op_bitwise_right_shift()
op_bitwise_xor()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()

op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()

op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logical_xor *Compute the truth value of* `x1 XOR x2`*, element-wise.*

Description

Compute the truth value of `x1 XOR x2`, element-wise.

Usage

```
op_logical_xor(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output boolean tensor.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()

op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
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op_arccos()
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op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
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op_argmin()
op_argpartition()
op_argsort()
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op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
op_bitwise_right_shift()
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op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
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op_cumsum()
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op_det()
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op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_log_softmax()
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op_logical_and()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()

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op_rot90()
op_round()
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op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()

op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logspace *Returns numbers spaced evenly on a log scale.*

Description

In linear space, the sequence starts at base ** start and ends with base ** stop (see endpoint below).

Usage

```
op_logspace(
  start,
  stop,
  num = 50L,
  endpoint = TRUE,
  base = 10L,
  dtype = NULL,
  axis = 1L
)
```

Arguments

start	The starting value of the sequence.
stop	The final value of the sequence, unless endpoint is FALSE. In that case, num + 1 values are spaced over the interval in log-space, of which all but the last (a sequence of length num) are returned.
num	Number of samples to generate. Defaults to 50.
endpoint	If TRUE, stop is the last sample. Otherwise, it is not included. Defaults to TRUE.
base	The base of the log space. Defaults to 10.
dtype	The type of the output tensor.
axis	The axis in the result to store the samples. Relevant only if start or stop are array-like.

Value

A tensor of evenly spaced samples on a log scale.

Note

Torch backend does not support axis argument.

See Also

- https://keras.io/api/ops/numpy#logspace-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_arccosh()
op_arcsin()
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op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_not()
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op_bitwise_xor()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
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op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_einsum()
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op_empty()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
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op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
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op_scatter_update()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
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op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_tanh_shrink()
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op_transpose()
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op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_logsumexp *Computes the logarithm of sum of exponentials of elements in a tensor.*

Description

Computes the logarithm of sum of exponentials of elements in a tensor.

Usage

```
op_logsumexp(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	An integer or a list of integers specifying the axis/axes along which to compute the sum. If NULL, the sum is computed over all elements. Defaults to NULL.
keepdims	A boolean indicating whether to keep the dimensions of the input tensor when computing the sum. Defaults to FALSE.

Value

A tensor containing the logarithm of the sum of exponentials of elements in x.

Examples

```
x <- op_convert_to_tensor(c(1, 2, 3))
op_logsumexp(x)

## tf.Tensor(3.4076059644443806, shape=(), dtype=float64)
```

See Also

- https://keras.io/api/ops/core#logsumexp-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()

op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()

op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()

op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()

op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_log_sigmoid *Logarithm of the sigmoid activation function.*

Description

It is defined as `f(x) = log(1 / (1 + exp(-x)))`.

Usage

```
op_log_sigmoid(x)
```

Arguments

x Input tensor.

Value

A tensor with the same shape as x.

Examples

```
x <- op_convert_to_tensor(c(-0.541391, 0.0, 0.50, 5.0))
op_log_sigmoid(x)

## tf.Tensor([-1.00004181 -0.69314718 -0.47407698 -0.00671535], shape=(4), dtype=float64)
```

See Also

- https://keras.io/api/ops/nn#logsigmoid-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
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op_array()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()

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op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
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op_hard_tanh()
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op_log_softmax()
op_logaddexp()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()

op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
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op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()

op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_log_softmax *Log-softmax activation function.*

Description

It is defined as: `f(x) = x - max(x) - log(sum(exp(x - max(x))))`

Usage

```
op_log_softmax(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	Integer, axis along which the log-softmax is applied. Defaults to -1.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_log_softmax(x)

## tf.Tensor([-2.407606   -1.4076059  -0.40760595], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#logsoftmax-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
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op_sparse_plus()
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op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_lstsq *Return the least-squares solution to a linear matrix equation.*

Description

Computes the vector x that approximately solves the equation a %*% x = b. The equation may be under-, well-, or over-determined (i.e., the number of linearly independent rows of a can be less than, equal to, or greater than its number of linearly independent columns). If a is square and of full rank, then x (but for round-off error) is the exact solution of the equation. Else, x minimizes the L2 norm of b - a %*% x.

If there are multiple minimizing solutions, the one with the smallest L2 norm is returned.

Usage

```
op_lstsq(a, b, rcond = NULL)
```

Arguments

a	"Coefficient" matrix of shape (M, N).
b	Ordinate or "dependent variable" values, of shape (M) or (M, K). If b is two-dimensional, the least-squares solution is calculated for each of the K columns of b.
rcond	Cut-off ratio for small singular values of a. For the purposes of rank determination, singular values are treated as zero if they are smaller than rcond times the largest singular value of a.

Value

Tensor with shape (N) or (N, K) containing the least-squares solutions.

NOTE: The output differs from `numpy.linalg.lstsq()`. NumPy returns a tuple with four elements, the first of which being the least-squares solutions and the others being essentially never used. Keras only returns the first value. This is done both to ensure consistency across backends (which cannot be achieved for the other values) and to simplify the API.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_eigh()
op_inv()
op_lu_factor()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()

op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()

op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()

op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_lu_factor *Computes the lower-upper decomposition of a square matrix.*

Description

Computes the lower-upper decomposition of a square matrix.

Usage

```
op_lu_factor(x)
```

Arguments

x	A tensor of shape `(..., M, M)`.

Value

A tuple of two tensors: a tensor of shape `(..., M, M)` containing the lower and upper triangular matrices and a tensor of shape `(..., M)` containing the pivots.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_eigh()
op_inv()
op_lstsq()
op_norm()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()

op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()

op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
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op_floor_divide()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()

op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_map *Map a function over leading array axes.*

Description

Like purrr::map() or base::lapply(), except inputs and outputs are in the form of stacked arrays. Consider using the op_vectorized_map() transform instead, unless you need to apply a function element by element for reduced memory usage or heterogeneous computation with other control flow primitives.

When xs is an array type, the semantics of op_map() match this implementation:

```
op_map <- function(xs, f) {
  xs |>
    op_unstack() |>
    lapply(f) |>
    op_stack()
}
```

Usage

```
op_map(xs, f)
```

Arguments

xs	Values over which to map along the leading axis.
f	Callable defines the function to apply element-wise over the first axis or axes of xs.

Value

Mapped values.

Examples

```
f <- function(x) x^2
xs <- op_arange(10)
ys <- op_map(xs, f)
ys

## tf.Tensor([ 1.  4.  9. 16. 25. 36. 49. 64. 81. 100.], shape=(10), dtype=float32)


f <- function(x) list(y1 = x^2, y2 = x * 10)  # Can have nested outputs
ys <- op_map(xs, f)
ys$y1

## tf.Tensor([ 1.  4.  9. 16. 25. 36. 49. 64. 81. 100.], shape=(10), dtype=float32)


ys$y2

## tf.Tensor([ 10.  20.  30.  40.  50.  60.  70.  80.  90. 100.], shape=(10), dtype=float32)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
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op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_matmul *Matrix product of two tensors.*

Description

- If both tensors are 1-dimensional, the dot product (scalar) is returned.
- If either tensor is N-D, N > 2, it is treated as a stack of matrices residing in the last two indexes and broadcast accordingly.
- If the first tensor is 1-D, it is promoted to a matrix by prepending a 1 to its dimensions. After matrix multiplication the prepended 1 is removed.
- If the second tensor is 1-D, it is promoted to a matrix by appending a 1 to its dimensions. After matrix multiplication the appended 1 is removed.

Usage

```
op_matmul(x1, x2)
```

Arguments

x1	First tensor.
x2	Second tensor.

Value

Output tensor, matrix product of the inputs.

See Also

- https://keras.io/api/ops/numpy#matmul-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()

op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()

op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()

op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()

op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()

op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()

op_logical_not()
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op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
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op_softmax()
op_softplus()
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op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_stack()
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op_stft()
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op_subtract()

op_sum()
op_svd()
op_swapaxes()
op_switch()
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op_take_along_axis()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_max *Return the maximum of a tensor or maximum along an axis.*

Description

Return the maximum of a tensor or maximum along an axis.

Usage

```
op_max(x, axis = NULL, keepdims = FALSE, initial = NULL)
```

Arguments

x	Input tensor.
axis	Axis or axes along which to operate. By default, flattened input is used.

keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one. Defaults to FALSE.
initial	The minimum value of an output element. Defaults to NULL.

Value

Maximum of x.

Examples

```
(x <- op_convert_to_tensor(rbind(c(1, 3, 5), c(1, 5, 2))))

## tf.Tensor(
## [[1. 3. 5.]
##  [1. 5. 2.]], shape=(2, 3), dtype=float64)


op_max(x)

## tf.Tensor(5.0, shape=(), dtype=float64)


op_max(x, axis = 1)

## tf.Tensor([1. 5. 5.], shape=(3), dtype=float64)


op_max(x, axis = 1, keepdims = TRUE)

## tf.Tensor([[1. 5. 5.]], shape=(1, 3), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#max-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()

op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
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op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
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op_correlate()
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op_cross()
op_ctc_decode()
op_cumprod()
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op_diag()
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op_digitize()
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op_einsum()
op_empty()
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op_eye()
op_flip()
op_floor()
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op_inner()
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op_logaddexp()
op_logdet()
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op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()

op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
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op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
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op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()

op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_einsum()
op_elu()
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op_exp()
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op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
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op_image_pad()
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op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_istft()
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op_less()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()

op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max_pool()
op_maximum()
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op_median()
op_meshgrid()
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op_moveaxis()
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op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_subtract()
op_sum()
op_svd()

op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()
op_trace()
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op_tri()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_maximum *Element-wise maximum of* x1 *and* x2.

Description

Element-wise maximum of x1 and x2.

Usage

```
op_maximum(x1, x2)

op_pmax(x1, x2)
```

Arguments

x1	First tensor.
x2	Second tensor.

Value

Output tensor, element-wise maximum of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#maximum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
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op_argmax()
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op_bitwise_and()
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op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
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op_image_perspective_transform()
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op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_irfft()
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op_log_softmax()
op_logaddexp()
op_logdet()
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op_logspace()
op_logsumexp()
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op_max_pool()
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op_one_hot()
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op_power()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_relu6()
op_repeat()
op_reshape()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_stack()
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op_tanh()
op_tanh_shrink()
op_tensordot()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
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op_unravel_index()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_max_pool *Max pooling operation.*

Description

Max pooling operation.

Usage

```
op_max_pool(
  inputs,
  pool_size,
  strides = NULL,
  padding = "valid",
  data_format = NULL
)
```

Arguments

- `inputs` Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format = "channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format = "channels_first"`. Pooling happens over the spatial dimensions only.
- `pool_size` int or tuple/list of integers of size `len(inputs_spatial_shape)`, specifying the size of the pooling window for each spatial dimension of the input tensor. If `pool_size` is int, then every spatial dimension shares the same `pool_size`.
- `strides` int or tuple/list of integers of size `len(inputs_spatial_shape)`. The stride of the sliding window for each spatial dimension of the input tensor. If `strides` is int, then every spatial dimension shares the same `strides`.
- `padding` string, either `"valid"` or `"same"`. `"valid"` means no padding is applied, and `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when `strides = 1`.
- `data_format` A string, either `"channels_last"` or `"channels_first"`. `data_format` determines the ordering of the dimensions in the inputs. If `data_format = "channels_last"`, `inputs` is of shape `(batch_size, ..., channels)` while if `data_format = "channels_first"`, `inputs` is of shape `(batch_size, channels, ...)`.

Value

A tensor of rank N+2, the result of the max pooling operation.

See Also

- https://keras.io/api/ops/nn#maxpool-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
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op_arccosh()
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op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_mean *Compute the arithmetic mean along the specified axes.*

Description

Compute the arithmetic mean along the specified axes.

Usage

```
op_mean(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	Axis or axes along which the means are computed. The default is to compute the mean of the flattened tensor.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

Value

Output tensor containing the mean values.

See Also

- https://keras.io/api/ops/numpy#mean-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()

op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()

op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()

op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_median *Compute the median along the specified axis.*

Description

Compute the median along the specified axis.

Usage

```
op_median(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	Axis or axes along which the medians are computed. Defaults to `axis = NULL` which is to compute the median(s) along a flattened version of the array.
keepdims	If this is set to `TRUE`, the axes which are reduce are left in the result as dimensions with size one.

Value

The output tensor.

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_average()`
`op_bincount()`
`op_bitwise_and()`

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()

op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()

op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()

op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()

op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()

op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_meshgrid *Creates grids of coordinates from coordinate vectors.*

Description

Given N 1-D tensors T0, T1, ..., TN-1 as inputs with corresponding lengths S0, S1, ..., SN-1, this creates an N N-dimensional tensors G0, G1, ..., GN-1 each with shape (S0, ..., SN-1) where the output Gi is constructed by expanding Ti to the result shape.

Usage

```
op_meshgrid(..., indexing = "xy")
```

Arguments

...	1-D tensors representing the coordinates of a grid.
indexing	"xy" or "ij". "xy" is cartesian; "ij" is matrix indexing of output. Defaults to "xy".

Value

Sequence of N tensors.

Examples

```
x <- op_array(c(1, 2, 3), "int32")
y <- op_array(c(4, 5, 6), "int32")

c(grid_x, grid_y) %<-% op_meshgrid(x, y, indexing = "ij")
grid_x

## tf.Tensor(
## [[1 1 1]
##  [2 2 2]
##  [3 3 3]], shape=(3, 3), dtype=int32)


# array([[1, 1, 1],
#        [2, 2, 2],
#        [3, 3, 3]))
grid_y

## tf.Tensor(
## [[4 5 6]
##  [4 5 6]
##  [4 5 6]], shape=(3, 3), dtype=int32)


# array([[4, 5, 6],
#        [4, 5, 6],
#        [4, 5, 6]))
```

See Also

- https://keras.io/api/ops/numpy#meshgrid-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()

op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()

op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()

op_quantile()
op_ravel()
op_real()
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op_repeat()
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op_right_shift()
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op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
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op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:

op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()

op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()

op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
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op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
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op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()

op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
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op_median()
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op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
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op_rfft()
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op_sparse_plus()
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op_triu()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
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op_where()
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---

op_min *Return the minimum of a tensor or minimum along an axis.*

Description

Return the minimum of a tensor or minimum along an axis.

Usage

```
op_min(x, axis = NULL, keepdims = FALSE, initial = NULL)
```

Arguments

x	Input tensor.
axis	Axis or axes along which to operate. By default, flattened input is used.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one. Defaults to FALSE.
initial	The maximum value of an output element. Defaults to NULL.

Value

Minimum of x.

Examples

```
(x <- op_convert_to_tensor(rbind(c(1, 3, 5), c(1, 5, 2))))

## tf.Tensor(
## [[1. 3. 5.]
##  [1. 5. 2.]], shape=(2, 3), dtype=float64)


op_min(x)

## tf.Tensor(1.0, shape=(), dtype=float64)


op_min(x, axis = 1)

## tf.Tensor([1. 3. 2.], shape=(3), dtype=float64)


op_min(x, axis = 1, keepdims = TRUE)

## tf.Tensor([[1. 3. 2.]], shape=(1, 3), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#min-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_not()
op_bitwise_or()
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op_bitwise_xor()
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op_clip()
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op_correlate()
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op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
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op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
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op_einsum()
op_empty()
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op_exp()
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op_expm1()
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op_full()
op_full_like()
op_get_item()
op_greater()

op_greater_equal()
op_histogram()
op_hstack()
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op_inner()
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op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
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op_ndim()
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op_prod()
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Other ops:
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op_convert_to_tensor()
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op_cos()
op_cosh()

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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
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op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()

op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()

op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_squeeze()
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op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
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op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
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op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_minimum   *Element-wise minimum of* x1 *and* x2.

Description

Element-wise minimum of x1 and x2.

Usage

```
op_minimum(x1, x2)

op_pmin(x1, x2)
```

Arguments

x1	First tensor.
x2	Second tensor.

Value

Output tensor, element-wise minimum of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#minimum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_mod *Returns the element-wise remainder of division.*

Description

Note that this function is automatically called when using the R operator %% with a tensor.

```
(x <- op_arange(10))
```

```
## tf.Tensor([ 1.  2.  3.  4.  5.  6.  7.  8.  9. 10.], shape=(10), dtype=float32)
```

```
op_mod(x, 3)
```

```
## tf.Tensor([1. 2. 0. 1. 2. 0. 1. 2. 0. 1.], shape=(10), dtype=float32)
```

```
x %% 3
```

```
## tf.Tensor([1. 2. 0. 1. 2. 0. 1. 2. 0. 1.], shape=(10), dtype=float32)
```

Usage

```
op_mod(x1, x2)
```

Arguments

x1	First tensor.
x2	Second tensor.

Value

Output tensor, element-wise remainder of division.

See Also

- https://keras.io/api/ops/numpy#mod-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()

op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()

op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()

op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
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op_cumprod()
op_cumsum()
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op_extract_sequences()
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op_get_item()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
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op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_isfinite()
op_isinf()
op_isnan()
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op_log1p()
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op_log_softmax()
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op_logical_xor()

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op_segment_sum()
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op_selu()
op_separable_conv()
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op_sign()
op_signbit()
op_silu()
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op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()

op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_moments *Calculates the mean and variance of* x.

Description

The mean and variance are calculated by aggregating the contents of x across axes. If x is 1-D and axes = c(1) this is just the mean and variance of a vector.

Usage

```
op_moments(x, axes, keepdims = FALSE, synchronized = FALSE)
```

Arguments

x	Input tensor.
axes	A list of axes which to compute mean and variance.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

synchronized
: Only applicable with the TensorFlow backend. If TRUE, synchronizes the global batch statistics (mean and variance) across all devices at each training step in a distributed training strategy. If FALSE, each replica uses its own local batch statistics.

Value

A list containing two tensors - mean and variance.

Examples

```
x <- op_convert_to_tensor(c(0, 1, 2, 3, 100), dtype = "float32")
op_moments(x, axes = c(1))

## [[1]]
## tf.Tensor(21.2, shape=(), dtype=float32)
##
## [[2]]
## tf.Tensor(1553.3601, shape=(), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()

op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()

op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()

op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()

op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()

op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_moveaxis` *Move axes of a tensor to new positions.*

Description

Other axes remain in their original order.

Usage

```
op_moveaxis(x, source, destination)
```

Arguments

`x`	Tensor whose axes should be reordered.
`source`	Original positions of the axes to move. These must be unique.
`destination`	Destinations positions for each of the original axes. These must also be unique.

Value

Tensor with moved axes.

See Also

- https://keras.io/api/ops/numpy#moveaxis-function

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_average()`
`op_bincount()`
`op_bitwise_and()`

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
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op_hstack()
op_identity()
op_imag()

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op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()

op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()

op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()

op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()

op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()

op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_multiply *Multiply arguments element-wise.*

Description

Note that this function is automatically called when using the R operator `*` with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_multiply(x, x)

## tf.Tensor([ 1.  4.  9. 16.], shape=(4), dtype=float32)


x * x

## tf.Tensor([ 1.  4.  9. 16.], shape=(4), dtype=float32)
```

Usage

```
op_multiply(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise product of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#multiply-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()

op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
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op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()

op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
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op_repeat()
op_reshape()
op_right_shift()
op_roll()
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op_round()
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op_select()
op_sign()
op_signbit()
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op_sinh()
op_size()
op_sort()
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op_sqrt()
op_square()

op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
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op_vdot()
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op_vstack()
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Other ops:
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op_arcsinh()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()

op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_multi_hot *Encodes integer labels as multi-hot vectors.*

Description

This function encodes integer labels as multi-hot vectors, where each label is mapped to a binary value in the resulting vector.

Usage

```
op_multi_hot(
  inputs,
  num_classes,
  axis = -1L,
  dtype = NULL,
  sparse = FALSE,
  ...
)
```

Arguments

inputs	Tensor of integer labels to be converted to multi-hot vectors.
num_classes	Integer, the total number of unique classes.
axis	(optional) Axis along which the multi-hot encoding should be added. Defaults to -1, which corresponds to the last dimension.
dtype	(optional) The data type of the resulting tensor. Default is backend's float type.
sparse	Whether to return a sparse tensor; for backends that support sparse tensors.
...	For forward/backwards compatability

Value

Tensor: The multi-hot encoded tensor.

Examples

```
data <- op_convert_to_tensor(c(0, 4))
op_multi_hot(data, num_classes = 5)

## tf.Tensor([1. 0. 0. 0. 1.], shape=(5), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:

op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()

op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_einsum()
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op_empty()
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op_erf()
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op_exp()
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op_expand_dims()
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op_extract_sequences()
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op_fft()
op_fft2()
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op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()

op_hard_sigmoid()
op_hard_silu()
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op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_logical_or()
op_logical_xor()
op_logspace()
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op_lstsq()
op_lu_factor()
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op_matmul()
op_max()
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op_mod()
op_moments()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
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op_slogdet()
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op_softmax()
op_softplus()
op_softsign()
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op_sparse_plus()
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op_stft()
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op_unstack()
op_var()
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op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_nan_to_num *Replace NaN with zero and infinity with large finite numbers.*

Description

Replace NaN with zero and infinity with large finite numbers.

Usage

```
op_nan_to_num(x, nan = 0, posinf = NULL, neginf = NULL)
```

Arguments

x	Input data.
nan	Optional float or int. Value to replace NaN entries with.
posinf	Optional float or int. Value to replace positive infinity with.
neginf	Optional float or int. Value to replace negative infinity with.

Value

x, with non-finite values replaced.

Example

```
(x <- op_convert_to_tensor(c(1, NaN, -Inf, Inf)))

## tf.Tensor([  1.  nan -inf  inf], shape=(4), dtype=float64)


op_nan_to_num(x)

## tf.Tensor([ 1.00000000e+000  0.00000000e+000 -1.79769313e+308  1.79769313e+308], shape=(4), dtype=f


op_nan_to_num(x, nan = -1, posinf = 2, neginf = -2)

## tf.Tensor([ 1. -1. -2.  2.], shape=(4), dtype=float64)
```

See Also

- https://keras.io/api/ops/numpy#nantonum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()

op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()

op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()

op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()

op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()

op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()

op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ndim *Return the number of dimensions of a tensor.*

Description

Return the number of dimensions of a tensor.

Usage

```
op_ndim(x)
```

Arguments

x	Input tensor.

Value

The number of dimensions in x.

See Also

- https://keras.io/api/ops/numpy#ndim-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
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op_isnan()
op_left_shift()
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op_less_equal()
op_linspace()
op_log()
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op_log1p()
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op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()

op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
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op_sqrt()
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op_sum()
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op_take()
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op_tanh()
op_tensordot()
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op_tri()
op_tril()
op_triu()
op_trunc()

op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_negative *Numerical negative, element-wise.*

Description

Note that this function is automatically called when using the unary R operator - with a tensor.

```
(x <- op_arange(4))
```

```
## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)
```

```
op_negative(x)

## tf.Tensor([-1. -2. -3. -4.], shape=(4), dtype=float32)
```

```
-x

## tf.Tensor([-1. -2. -3. -4.], shape=(4), dtype=float32)
```

Usage

```
op_negative(x)
```

Arguments

x	Input tensor.

Value

Output tensor, y = -x.

See Also

- https://keras.io/api/ops/numpy#negative-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()

op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()

op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
op_all()
op_any()
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op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
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op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()

op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_eigh()
op_einsum()
op_elu()
op_empty()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()

op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()

op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_nonzero *Return the indices of the elements that are non-zero.*

Description

Return the indices of the elements that are non-zero.

Usage

```
op_nonzero(x)
```

Arguments

x Input tensor.

Details

Example:

op_nonzero() indices can be used with <tensor>@r[

```
(x <- op_scatter(indices = rbind(1, 5, 10), values = c(1, 2, 3), shape = c(10)))

## tf.Tensor([1. 0. 0. 0. 2. 0. 0. 0. 0. 3.], shape=(10), dtype=float64)


(nz <- op_nonzero(x))
```

```
## tf.Tensor(
## [[ 1]
##  [ 5]
##  [10]], shape=(3, 1), dtype=int32)
```

```
x@r[nz]
```

```
## tf.Tensor([1. 2. 3.], shape=(3), dtype=float64)
```

```
# same as `x@r[nz]`
x@r[x != 0]
```

```
## tf.Tensor([1. 2. 3.], shape=(3), dtype=float64)
```

```
x@r[op_cast(x, "bool")]
```

```
## tf.Tensor([1. 2. 3.], shape=(3), dtype=float64)
```

```
# 2d example
(x2 <- op_stack(c(x, op_roll(x, 1), op_roll(x, 2))))
```

```
## tf.Tensor(
## [[1. 0. 0. 0. 2. 0. 0. 0. 0. 3.]
##  [3. 1. 0. 0. 0. 2. 0. 0. 0. 0.]
##  [0. 3. 1. 0. 0. 0. 2. 0. 0. 0.]], shape=(3, 10), dtype=float64)
```

```
x2@r[op_nonzero(x2)]
```

```
## tf.Tensor([1. 2. 3. 3. 1. 2. 3. 1. 2.], shape=(9), dtype=float64)
```

```
x3 <- op_stack(c(x2, x2*1.1))
x3@r[op_nonzero(x3)]
```

```
## tf.Tensor([1.  2.  3.  3.  1.  2.  3.  1.  2.  1.1 2.2 3.3 3.3 1.1 2.2 3.3 1.1 2.2], shape=(18), dtype=f
```

Value

Indices of elements that are non-zero.

See Also

- https://keras.io/api/ops/numpy#nonzero-function

Other numpy ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()

op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
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op_logdet()
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op_logical_xor()
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op_lstsq()
op_matmul()
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op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
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op_mod()

op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_ones()
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op_power()
op_prod()
op_quantile()
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op_reciprocal()
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op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
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op_binary_crossentropy()
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op_bitwise_not()
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op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_eigh()
op_einsum()
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op_empty()
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op_fft2()

op_flip()
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op_fori_loop()
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op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
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op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()

op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()

op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()

op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_norm *Matrix or vector norm.*

Description

This function is able to return one of eight different matrix norms, or one of an infinite number of vector norms (described below), depending on the value of the ord parameter.

Usage

```
op_norm(x, ord = NULL, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
ord	Order of the norm (see table under Notes). The default is NULL.
axis	If axis is an integer, it specifies the axis of x along which to compute the vector norms. If axis is a length 2 vector, it specifies the axes that hold 2-D matrices, and the matrix norms of these matrices are computed.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

Value

Norm of the matrix or vector(s).

Note

For values of ord < 1, the result is, strictly speaking, not a mathematical 'norm', but it may still be useful for various numerical purposes. The following norms can be calculated:

- For matrices:
  - ord=NULL: Frobenius norm
  - ord="fro": Frobenius norm
  - ord="nuc": nuclear norm
  - ord=Inf: max(sum(abs(x), axis=2))
  - ord=-Inf: min(sum(abs(x), axis=2))
  - ord=0: not supported
  - ord=1: max(sum(abs(x), axis=1))
  - ord=-1: min(sum(abs(x), axis=1))
  - ord=2: 2-norm (largest sing. value)
  - ord=-2: smallest singular value
  - other: not supported
- For vectors:
  - ord=NULL: 2-norm
  - ord="fro": not supported
  - ord="nuc": not supported
  - ord=Inf: max(abs(x))
  - ord=-Inf: min(abs(x))
  - ord=0: sum(x != 0)
  - ord=1: as below
  - ord=-1: as below
  - ord=2: as below
  - ord=-2: as below
  - other: sum(abs(x)^ord)^(1/ord)

Examples

```
x <- op_reshape(op_arange(9, dtype="float32") - 4, c(3, 3))
op_norm(x)

## tf.Tensor(8.306623, shape=(), dtype=float32)


# 7.7459664
```

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_eigh()
op_inv()
op_lstsq()
op_lu_factor()
op_slogdet()
op_solve_triangular()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()

op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
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op_convert_to_tensor()
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op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()

op_empty()
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op_erfinv()
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op_expm1()
op_extract_sequences()
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op_fft2()
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op_floor()
op_floor_divide()
op_fori_loop()
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op_get_item()
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op_greater_equal()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_moveaxis()
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op_normalize()
op_not_equal()
op_one_hot()

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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()

op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()

op_zeros_like()

---

op_normalize *Normalizes x over the specified axis.*

Description

It is defined as: op_normalize(x) = x / max(norm(x), epsilon).

Usage

```
op_normalize(x, axis = -1L, order = 2L, epsilon = NULL)
```

Arguments

x	Input tensor.
axis	The axis or axes along which to perform normalization. Default to -1.
order	The exponent value in the norm formulation. Defaults to 2.
epsilon	A lower bound value for the norm. Defaults to config_epsilon().

Value

The normalized array.

Examples

```
x <- op_convert_to_tensor(rbind(c(1, 2, 3), c(4, 5, 6)))
x_norm <- op_normalize(x)
x_norm

## tf.Tensor(
## [[0.26726124 0.53452248 0.80178373]
##  [0.45584231 0.56980288 0.68376346]], shape=(2, 3), dtype=float64)
```

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/ops/normalize

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()

op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()

op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()

op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
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op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()

op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_not_equal *Return* (x1 != x2) *element-wise.*

Description

Note that this function is automatically called when using the R operator != with a tensor.

```
(x <- op_arange(4))
```

```
## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)
```

```
op_not_equal(x, 2)
```

```
## tf.Tensor([ True False  True  True], shape=(4), dtype=bool)
```

```
x != 2
```

```
## tf.Tensor([ True False  True  True], shape=(4), dtype=bool)
```

Usage

```
op_not_equal(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise comparison of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#notequal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()

op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()

op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()

op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_norm()
op_normalize()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ones *Return a new tensor of given shape and type, filled with ones.*

Description

Return a new tensor of given shape and type, filled with ones.

Usage

```
op_ones(shape, dtype = NULL)
```

Arguments

shape	Shape of the new tensor.
dtype	Desired data type of the tensor.

Value

Tensor of ones with the given shape and dtype.

See Also

- https://keras.io/api/ops/numpy#ones-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()

op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
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op_celu()
op_cholesky()
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op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()

op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ones_like *Return a tensor of ones with the same shape and type of* x.

Description

Return a tensor of ones with the same shape and type of x.

Usage

```
op_ones_like(x, dtype = NULL)
```

Arguments

x	Input tensor.
dtype	Overrides the data type of the result.

Value

A tensor of ones with the same shape and type as x.

See Also

- https://keras.io/api/ops/numpy#oneslike-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
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op_arange()
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op_arccosh()
op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
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op_binary_crossentropy()
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op_bitwise_or()
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op_bitwise_xor()
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op_conv_transpose()
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op_convert_to_tensor()
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op_cumprod()
op_cumsum()
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op_det()
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op_diagonal()
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op_divide_no_nan()
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op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
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op_fori_loop()
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op_hard_tanh()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_isnan()
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op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
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op_maximum()
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op_moveaxis()
op_multi_hot()
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op_ones()
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op_power()

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op_psnr()
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op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
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op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_one_hot *Converts integer tensor* x *into a one-hot tensor.*

Description

The one-hot encoding is a representation where each integer value is converted into a binary vector with a length equal to `num_classes`, and the index corresponding to the integer value is marked as 1, while all other indices are marked as 0.

Usage

```
op_one_hot(
  x,
  num_classes,
  axis = -1L,
  dtype = NULL,
  sparse = FALSE,
  zero_indexed = FALSE
)
```

Arguments

`x`	Integer tensor to be encoded. The shape can be arbitrary, but the dtype should be integer. R factors are coerced to integer.
`num_classes`	Number of classes for the one-hot encoding. If `x` is a factor and `num_classes` is `NULL` or missing, then `levels(x)` is used.
`axis`	Axis along which the encoding is performed. `-1` represents the last axis. Defaults to `-1`.
`dtype`	(Optional) Data type of the output tensor. If not provided, it defaults to the default data type of the backend.
`sparse`	Whether to return a sparse tensor; for backends that support sparse tensors.
`zero_indexed`	If `TRUE`, treats indices as zero-based (`0` encodes to first position); if `FALSE` (default), treats indices as one-based (`1` encodes to first position).

Value

Integer tensor: One-hot encoded tensor with the same shape as `x` except for the specified `axis` dimension, which will have a length of `num_classes`. The dtype of the output tensor is determined by `dtype` or the default data type of the backend.

Examples

```
x <- op_array(c(2, 4, 3, 1), "int32")
op_one_hot(x, num_classes = 4)

## tf.Tensor(
## [[0. 1. 0. 0.]
##  [0. 0. 0. 1.]
##  [0. 0. 1. 0.]
##  [1. 0. 0. 0.]], shape=(4, 4), dtype=float32)
```

```
op_one_hot(x - 1, num_classes = 4, zero_indexed = TRUE)

## tf.Tensor(
## [[0. 1. 0. 0.]
##  [0. 0. 0. 1.]
##  [0. 0. 1. 0.]
##  [1. 0. 0. 0.]], shape=(4, 4), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#onehot-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()

op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()

op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()

op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_isinf()
op_isnan()
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op_leaky_relu()
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op_less()
op_less_equal()
op_linspace()
op_log()
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op_log1p()

op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
op_maximum()
op_mean()
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op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
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op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_outer *Compute the outer product of two vectors.*

Description

Given two vectors x1 and x2, the outer product is:

```
out[i, j] = x1[i] * x2[j]
```

Usage

```
op_outer(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Outer product of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#outer-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
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op_eye()
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op_floor()
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op_get_item()
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op_logaddexp()
op_logdet()
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op_logspace()
op_lstsq()
op_matmul()
op_max()
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op_meshgrid()
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op_minimum()
op_mod()
op_moveaxis()
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op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_size()

op_sort()
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op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
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op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
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op_bitwise_invert()
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op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
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op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
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op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_empty()
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op_exp()
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op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_imag()
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op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()

op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_xor()
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op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
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op_saturate_cast()
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op_slogdet()
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op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
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op_split()
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op_square()
op_squareplus()
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op_sum()
op_svd()
op_swapaxes()
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op_take()
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op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_pad *Pad a tensor.*

Description

Pad a tensor.

Usage

```
op_pad(x, pad_width, mode = "constant", constant_values = NULL)
```

Arguments

x
: Tensor to pad.

pad_width
: Number of values padded to the edges of each axis. `((before_1, after_1), ...(before_N, after_N))` unique pad widths for each axis. `((before, after),)` yields same before and after pad for each axis. `(pad,)` or `int` is a shortcut for `before = after = pad` width for all axes.

mode
: One of `"constant"`, `"edge"`, `"linear_ramp"`, `"maximum"`, `"mean"`, `"median"`, `"minimum"`, `"reflect"`, `"symmetric"`, `"wrap"`, `"empty"`, `"circular"`. Defaults to `"constant"`.

constant_values
: Value to pad with if `mode == "constant"`. Defaults to `0`. A `ValueError` is raised if not `NULL` and `mode != "constant"`.

Value

Padded tensor.

Note

Torch backend only supports modes `"constant"`, `"reflect"`, `"symmetric"` and `"circular"`. Only Torch backend supports `"circular"` mode.

Note: Tensorflow backend only supports modes `"constant"`, `"reflect"` and `"symmetric"`.

See Also

- https://keras.io/api/ops/numpy#pad-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
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op_bitwise_not()
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op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

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op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
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op_get_item()
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op_logical_xor()
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op_matmul()
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op_tile()
op_trace()
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op_trunc()
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op_vectorize()
op_vstack()
op_where()
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op_zeros_like()

Other ops:
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op_bitwise_xor()
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op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_is_tensor()
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op_matmul()
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op_max_pool()
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op_meshgrid()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_nonzero()
op_norm()
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op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
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op_squeeze()
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op_std()
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op_tril()
op_triu()
op_trunc()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_polar *Constructs a complex tensor whose elements are Cartesian*

Description

coordinates corresponding to the polar coordinates with absolute value abs and angle angle.

The operation is numerically equivalent to `torch.polar()`. It is not equivalent to `scipy.lingalg.polar()` which performs Singular Value Decomposition.

Given the magnitude (abs_) and angle (angle), this function computes the corresponding complex number in the form of `real + imaginary * 1i`, where:

- `real = abs_ * cos(angle)`
- `imaginary = abs_ * sin(angle)`

Usage

```
op_polar(abs_, angle)
```

Arguments

abs_	The magnitude (absolute value) of the complex number.
angle	The angle (in radians) of the complex number.

Value

A complex number (or array of complex numbers) with the same shape as abs_ and angle.

Examples

```
abs_ <- random_normal(c(1, 2))
angle <- random_normal(c(1, 2))
op_shape(op_polar(abs_, angle))

## shape(1, 2)


op_polar(abs_, angle)

## tf.Tensor([[-0.10252866-1.2460487j -0.2586355 -1.0352845j]], shape=(1, 2), dtype=complex64)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()

op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

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op_any()
op_append()
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op_arctan2()
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op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_ceil()
op_celu()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_imag()
op_image_affine_transform()
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op_image_extract_patches()
op_image_gaussian_blur()
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op_image_map_coordinates()
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op_image_perspective_transform()
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op_in_top_k()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()

op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()

op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_power *First tensor elements raised to powers from second tensor, element-wise.*

Description

Note that this function is automatically called when using the R operator ^ with a tensor.

```
(x <- op_arange(4))

## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)


op_power(2, x)

## tf.Tensor([ 2.  4.  8. 16.], shape=(4), dtype=float32)


2 ^ x

## tf.Tensor([ 2.  4.  8. 16.], shape=(4), dtype=float32)
```

Usage

```
op_power(x1, x2)
```

Arguments

x1	The bases.
x2	The exponents.

Value

Output tensor, the bases in x1 raised to the exponents in x2.

See Also

- https://keras.io/api/ops/numpy#power-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()

op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
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op_vstack()
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op_zeros_like()

Other ops:
op_abs()
op_add()
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op_arccosh()
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op_arctan()
op_arctan2()
op_arctanh()
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op_bitwise_xor()
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op_celu()
op_cholesky()
op_clip()
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op_cond()
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op_conv()
op_conv_transpose()
op_convert_to_numpy()
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op_cumprod()
op_cumsum()
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op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
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op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()

op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
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op_ndim()
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op_nonzero()
op_norm()
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op_polar()
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op_searchsorted()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_prod *Return the product of tensor elements over a given axis.*

Description

Return the product of tensor elements over a given axis.

Usage

```
op_prod(x, axis = NULL, keepdims = FALSE, dtype = NULL)
```

Arguments

x	Input tensor.
axis	Axis or axes along which a product is performed. The default, axis = NULL, will compute the product of all elements in the input tensor.
keepdims	If this is set to TRUE, the axes which are reduce are left in the result as dimensions with size one.
dtype	Data type of the returned tensor.

Value

Product of elements of x over the given axis or axes.

See Also

- https://keras.io/api/ops/numpy#prod-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()

op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_quantile()
op_ravel()
op_real()

op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()

op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_clip()
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op_cond()
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op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
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op_cosh()
op_count_nonzero()
op_cross()

op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
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op_erfinv()
op_exp()
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op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()

op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
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op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()

op_matmul()
op_max()
op_max_pool()
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op_meshgrid()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_polar()
op_power()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
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op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
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op_tanh()

op_tanh_shrink()
op_tensordot()
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op_trace()
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op_var()
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op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_psnr *Peak Signal-to-Noise Ratio (PSNR) function.*

Description

This function computes the Peak Signal-to-Noise Ratio between two signals, x1 and x2. PSNR is a measure of the quality of a reconstructed signal. The higher the PSNR, the closer the reconstructed signal is to the original signal. Note that it can become negative when the signal power is smaller that the noise power.

Usage

```
op_psnr(x1, x2, max_val)
```

Arguments

x1	The first input signal.
x2	The second input signal. Must have the same shape as x1.
max_val	The maximum possible value in the signals.

Value

float: The PSNR value between x1 and x2.

Examples

```
x1 <- random_normal(c(2, 4, 4, 3))
x2 <- random_normal(c(2, 4, 4, 3))
max_val <- 1.0
op_psnr(x1, x2, max_val)

## tf.Tensor(-3.5293808, shape=(), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()

op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()

op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()

op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_qr *Computes the QR decomposition of a tensor.*

Description

Computes the QR decomposition of a tensor.

Usage

```
op_qr(x, mode = "reduced")
```

Arguments

x	Input tensor of shape (..., M, N).
mode	A string specifying the mode of the QR decomposition. • 'reduced': Returns the reduced QR decomposition. (default) • 'complete': Returns the complete QR decomposition.

Value

A list containing two tensors. The first tensor of shape (..., M, K) is the orthogonal matrix q and the second tensor of shape (..., K, N)is the upper triangular matrixr, where K = min(M, N)`.

Examples

```
x <- op_convert_to_tensor(rbind(c(1, 2), c(3, 4), c(5, 6)))
op_qr(x)

## $q
## tf.Tensor(
## [[-0.16903085  0.89708523]
##  [-0.50709255  0.27602622]
##  [-0.84515425 -0.34503278]], shape=(3, 2), dtype=float64)
##
## $r
## tf.Tensor(
## [[-5.91607978 -7.43735744]
##  [ 0.          0.82807867]], shape=(2, 2), dtype=float64)


c(q, r) %<-% op_qr(x)
```

See Also

- https://keras.io/api/ops/core#qr-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_rfft()
op_rsqrt()

op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()

op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
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op_cumsum()
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op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()

op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
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op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()

op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()

op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()

op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_quantile *Compute the q-th quantile(s) of the data along the specified axis.*

Description

Compute the q-th quantile(s) of the data along the specified axis.

Usage

```
op_quantile(x, q, axis = NULL, method = "linear", keepdims = FALSE)
```

Arguments

`x`	Input tensor.
`q`	Probability or sequence of probabilities for the quantiles to compute. Values must be between 0 and 1 inclusive.
`axis`	Axis or axes along which the quantiles are computed. Defaults to `axis=NULL` which is to compute the quantile(s) along a flattened version of the array.
`method`	A string specifies the method to use for estimating the quantile. Available methods are `"linear"`, `"lower"`, `"higher"`, `"midpoint"`, and `"nearest"`. Defaults to `"linear"`. If the desired quantile lies between two data points `i < j`: • `"linear"`: `i + (j - i) * fraction`, where fraction is the fractional part of the index surrounded by `i` and `j`. • `"lower"`: `i`. • `"higher"`: `j`. • `"midpoint"`: `(i + j) / 2` • `"nearest"`: `i` or `j`, whichever is nearest.
`keepdims`	If this is set to `TRUE`, the axes which are reduce are left in the result as dimensions with size one.

Value

The quantile(s). If `q` is a single probability and `axis = NULL`, then the result is a scalar. If multiple probabilities levels are given, first axis of the result corresponds to the quantiles. The other axes are the axes that remain after the reduction of `x`.

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_average()`

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()

op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_ravel()
op_real()
op_reciprocal()

op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
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op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
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op_bitwise_xor()
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op_cosh()
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op_ctc_decode()

op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
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op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
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op_floor_divide()
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op_gelu()
op_get_item()
op_glu()
op_greater()
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op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()

op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
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op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()

op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()

op_tensordot()
op_threshold()
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op_top_k()
op_trace()
op_transpose()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_ravel *Return a contiguous flattened tensor.*

Description

A 1-D tensor, containing the elements of the input, is returned.

Usage

```
op_ravel(x)
```

Arguments

x	Input tensor.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#ravel-function

Other numpy ops:
op_abs()

op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()

op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()

op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()

op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()

op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()

op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()

op_quantile()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()

op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_real *Return the real part of the complex argument.*

Description

Return the real part of the complex argument.

Usage

```
op_real(x)
```

Arguments

x	Input tensor.

Value

The real component of the complex argument.

See Also

- https://keras.io/api/ops/numpy#real-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()

op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()

op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()

op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()

op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()

op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()

op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_rearrange *Rearranges the axes of a Keras tensor according to a specified pattern,*

Description

einops-style.

Usage

```
op_rearrange(tensor, pattern, ...)
```

Arguments

tensor	Input Keras tensor.
pattern	String describing the rearrangement in einops notation.
...	axes_lengths, named arguments specifying lengths of axes when axes decomposition is used.

Value

Tensor: A Keras tensor with rearranged axes.

Follows the logic of:

1. If decomposition is needed, reshape to match decomposed dimensions.
2. Permute known and inferred axes to match the form of the output.
3. Reshape to match the desired output shape.

Example Usage:

```
images <- op_ones(c(32, 30, 40, 3)) # BHWC format

# Reordering to BCHW
op_rearrange(images, 'b h w c -> b c h w') |> op_shape()

## shape(32, 3, 30, 40)
```

```
# "Merge" along first axis - concat images from a batch
op_rearrange(images, 'b h w c -> (b h) w c') |> op_shape()

## shape(960, 40, 3)


# "Merge" along second axis - concat images horizontally
op_rearrange(images, 'b h w c -> h (b w) c') |> op_shape()

## shape(30, 1280, 3)


# Flatten images into a CHW vector
op_rearrange(images, 'b h w c -> b (c h w)') |> op_shape()

## shape(32, 3600)


# Decompose H and W axes into 4 smaller patches
op_rearrange(images, 'b (h1 h) (w1 w) c -> (b h1 w1) h w c', h1 = 2, w1 = 2) |> op_shape()

## shape(128, 15, 20, 3)


# Space-to-depth decomposition of input axes
op_rearrange(images, 'b (h h1) (w w1) c -> b h w (c h1 w1)', h1 = 2, w1 = 2) |> op_shape()

## shape(32, 15, 20, 12)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()

op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()

op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()

op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()

op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()

op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_reciprocal *Return the reciprocal of the argument, element-wise.*

Description

Calculates 1/x.

Usage

```
op_reciprocal(x)
```

Arguments

x	Input tensor.

Value

Output tensor, element-wise reciprocal of x.

See Also

- https://keras.io/api/ops/numpy#reciprocal-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()

op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()

op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()

op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()

op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
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op_floor_divide()
op_fori_loop()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()

op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_logical_xor()
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op_max_pool()
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op_median()
op_meshgrid()
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op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()

op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()

op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()

op_while_loop()
op_zeros()
op_zeros_like()

op_relu *Rectified linear unit activation function.*

Description

It is defined as `f(x) = max(0, x)`.

Usage

```
op_relu(x)
```

Arguments

x	Input tensor.

Value

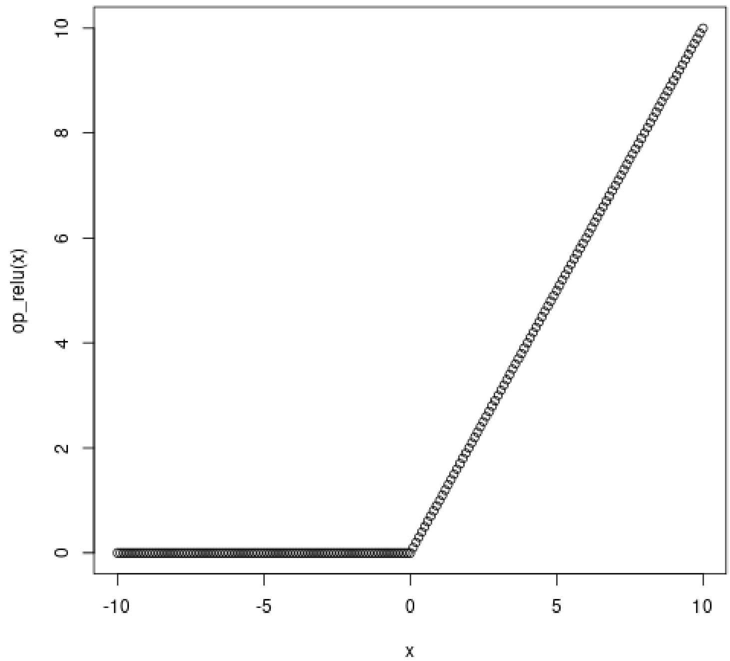
A tensor with the same shape as `x`.

Examples

```
x1 <- op_convert_to_tensor(c(-1, 0, 1, 0.2))
op_relu(x1)
```

```
## tf.Tensor([0.  0.  1.  0.2], shape=(4), dtype=float64)
```

```
x <- seq(-10, 10, .1)
plot(x, op_relu(x))
```



See Also

- https://keras.io/api/ops/nn#relu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()

op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_relu6 *Rectified linear unit activation function with upper bound of 6.*

Description

It is defined as `f(x) = op_clip(x, 0, 6)`.

Usage

```
op_relu6(x)
```

Arguments

x	Input tensor.

Value

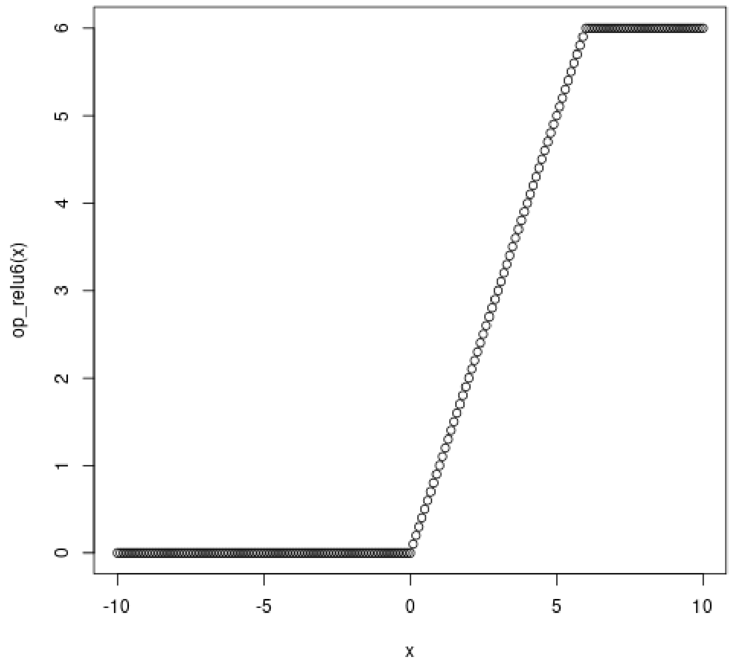
A tensor with the same shape as `x`.

Examples

```
x <- op_convert_to_tensor(c(-3, -2, 0.1, 0.2, 6, 8))
op_relu6(x)
```

```
## tf.Tensor([0.  0.  0.1 0.2 6.  6. ], shape=(6), dtype=float64)
```

```
x <- seq(-10, 10, .1)
plot(x, op_relu6(x))
```



See Also

- https://keras.io/api/ops/nn#relu6-function

Other nn ops:
`op_average_pool()`
`op_batch_normalization()`
`op_binary_crossentropy()`
`op_categorical_crossentropy()`
`op_celu()`
`op_conv()`
`op_conv_transpose()`
`op_ctc_loss()`
`op_depthwise_conv()`
`op_dot_product_attention()`
`op_elu()`
`op_gelu()`
`op_glu()`
`op_hard_shrink()`
`op_hard_sigmoid()`
`op_hard_silu()`
`op_hard_tanh()`
`op_leaky_relu()`
`op_log_sigmoid()`

op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
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op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
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op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_repeat *Repeat each element of a tensor after themselves.*

Description

Repeat each element of a tensor after themselves.

Usage

```
op_repeat(x, repeats, axis = NULL)
```

Arguments

x	Input tensor.
repeats	The number of repetitions for each element.
axis	The axis along which to repeat values. By default, use the flattened input array, and return a flat output array.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#repeat-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()

op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()

op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()

op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
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op_triu()
op_trunc()
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op_vdot()
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op_vstack()
op_where()
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op_zeros_like()

Other ops:

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op_conv_transpose()
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op_convert_to_tensor()
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op_floor_divide()
op_fori_loop()
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op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
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op_hard_silu()
op_hard_tanh()
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op_hstack()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_isnan()
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op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()

op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
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op_meshgrid()
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op_moments()
op_moveaxis()
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op_multiply()
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op_ndim()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()

op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()

op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_reshape *Gives a new shape to a tensor without changing its data.*

Description

Gives a new shape to a tensor without changing its data.

Usage

```
op_reshape(x, newshape)
```

Arguments

x	Input tensor.
newshape	The new shape should be compatible with the original shape. One shape dimension can be -1 in which case the value is inferred from the length of the array and remaining dimensions.

Value

The reshaped tensor.

See Also

- https://keras.io/api/ops/numpy#reshape-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_argmin()
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op_array()
op_associative_scan()
op_average()
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op_bincount()
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op_bitwise_not()
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op_diff()
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op_erfinv()
op_exp()
op_exp2()

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op_fft2()
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op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_inv()
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op_isinf()
op_isnan()
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op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
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op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
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op_ones()
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op_outer()
op_pad()
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op_prod()
op_psnr()
op_qr()
op_quantile()
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op_reciprocal()
op_relu()
op_relu6()
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op_rms_normalization()
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op_scan()
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op_segment_sum()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
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op_split()
op_sqrt()
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op_zeros_like()

---

op_rfft *Real-valued Fast Fourier Transform along the last axis of the input.*

Description

Computes the 1D Discrete Fourier Transform of a real-valued signal over the inner-most dimension of input.

Since the Discrete Fourier Transform of a real-valued signal is Hermitian-symmetric, RFFT only returns the `fft_length / 2 + 1` unique components of the FFT: the zero-frequency term, followed by the `fft_length / 2` positive-frequency terms.

Along the axis RFFT is computed on, if `fft_length` is smaller than the corresponding dimension of the input, the dimension is cropped. If it is larger, the dimension is padded with zeros.

Usage

```
op_rfft(x, fft_length = NULL)
```

Arguments

`x`	Input tensor.
`fft_length`	An integer representing the number of the fft length. If not specified, it is inferred from the length of the last axis of `x`. Defaults to `NULL`.

Value

A list containing two tensors - the real and imaginary parts of the output.

Examples

```
x <- op_convert_to_tensor(c(0, 1, 2, 3, 4))
op_rfft(x)


## [[1]]
## tf.Tensor([10.  -2.5 -2.5], shape=(3), dtype=float64)
##
## [[2]]
## tf.Tensor([0.         3.4409548  0.81229924], shape=(3), dtype=float64)



op_rfft(x, 3)


## [[1]]
## tf.Tensor([ 3.  -1.5], shape=(2), dtype=float64)
##
## [[2]]
## tf.Tensor([0.        0.8660254], shape=(2), dtype=float64)
```

See Also

- https://keras.io/api/ops/fft#rfft-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()

op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
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op_max()
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op_meshgrid()
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op_mod()
op_moments()
op_moveaxis()
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op_multiply()
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op_polar()
op_power()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_relu6()
op_repeat()
op_reshape()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_svd()
op_swapaxes()
op_switch()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_right_shift` *Shift the bits of an integer to the right.*

Description

Bits are shifted to the right `y`. Because the internal representation of numbers is in binary format, this operation is equivalent to dividing `x` by `2^y`.

Usage

```
op_right_shift(x, y)
```

Arguments

`x`	Input integer tensor.
`y`	Input integer tensor.

Value

Result tensor.

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_average()`
`op_bincount()`
`op_bitwise_and()`

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
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op_expm1()
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op_floor_divide()
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op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()

op_inner()
op_isclose()
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op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
op_all()
op_any()
op_append()
op_arange()

op_arccos()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_rms_normalization *Performs Root Mean Square (RMS) normalization on* x.

Description

The Keras operation implements the operation as described in Root Mean Square Layer Normalization by Biao Zhang et al.

The operation is different from LayerNormalization with RMS scaling.

It is defined as `rms_normalization(x) = x * rsqrt(mean(square(x))) * scale`

Usage

```
op_rms_normalization(x, scale = 1L, axis = -1L, epsilon = NULL)
```

Arguments

x	Input tensor.
scale	Optional scaling factor for the normalization.
axis	The axis or axes along which to perform normalization. Default to -1.
epsilon	A lower bound value for the norm. Defaults to `config_epsilon()`.

Value

The normalized array.

Examples

```
x <- random_uniform(c(1, 10))
x_norm <- op_rms_normalization(x, scale = 10)
x_norm
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()

op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
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op_celu()
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op_cond()
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op_conv_transpose()
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op_cumsum()
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op_divide()
op_divide_no_nan()
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op_dot_product_attention()
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op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()

op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_roll *Roll tensor elements along a given axis.*

Description

Elements that roll beyond the last position are re-introduced at the first.

Usage

```
op_roll(x, shift, axis = NULL)
```

Arguments

x	Input tensor.

shift	The number of places by which elements are shifted.
axis	The axis along which elements are shifted. By default, the array is flattened before shifting, after which the original shape is restored.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#roll-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()

op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()

op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()

op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()

op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_rot90 *Rotate an array by 90 degrees in the plane specified by axes.*

Description

This function rotates an array counterclockwise by 90 degrees k times in the plane specified by axes. Supports arrays of two or more dimensions.

Usage

```
op_rot90(array, k = 1L, axes = list(1L, 2L))
```

Arguments

array	Input array to rotate.
k	Number of times the array is rotated by 90 degrees.
axes	A tuple of two integers specifying the plane of rotation (defaults to (1, 2)).

Value

Rotated array.

Examples

```
m <- 1:4 |> op_reshape(c(2, 2))
m

## tf.Tensor(
## [[1 2]
##  [3 4]], shape=(2, 2), dtype=int32)


op_rot90(m)

## tf.Tensor(
## [[2 4]
##  [1 3]], shape=(2, 2), dtype=int32)


m <- 1:8 |> op_reshape(c(2, 2, 2))
m
```

```
## tf.Tensor(
## [[[1 2]
##   [3 4]]
##
##  [[5 6]
##   [7 8]]], shape=(2, 2, 2), dtype=int32)
```

```
op_rot90(m, k = 1, axes = c(2, 3))
```

```
## tf.Tensor(
## [[[2 4]
##   [1 3]]
##
##  [[6 8]
##   [5 7]]], shape=(2, 2, 2), dtype=int32)
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()

op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_round()
op_saturate_cast()
op_select()
op_sign()

op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()

op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()

op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()

op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()

op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_round — *Evenly round to the given number of decimals.*

Description

Evenly round to the given number of decimals.

Usage

```
op_round(x, decimals = 0L)
```

Arguments

x	Input tensor.
decimals	Number of decimal places to round to. Defaults to 0.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#round-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()

op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()

op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()

op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()

op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()

op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()

op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
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op_median()
op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()

op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()

op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_rsqrt *Computes reciprocal of square root of x element-wise.*

Description

Computes reciprocal of square root of x element-wise.

Usage

```
op_rsqrt(x)
```

Arguments

x	input tensor

Value

A tensor with the same dtype as x.

Examples

```
x <- op_convert_to_tensor(c(1, 10, 100))
op_rsqrt(x)

## tf.Tensor([1.         0.31622777 0.1       ], shape=(3), dtype=float64)


# array([1, 0.31622776, 0.1], dtype=float32)
```

See Also

- https://keras.io/api/ops/core#rsqrt-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
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op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()

op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_not()
op_bitwise_or()
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op_broadcast_to()
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op_categorical_crossentropy()
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op_det()
op_diag()
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op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_einsum()
op_elu()
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op_log1p()
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op_log_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_squareplus()
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op_stft()
op_stop_gradient()
op_subset()
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op_sum()
op_svd()
op_swapaxes()
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op_tanh_shrink()
op_tensordot()
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op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_saturate_cast *Performs a safe saturating cast to the desired dtype.*

Description

Saturating cast prevents data type overflow when casting to dtype with smaller values range. E.g. op_cast(c(-1, 256), "float32") |> op_cast("uint8") returns c(255, 0), but op_cast(c(-1, 256), "float32") |> op_saturate_cast("uint8") returns c(0, 255).

Usage

```
op_saturate_cast(x, dtype)
```

Arguments

x	A tensor or variable.
dtype	The target type.

Value

A safely casted tensor of the specified dtype.

Examples

Image resizing with bicubic interpolation may produce values outside original range.

```
image2x2 <- np_array(as.integer(c(0, 1, 254, 255)), "uint8") |>
  array_reshape(c(1, 2, 2, 1))
image4x4 <- image2x2 |>
  tensorflow::tf$image$resize(shape(4, 4), method="bicubic")
image4x4 |> as.array() |> drop()
```

```
##            [,1]      [,2]      [,3]      [,4]
## [1,] -22.50000 -22.20462 -21.61891 -21.32353
## [2,]  52.52605  52.82143  53.40715  53.70253
## [3,] 201.29752 201.59288 202.17859 202.47395
## [4,] 276.32355 276.61893 277.20465 277.50006
```

Casting this resized image back to `uint8` will cause overflow.

```
image4x4_casted <- op_cast(image4x4, "uint8")
image4x4_casted |> as.array() |> drop()
```

```
##      [,1] [,2] [,3] [,4]
## [1,]  234  234  235  235
## [2,]   52   52   53   53
## [3,]  201  201  202  202
## [4,]   20   20   21   21
```

Saturate casting to `uint8` will clip values to `uint8` range before casting and will not cause overflow.

```
image4x4_saturate_casted <- image4x4 |> op_saturate_cast("uint8")
image4x4_saturate_casted |> as.array() |> drop()
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    0    0    0    0
## [2,]   52   52   53   53
## [3,]  201  201  202  202
## [4,]  255  255  255  255
```

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`

op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()

op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()

op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
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op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
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op_divide_no_nan()
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op_dot_product_attention()
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op_gelu()
op_get_item()
op_glu()
op_greater()
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op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_isinf()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_logsumexp()
op_lstsq()
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op_outer()
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op_psnr()
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op_right_shift()
op_rms_normalization()
op_roll()

op_rot90()
op_round()
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op_scan()
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op_scatter_update()
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op_segment_sum()
op_select()
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op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_scan *Scan a function over leading array axes while carrying along state.*

Description

When the type of xs is an array type or NULL, and the type of ys is an array type, the semantics of op_scan() are given roughly by this implementation:

```
op_scan <- function(f, init, xs = NULL, length = NULL) {
  xs <- xs %||% vector("list", length)
  if(!is.list(xs))
    xs <- op_unstack(xs)
  ys <- vector("list", length(xs))
  carry <- init
  for (i in seq_along(xs)) {
    c(carry, y) %<-% f(carry, xs[[i]])
    ys[[i]] <- y
  }
  list(carry, op_stack(ys))
}
```

The loop-carried value `carry` (`init`) must hold a fixed shape and dtype across all iterations.

In TensorFlow, `y` must match `carry` in shape and dtype. This is not required in other backends.

Usage

```
op_scan(f, init, xs = NULL, length = NULL, reverse = FALSE, unroll = 1L)
```

Arguments

`f`	Callable defines the logic for each loop iteration. This accepts two arguments where the first is a value of the loop carry and the second is a slice of `xs` along its leading axis. This callable returns a pair where the first represents a new value for the loop carry and the second represents a slice of the output.
`init`	The initial loop carry value. This can be a scalar, tensor, or any nested structure. It must match the structure of the first element returned by `f`.
`xs`	Optional value to scan along its leading axis. This can be a tensor or any nested structure. If `xs` is not provided, you must specify `length` to define the number of loop iterations. Defaults to `NULL`.
`length`	Optional integer specifying the number of loop iterations. If `length` is not provided, it defaults to the sizes of leading axis of the arrays in `xs`. Defaults to `NULL`.
`reverse`	Optional boolean specifying whether to run the scan iteration forward or in reverse, equivalent to reversing the leading axes of the arrays in both `xs` and in `ys`.
`unroll`	Optional positive integer or boolean specifying how many scan iterations to unroll within a single iteration of a loop. If an integer is provided, it determines how many unrolled loop iterations to run within a single rolled iteration of the loop. If a boolean is provided, it will determine if the loop is completely unrolled (`unroll=TRUE`) or left completely unrolled (`unroll=FALSE`). Note that unrolling is only supported by JAX and TensorFlow backends.

Value

A pair where the first element represents the final loop carry value and the second element represents the stacked outputs of `f` when scanned over the leading axis of the inputs.

Examples

```
sum_fn <- function(c, x) list(c + x, c + x)
init <- op_array(0L)
xs <- op_array(1:5)
c(carry, result) %<-% op_scan(sum_fn, init, xs)
carry

## tf.Tensor(15, shape=(), dtype=int32)


result
```

```
## tf.Tensor([ 1  3  6 10 15], shape=(5), dtype=int32)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()

op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
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op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
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op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_scatter *Returns a tensor of shape* shape *where* indices *are set to* values.

Description

At a high level, this operation does zeros[indices] = updates and returns the output. It is equivalent to:

```
output <- op_scatter_update(op_zeros(shape), indices, values)
```

Usage

```
op_scatter(indices, values, shape)
```

Arguments

indices	A tensor or list specifying indices for the values in values.
values	A tensor, the values to be set at indices.
shape	Shape of the output tensor.

Value

A tensor of shape shape where indices are set to values.

Examples

```
op_scatter(indices = rbind(1), values = 1, shape = c(5))

## tf.Tensor([1. 0. 0. 0. 0.], shape=(5), dtype=float64)


op_scatter(indices = rbind(1, 3), values = 1:2, shape = c(5))

## tf.Tensor([1 0 2 0 0], shape=(5), dtype=int32)
```

```
indices <- rbind(c(1, 2), c(2, 2))
values <- op_array(c(1, 1))
op_scatter(indices, values, shape = c(2, 2))

## tf.Tensor(
## [[0. 1.]
##  [0. 1.]], shape=(2, 2), dtype=float32)
```

See Also

- https://keras.io/api/ops/core#scatter-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()

op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
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op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
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op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()

op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
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op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()

op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()

op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_scatter_update   *Update inputs via updates at scattered (sparse) indices.*

Description

At a high level, this operation does `inputs[indices] <- updates`. Assume `inputs` is a tensor of shape `(D1, D2, ..., Dn)`, there are 2 main usages of `scatter_update`.

1. `indices` is a 2D tensor of shape `(num_updates, n)`, where `num_updates` is the number of updates to perform, and `updates` is a 1D tensor of shape `(num_updates)`. For example, if `inputs` is `op_zeros(c(4, 4, 4))`, and we want to update `inputs[2, 3, 4]` and `inputs[1, 2, 4]` as `1`, then we can use:

```
inputs <- op_zeros(c(4, 4, 4))
indices <- rbind(c(2, 3, 4),
                 c(1, 2, 4))
updates <- op_array(c(1, 1), "float32")
op_scatter_update(inputs, indices, updates)

## tf.Tensor(
## [[[0. 0. 0. 0.]
##   [0. 0. 0. 1.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]]
##
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 1.]
##   [0. 0. 0. 0.]]
##
```

```
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]]
##
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]]], shape=(4, 4, 4), dtype=float32)
```

2 `indices` is a 2D tensor of shape `(num_updates, k)`, where `num_updates` is the number of updates to perform, and `k` (`k <= n`) is the size of each index in `indices`. `updates` is a `n - k`-D tensor of shape `(num_updates, shape(inputs)[-(1:k)])`. For example, if `inputs <- op_zeros(c(4, 4, 4))`, and we want to update `inputs[1, 2, ]` and `inputs[2, 3, ]` as `[1, 1, 1, 1]`, then `indices` would have shape `(num_updates, 2)` (`k = 2`), and `updates` would have shape `(num_updates, 4)` (`shape(inputs)[3:4] == 4`). See the code below:

```
inputs <- op_zeros(c(4, 4, 4))
indices <- rbind(c(2, 3),
                 c(3, 4))
updates <- op_array(rbind(c(1, 1, 1, 1),
                          c(1, 1, 1, 1)),
                    "float32")
op_scatter_update(inputs, indices, updates)
```

```
## tf.Tensor(
## [[[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]]
##
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [1. 1. 1. 1.]
##   [0. 0. 0. 0.]]
##
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [1. 1. 1. 1.]]
##
##  [[0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]
##   [0. 0. 0. 0.]]], shape=(4, 4, 4), dtype=float32)
```

Usage

```
op_scatter_update(inputs, indices, updates)
```

Arguments

`inputs`	A tensor, the tensor to be updated.
`indices`	A tensor or list of shape `(N, inputs$ndim)`, specifying indices to update. `N` is the number of indices to update, must be equal to the first dimension of `updates`.
`updates`	A tensor, the new values to be put to `inputs` at `indices`.

Value

A tensor, has the same shape and dtype as `inputs`.

See Also

- `https://keras.io/api/ops/core#scatterupdate-function`

Other core ops:
`op_associative_scan()`
`op_cast()`
`op_cond()`
`op_convert_to_numpy()`
`op_convert_to_tensor()`
`op_custom_gradient()`
`op_dtype()`
`op_fori_loop()`
`op_is_tensor()`
`op_map()`
`op_rearrange()`
`op_scan()`
`op_scatter()`
`op_searchsorted()`
`op_shape()`
`op_slice()`
`op_slice_update()`
`op_stop_gradient()`
`op_subset()`
`op_switch()`
`op_unstack()`
`op_vectorized_map()`
`op_while_loop()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()

op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
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op_istft()
op_leaky_relu()
op_left_shift()
op_less()
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op_linspace()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()

op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
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op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
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op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
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op_stop_gradient()
op_subset()
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op_sum()
op_svd()
op_swapaxes()
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op_take()
op_take_along_axis()
op_tan()
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op_tanh_shrink()

op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_searchsorted   *Perform a binary search*

Description

Perform a binary search, returning indices for insertion of `values` into `sorted_sequence` that maintain the sorting order.

Usage

```
op_searchsorted(sorted_sequence, values, side = "left", zero_indexed = FALSE)
```

Arguments

`sorted_sequence`	1-D input tensor, sorted along the innermost dimension.
`values`	N-D tensor of query insertion values.
`side`	`'left'` or `'right'`, specifying the direction in which to insert for the equality case (tie-breaker).
`zero_indexed`	If `TRUE`, the returned indices are zero-based (`0` encodes to first position); if `FALSE` (default), the returned indices are one-based (`1` encodes to first position).

Value

Tensor of insertion indices of same shape as `values`.

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
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op_segment_sum()
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op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
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op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_subset()
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op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_segment_max *Computes the max of segments in a tensor.*

Description

Computes the max of segments in a tensor.

Usage

```
op_segment_max(data, segment_ids, num_segments = NULL, sorted = FALSE)
```

Arguments

data	Input tensor.
segment_ids	A N-D tensor containing segment indices for each element in data. head(op_shape(data), length(op_shape(segment_ids))) should match op_shape(segment_ids)
num_segments	An integer representing the total number of segments. If not specified, it is inferred from the maximum value in segment_ids.
sorted	A boolean indicating whether segment_ids is sorted. Defaults to FALSE.

Value

A tensor containing the max of segments, where each element represents the max of the corresponding segment in data.

Examples

```
data <- op_convert_to_tensor(c(1, 2, 10, 20, 100, 200))
segment_ids <- op_array(c(1, 1, 2, 2, 3, 3), "int32")
num_segments <- 3
op_segment_max(data, segment_ids, num_segments)


## tf.Tensor([  2.  20. 200.], shape=(3), dtype=float64)


# array([2, 20, 200], dtype=int32)
```

See Also

- https://keras.io/api/ops/core#segmentmax-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_sum()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()

op_isfinite()
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op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
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op_lstsq()
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op_max()
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op_maximum()
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op_median()
op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()

op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
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op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_segment_sum *Computes the sum of segments in a tensor.*

Description

Computes the sum of segments in a tensor.

Usage

```
op_segment_sum(data, segment_ids, num_segments = NULL, sorted = FALSE)
```

Arguments

data	Input tensor.
segment_ids	A N-D tensor containing segment indices for each element in data. Num dims for segment ids should be strictly smaller or equal to number of dims in data.
num_segments	An integer representing the total number of segments. If not specified, it is inferred from the maximum value in segment_ids.
sorted	A boolean indicating whether segment_ids is sorted. Defaults to FALSE.

Value

A tensor containing the sum of segments, where each element represents the sum of the corresponding segment in data.

Examples

```
data <- op_array(c(1, 2, 10, 20, 100, 200))
segment_ids <- op_array(c(1, 1, 2, 2, 3, 3), "int32")
num_segments <- 3
op_segment_sum(data, segment_ids, num_segments)

## tf.Tensor([  3.   30. 300.], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/core#segmentsum-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()

op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_solve()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()

op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
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op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_full_like()
op_gelu()
op_get_item()
op_glu()
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op_hard_sigmoid()
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op_hard_tanh()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()

op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_select *Return elements from* choicelist, *based on conditions in* condlist.

Description

Return elements from choicelist, based on conditions in condlist.

Usage

```
op_select(condlist, choicelist, default = 0L)
```

Arguments

condlist	List of boolean tensors. The list of conditions which determine from which array in choicelist the output elements are taken. When multiple conditions are satisfied, the first one encountered in condlist is used.
choicelist	List of tensors. The list of tensors from which the output elements are taken. This list has to be of the same length as `condlist`.
default	Optional scalar value. The element inserted in the output when all conditions evaluate to `FALSE`.

Value

Tensor where the output at position `m` is the `m`-th element of the tensor in `choicelist` where the `m`-th element of the corresponding tensor in `condlist` is `TRUE`.

Examples

```
x <- op_arange(6L)
condlist <- list(x < 3, x > 3)
choicelist <- list(x, x^2)
op_select(condlist, choicelist, 42)

## tf.Tensor([ 1  2 42 16 25 36], shape=(6), dtype=int32)
```

See Also

Other numpy ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()

op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cast()
op_categorical_crossentropy()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_selu *Scaled Exponential Linear Unit (SELU) activation function.*

Description

It is defined as:
`f(x) = scale * alpha * (exp(x) - 1.) for x < 0`, `f(x) = scale * x for x >= 0`.

Usage

```
op_selu(x)
```

Arguments

x	Input tensor.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-1, 0, 1))
op_selu(x)

## tf.Tensor([-1.1113307  0.         1.050701 ], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#selu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_separable_conv   *General N-D separable convolution.*

Description

This ops supports 1D and 2D separable convolution. `separable_conv` is a depthwise conv followed by a pointwise conv.

Usage

```
op_separable_conv(
```

```
  inputs,
  depthwise_kernel,
  pointwise_kernel,
  strides = 1L,
  padding = "valid",
  data_format = NULL,
  dilation_rate = 1L
)
```

Arguments

inputs
: Tensor of rank N+2. `inputs` has shape `(batch_size,) + inputs_spatial_shape + (num_channels,)` if `data_format="channels_last"`, or `(batch_size, num_channels) + inputs_spatial_shape` if `data_format="channels_first"`.

depthwise_kernel
: Tensor of rank N+2. `depthwise_kernel` has shape `[kernel_spatial_shape, num_input_channels, n`
`num_input_channels` should match the number of channels in `inputs`.

pointwise_kernel
: Tensor of rank N+2. `pointwise_kernel` has shape `(*ones_like(kernel_spatial_shape), num_inpu`

strides
: int or int tuple/list of `len(inputs_spatial_shape)`, specifying the strides of the convolution along each spatial dimension. If `strides` is int, then every spatial dimension shares the same `strides`.

padding
: string, either `"valid"` or `"same"`. `"valid"` means no padding is applied, and `"same"` results in padding evenly to the left/right or up/down of the input such that output has the same height/width dimension as the input when `strides=1`.

data_format
: A string, either `"channels_last"` or `"channels_first"`. `data_format` determines the ordering of the dimensions in the inputs. If `data_format="channels_last"`, `inputs` is of shape `(batch_size, ..., channels)` while if `data_format="channels_first"`, `inputs` is of shape `(batch_size, channels, ...)`.

dilation_rate
: int or int tuple/list of `len(inputs_spatial_shape)`, specifying the dilation rate to use for dilated convolution. If `dilation_rate` is int, then every spatial dimension shares the same `dilation_rate`.

Value

A tensor of rank N+2, the result of the depthwise conv operation.

See Also

- https://keras.io/api/ops/nn#separableconv-function

Other nn ops:
`op_average_pool()`
`op_batch_normalization()`
`op_binary_crossentropy()`
`op_categorical_crossentropy()`
`op_celu()`
`op_conv()`

op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()

op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_eigh()
op_einsum()
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op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()

op_segment_sum()
op_select()
op_selu()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()

op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_shape *Gets the shape of the tensor input.*

Description

Gets the shape of the tensor input.

Usage

```
op_shape(x)
```

Arguments

x	A tensor. This function will try to access the shape attribute of the input tensor.

Value

A list of integers or NULL values, indicating the shape of the input tensor.

Note

On the TensorFlow backend, when x is a tf.Tensor with dynamic shape, dimensions which are dynamic in the context of a compiled function will have a tf.Tensor value instead of a static integer value.

Examples

```
x <- op_zeros(c(8, 12))
op_shape(x)

## shape(8, 12)
```

See Also

- https://keras.io/api/ops/core#shape-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()

op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
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op_full_like()
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op_hard_silu()
op_hard_tanh()
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op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_isinf()
op_isnan()
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op_meshgrid()
op_min()

op_minimum()
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op_multiply()
op_nan_to_num()
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op_negative()
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op_not_equal()
op_one_hot()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
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op_right_shift()
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op_rsqrt()
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op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()

op_separable_conv()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sigmoid *Sigmoid activation function.*

Description

It is defined as `f(x) = 1 / (1 + exp(-x))`.

Usage

```
op_sigmoid(x)
```

Arguments

x Input tensor.

Value

A tensor with the same shape as `x`.

Examples

```
x <- op_convert_to_tensor(c(-6, 1, 0, 1, 6))
op_sigmoid(x)

## tf.Tensor([0.00247262 0.73105858 0.5        0.73105858 0.99752738], shape=(5), dtype=float64)
```

See Also

- https://keras.io/api/ops/nn#sigmoid-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()

op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()

op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()

op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sign *Returns a tensor with the signs of the elements of* x.

Description

Returns a tensor with the signs of the elements of x.

Usage

```
op_sign(x)
```

Arguments

x Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#sign-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_signbit()
op_sin()
op_sinh()
op_size()
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op_split()
op_sqrt()
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op_stack()
op_std()
op_subtract()
op_sum()
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op_take()
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op_tanh()
op_tensordot()
op_tile()
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op_zeros_like()

Other ops:
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op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_signbit *Return the sign bit of the elements of* x.

Description

The output boolean tensor contains TRUE where the sign of x is negative, and FALSE otherwise.

Usage

```
op_signbit(x)
```

Arguments

x	Input tensor.

Value

Output boolean tensor of same shape as x.

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()

op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()

op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_sin()
op_sinh()

op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()

op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
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op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()

op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_hstack()
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op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()

op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_leaky_relu()
op_left_shift()
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op_less_equal()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()

op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_silu()

op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()

op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_silu *Sigmoid Linear Unit (SiLU) activation function, also known as Swish.*

Description

The SiLU activation function is computed by the sigmoid function multiplied by its input. It is defined as `f(x) = x * sigmoid(x)`.

Usage

```
op_silu(x)
```

Arguments

x	Input tensor.

Value

A tensor with the same shape as x.

Examples

```
x <- op_convert_to_tensor(c(-6, 1, 0, 1, 6))
op_sigmoid(x)

## tf.Tensor([0.00247262 0.73105858 0.5        0.73105858 0.99752738], shape=(5), dtype=float64)


op_silu(x)

## tf.Tensor([-0.01483574  0.73105858  0.          0.73105858  5.98516426], shape=(5), dtype=float64)
```

See Also

- https://keras.io/api/ops/nn#silu-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()

op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()

op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()

op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sin *Trigonometric sine, element-wise.*

Description

Trigonometric sine, element-wise.

Usage

```
op_sin(x)
```

Arguments

x Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#sin-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
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op_log1p()
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op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
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op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
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op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
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op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sinh *Hyperbolic sine, element-wise.*

Description

Hyperbolic sine, element-wise.

Usage

```
op_sinh(x)
```

Arguments

x	Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#sinh-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()

op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()

op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
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op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()

op_signbit()
op_sin()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
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op_zeros_like()

Other ops:
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op_argmin()
op_argpartition()
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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
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op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()

op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()

op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()

op_sign()
op_signbit()
op_silu()
op_sin()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_size *Return the number of elements in a tensor.*

Description

Return the number of elements in a tensor.

Usage

```
op_size(x)
```

Arguments

x	Input tensor.

Value

Number of elements in x.

See Also

- https://keras.io/api/ops/numpy#size-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()

op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
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op_add()
op_all()
op_any()
op_append()
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op_arccos()
op_arccosh()
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op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
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op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_xor()
op_broadcast_to()
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op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
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op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()

op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
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op_left_shift()
op_less()
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op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()

op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_slice *Return a slice of an input tensor.*

Description

At a high level, this operation is an explicit replacement for array slicing e.g. `inputs[start_indices:(start_indices + shape)]`. Unlike slicing via brackets, this operation will accept tensor start indices on all backends, which is useful when indices dynamically computed via other tensor operations.

```
(inputs <- op_arange(5*5) |> op_reshape(c(5, 5)))
```

```
## tf.Tensor(
## [[ 1.  2.  3.  4.  5.]
##  [ 6.  7.  8.  9. 10.]
##  [11. 12. 13. 14. 15.]
```

```
## [16. 17. 18. 19. 20.]
## [21. 22. 23. 24. 25.]], shape=(5, 5), dtype=float32)
```

```
start_indices <- c(3, 3)
shape <- c(2, 2)
op_slice(inputs, start_indices, shape)
```

```
## tf.Tensor(
## [[13. 14.]
## [18. 19.]], shape=(2, 2), dtype=float32)
```

Usage

```
op_slice(inputs, start_indices, shape)
```

Arguments

inputs	A tensor, the tensor to be sliced.
start_indices	A list of length inputs$ndim, specifying the starting indices for updating.
shape	The full shape of the returned slice.

Value

A tensor, has the same shape and dtype as inputs.

See Also

- https://keras.io/api/ops/core#slice-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice_update()

op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
op_logdet()
op_logical_and()
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op_lstsq()
op_lu_factor()
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op_moveaxis()
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op_ones()
op_ones_like()
op_outer()
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op_polar()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
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op_sort()
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op_sparse_plus()
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op_stft()

op_stop_gradient()
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op_sum()
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op_swapaxes()
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op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
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op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_slice_update *Update an input by slicing in a tensor of updated values.*

Description

At a high level, this operation does `inputs[start_indices: start_indices + updates.shape] = updates`. Assume inputs is a tensor of shape `(D1, D2, ..., Dn)`, `start_indices` must be a list of n integers, specifying the starting indices. `updates` must have the same rank as `inputs`, and the size of each dim must not exceed `Di - start_indices[i]`. For example, if we have 2D inputs `inputs = op_zeros(c(5, 5))`, and we want to update the intersection of last 2 rows and last 2 columns as 1, i.e., `inputs[4:5, 4:5] = op_ones(c(2, 2))`, then we can use the code below:

```
inputs <- op_zeros(c(5, 5))
start_indices <- c(3, 3)
updates <- op_ones(c(2, 2))
op_slice_update(inputs, start_indices, updates)
```

```
## tf.Tensor(
## [[0. 0. 0. 0. 0.]
##  [0. 0. 0. 0. 0.]
##  [0. 0. 1. 1. 0.]
##  [0. 0. 1. 1. 0.]
##  [0. 0. 0. 0. 0.]], shape=(5, 5), dtype=float32)
```

Usage

```
op_slice_update(inputs, start_indices, updates)
```

Arguments

`inputs`	A tensor, the tensor to be updated.
`start_indices`	A list of length `inputs$ndim`, specifying the starting indices for updating.
`updates`	A tensor, the new values to be put to `inputs` at `indices`. `updates` must have the same rank as `inputs`.

Value

A tensor, has the same shape and dtype as `inputs`.

See Also

- https://keras.io/api/ops/core#sliceupdate-function

Other core ops:
`op_associative_scan()`
`op_cast()`
`op_cond()`
`op_convert_to_numpy()`
`op_convert_to_tensor()`
`op_custom_gradient()`
`op_dtype()`
`op_fori_loop()`
`op_is_tensor()`
`op_map()`
`op_rearrange()`
`op_scan()`
`op_scatter()`
`op_scatter_update()`
`op_searchsorted()`
`op_shape()`

op_slice()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
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op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()

op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_slogdet *Compute the sign and natural logarithm of the determinant of a matrix.*

Description

Compute the sign and natural logarithm of the determinant of a matrix.

Usage

```
op_slogdet(x)
```

Arguments

x	Input matrix. It must 2D and square.

Value

A list: `(sign, logabsdet)`. `sign` is a number representing the sign of the determinant. For a real matrix, this is 1, 0, or -1. For a complex matrix, this is a complex number with absolute value 1 (i.e., it is on the unit circle), or else 0. `logabsdet` is the natural log of the absolute value of the determinant.

See Also

Other linear algebra ops:
`op_cholesky()`
`op_det()`
`op_eig()`
`op_eigh()`
`op_inv()`
`op_lstsq()`
`op_lu_factor()`
`op_norm()`
`op_solve_triangular()`
`op_svd()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`
`op_associative_scan()`
`op_average()`
`op_average_pool()`
`op_batch_normalization()`
`op_binary_crossentropy()`

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()

op_elu()
op_empty()
op_equal()
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op_full()
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op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
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op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()

op_is_tensor()
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op_isfinite()
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op_log2()
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op_log_softmax()
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op_moveaxis()
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op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_soft_shrink()

op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_sum()
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op_switch()
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op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()

op_zeros()
op_zeros_like()

---

op_softmax *Softmax activation function.*

Description

The elements of the output vector lie within the range `(0, 1)`, and their total sum is exactly 1 (excluding the floating point rounding error).

Each vector is processed independently. The `axis` argument specifies the axis along which the function is applied within the input.

It is defined as: `f(x) = exp(x) / sum(exp(x))`

Usage

```
op_softmax(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	Integer, axis along which the softmax is applied.

Value

A tensor with the same shape as `x`.

Examples

```
x <- op_array(c(-1, 0, 1))
op_softmax(x)

## tf.Tensor([0.09003057 0.24472848 0.66524094], shape=(3), dtype=float32)
```

See Also

- https://keras.io/api/ops/nn#softmax-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()

op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()

op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
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op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()

op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
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op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fori_loop()
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op_gelu()
op_get_item()
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op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()

op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
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op_reciprocal()
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op_rms_normalization()
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op_rsqrt()
op_saturate_cast()
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op_segment_sum()
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op_separable_conv()
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op_slogdet()
op_soft_shrink()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
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op_sum()
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op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()

op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_softplus *Softplus activation function.*

Description

It is defined as `f(x) = log(exp(x) + 1)`, where `log` is the natural logarithm and `exp` is the exponential function.

Usage

```
op_softplus(x)
```

Arguments

x	Input tensor.

Value

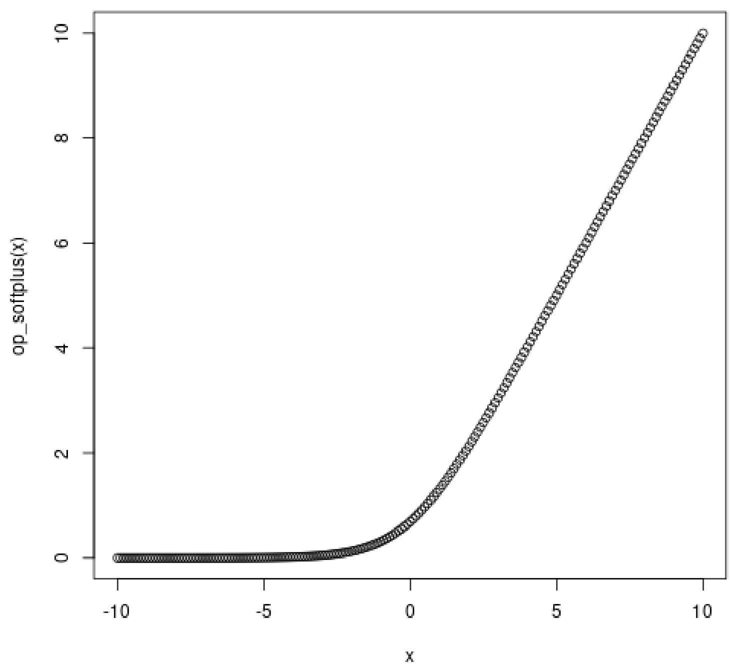
A tensor with the same shape as `x`.

Examples

```
x <- op_convert_to_tensor(c(-0.555, 0, 0.555))
op_softplus(x)

## tf.Tensor([0.45366606 0.69314718 1.00866606], shape=(3), dtype=float64)
```

```
x <- seq(-10, 10, .1)
plot(x, op_softplus(x))
```



See Also

- https://keras.io/api/ops/nn#softplus-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
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op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softsign()
op_sparse_categorical_crossentropy()
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Other ops:
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op_arctanh()
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op_argpartition()
op_argsort()
op_array()

op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_xor()
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op_image_rgb_to_hsv()
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op_sinh()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_softsign *Softsign activation function.*

Description

It is defined as `f(x) = x / (abs(x) + 1)`.

Usage

```
op_softsign(x)
```

Arguments

x	Input tensor.

Value

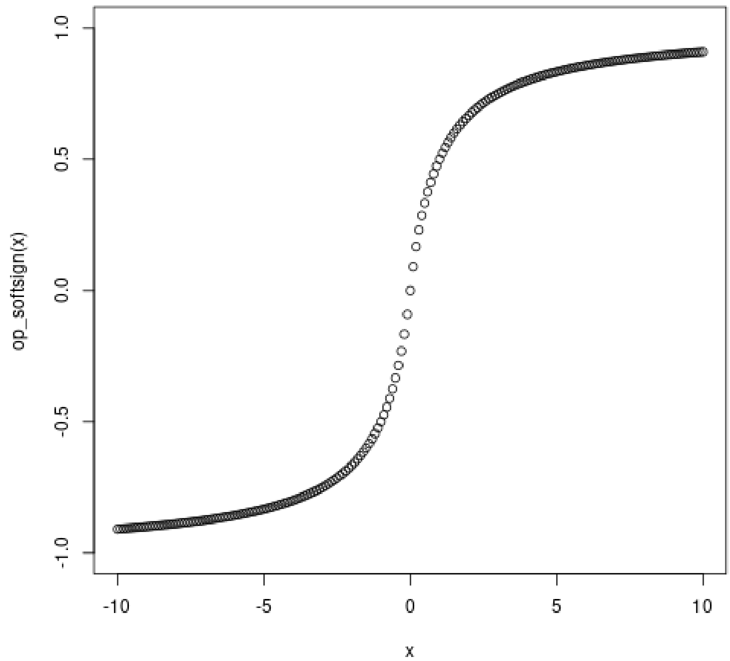
A tensor with the same shape as `x`.

Examples

```
x <- op_convert_to_tensor(c(-0.100, -10.0, 1.0, 0.0, 100.0))
op_softsign(x)

## tf.Tensor([-0.09090909 -0.90909091  0.5        0.         0.99009901], shape=(5), dtype=float64)

x <- seq(-10, 10, .1)
plot(x, op_softsign(x), ylim = c(-1, 1))
```



See Also

- https://keras.io/api/ops/nn#softsign-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()

op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
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op_threshold()
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Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_cast()
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op_celu()
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op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

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op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
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op_softmax()
op_softplus()
op_solve()
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op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()

op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_soft_shrink *Soft Shrink activation function.*

Description

It is defined as

f(x) = x - threshold if x > threshold, f(x) = x + threshold if x < -threshold, f(x) = 0 otherwise.

Usage

```
op_soft_shrink(x, threshold = 0.5)
```

Arguments

x	Input tensor.
threshold	Threshold value. Defaults to 0.5.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-1, 0, 1))
op_soft_shrink(x)

## tf.Tensor([-0.5  0.   0.5], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()

op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()

op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()

op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()

op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()

op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_solve *Solves a linear system of equations given by* a x = b.

Description

Solves for x in the equation a %*% x == b.

Usage

```
op_solve(a, b)
```

Arguments

a	A tensor of shape (..., M, M) representing the coefficients matrix.
b	A tensor of shape (..., M) or (..., M, N) representing the right-hand side or "dependent variable" matrix.

Value

A tensor of shape (..., M) or (..., M, N) representing the solution of the linear system. Returned shape is identical to b.

Examples

```
a <- op_array(c(1, 2, 4, 5), dtype="float32") |> op_reshape(c(2, 2))
b <- op_array(c(2, 4, 8, 10), dtype="float32") |> op_reshape(c(2, 2))
op_solve(a, b)

## tf.Tensor(
## [[2. 0.]
##  [0. 2.]], shape=(2, 2), dtype=float32)
```

See Also

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_stft()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()

op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()

op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()

op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()

op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_solve_triangular   *Solves a linear system of equations given by* a %*% x = b.

Description

Solves a linear system of equations given by a %*% x = b.

Usage

```
op_solve_triangular(a, b, lower = FALSE)
```

Arguments

a	A tensor of shape (..., M, M) representing the coefficients matrix.
b	A tensor of shape (..., M) or (..., M, N) representing the right-hand side or "dependent variable" matrix.
lower	logical. Use only data contained in the lower triangle of a. Default is to use upper triangle.

Value

A tensor of shape (..., M) or (..., M, N) representing the solution of the linear system. Returned shape is identical to b.

See Also

Other linear algebra ops:
op_cholesky()
op_det()
op_eig()
op_eigh()
op_inv()
op_lstsq()
op_lu_factor()
op_norm()
op_slogdet()
op_svd()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()

op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()

op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()

op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()

op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()

op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sort *Sorts the elements of* x *along a given axis in ascending order.*

Description

Sorts the elements of x along a given axis in ascending order.

Usage

```
op_sort(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	Axis along which to sort. If NULL, the tensor is flattened before sorting. Defaults to -1; the last axis.

Value

Sorted tensor.

See Also

- https://keras.io/api/ops/numpy#sort-function

Other numpy ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()

op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_sin()
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op_size()
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op_sqrt()
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op_squeeze()
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op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()

op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_extract_sequences()
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op_floor_divide()
op_fori_loop()
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op_gelu()
op_get_item()
op_glu()
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op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
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op_log_softmax()
op_logaddexp()
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op_quantile()

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op_slogdet()
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op_solve()
op_solve_triangular()
op_sparse_categorical_crossentropy()
op_sparse_plus()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sparsemax   *Sparsemax activation function.*

Description

For each batch `i`, and class `j`, sparsemax activation function is defined as:
`sparsemax(x)[i, j] = max(x[i, j] - (x[i, :]), 0).`

Usage

```
op_sparsemax(x, axis = -1L)
```

Arguments

x	Input tensor.
axis	int, axis along which the sparsemax operation is applied.

Value

A tensor, output of sparsemax transformation. Has the same type and shape as x.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_sparsemax(x)

## tf.Tensor([0. 0. 1.], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
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op_leaky_relu()
op_log_sigmoid()
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op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()

op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
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op_average_pool()
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op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
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op_transpose()
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op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_sparse_categorical_crossentropy

Computes sparse categorical cross-entropy loss.

Description

The sparse categorical cross-entropy loss is similar to categorical cross-entropy, but it is used when the target tensor contains integer class labels instead of one-hot encoded vectors. It measures the dissimilarity between the target and output probabilities or logits.

Usage

```
op_sparse_categorical_crossentropy(
  target,
  output,
  from_logits = FALSE,
  axis = -1L
)
```

Arguments

`target`	The target tensor representing the true class labels as integers. Its shape should match the shape of the `output` tensor except for the last dimension.
`output`	The output tensor representing the predicted probabilities or logits. Its shape should match the shape of the `target` tensor except for the last dimension.
`from_logits`	(optional) Whether `output` is a tensor of logits or probabilities. Set it to `TRUE` if `output` represents logits; otherwise, set it to `FALSE` if `output` represents probabilities. Defaults to `FALSE`.
`axis`	(optional) The axis along which the sparse categorical cross-entropy is computed. Defaults to `-1`, which corresponds to the last dimension of the tensors.

Value

Integer tensor: The computed sparse categorical cross-entropy loss between `target` and `output`.

Examples

```
target <- op_array(c(0, 1, 2), dtype="int32")
output <- op_array(rbind(c(0.9, 0.05, 0.05),
                         c(0.1, 0.8,  0.1),
                         c(0.2, 0.3,  0.5)))
op_sparse_categorical_crossentropy(target, output)

## tf.Tensor([0.10536052 0.22314355 0.69314718], shape=(3), dtype=float64)
```

See Also

- https://keras.io/api/ops/nn#sparsecategoricalcrossentropy-function

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
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op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_celu()
op_cholesky()
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op_cond()
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op_hard_shrink()
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op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_imag()
op_image_affine_transform()
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op_image_extract_patches()
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op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sparse_plus *SparsePlus activation function.*

Description

It is defined as

`f(x) = 0` for x <= -1. `f(x) = (1/4) * (x + 1)^2` for -1 `< x < 1`. `f(x) = x` for x >= 1.

Usage

```
op_sparse_plus(x)
```

Arguments

x	Input tensor.

Value

A tensor with the same shape as `x`.

Examples

```
x <- op_array(c(-1.0, 0.0, 1.0))
op_sparse_plus(x)

## tf.Tensor([0.   0.25 1.  ], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
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op_hard_tanh()
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op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()

op_sparse_categorical_crossentropy()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()

op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()

op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()

op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
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op_matmul()
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op_max_pool()
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op_median()
op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()

op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
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op_sigmoid()
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op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
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op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_split *Split a tensor into chunks.*

Description

Split a tensor into chunks.

Usage

```
op_split(x, indices_or_sections, axis = 1L)
```

Arguments

x
: Input tensor.

indices_or_sections
: If an integer, N, the tensor will be split into N equal sections along `axis`. If a 1-D array of sorted integers, the entries indicate indices at which the tensor will be split along `axis`.

axis
: Axis along which to split. Defaults to 1, the first axis.

Value

A list of tensors.

Note

A split does not have to result in equal division when using Torch backend.

Example

```
x <- op_arange(12)

# pass a scalar integer for n sections
op_split(x, 2)

## [[1]]
## tf.Tensor([1. 2. 3. 4. 5. 6.], shape=(6), dtype=float32)
##
## [[2]]
## tf.Tensor([ 7.  8.  9. 10. 11. 12.], shape=(6), dtype=float32)


op_split(x, 3)

## [[1]]
## tf.Tensor([1. 2. 3. 4.], shape=(4), dtype=float32)
##
## [[2]]
## tf.Tensor([5. 6. 7. 8.], shape=(4), dtype=float32)
##
## [[3]]
## tf.Tensor([ 9. 10. 11. 12.], shape=(4), dtype=float32)


# 1-d array/tensor for indices
op_split(x, array(c(3, 8)))

## [[1]]
## tf.Tensor([1. 2.], shape=(2), dtype=float32)
##
```

```
## [[2]]
## tf.Tensor([3. 4. 5. 6. 7.], shape=(5), dtype=float32)
##
## [[3]]
## tf.Tensor([ 8.  9. 10. 11. 12.], shape=(5), dtype=float32)
```

```
op_split(x, array(c(3)))
```

```
## [[1]]
## tf.Tensor([1. 2.], shape=(2), dtype=float32)
##
## [[2]]
## tf.Tensor([ 3.  4.  5.  6.  7.  8.  9. 10. 11. 12.], shape=(10), dtype=float32)
```

See Also

- https://keras.io/api/ops/numpy#split-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
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op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
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op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
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op_expm1()
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op_floor()
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op_full_like()
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op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
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op_isinf()
op_isnan()
op_left_shift()
op_less()

op_less_equal()
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op_logdet()
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op_logical_not()
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op_logical_xor()
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op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
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op_reshape()
op_right_shift()
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op_tanh()
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op_tril()
op_triu()
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op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_arctan2()
op_arctanh()

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op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
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op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_not()
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op_bitwise_right_shift()
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op_convert_to_tensor()
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op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
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op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()

op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
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op_einsum()
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op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()

op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()

op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()

op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
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op_sum()
op_svd()
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op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sqrt *Return the non-negative square root of a tensor, element-wise.*

Description

Return the non-negative square root of a tensor, element-wise.

Usage

```
op_sqrt(x)
```

Arguments

x	Input tensor.

Value

Output tensor, the non-negative square root of x.

See Also

- https://keras.io/api/ops/numpy#sqrt-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()

op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor()
op_floor_divide()
op_full()
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op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
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op_isinf()
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op_logical_or()
op_logical_xor()
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op_lstsq()
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op_mean()
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op_meshgrid()
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op_mod()
op_moveaxis()
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op_vstack()

op_where()
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op_zeros_like()

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op_eye()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()

op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
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op_left_shift()
op_less()
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op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()

op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
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op_multiply()
op_nan_to_num()
op_ndim()
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op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()

op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()

op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_square *Return the element-wise square of the input.*

Description

Return the element-wise square of the input.

Usage

```
op_square(x)
```

Arguments

x	Input tensor.

Value

Output tensor, the square of x.

See Also

- https://keras.io/api/ops/numpy#square-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
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op_power()
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op_quantile()
op_ravel()
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op_reciprocal()
op_repeat()
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op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()

op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
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Other ops:
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op_array()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_separable_conv()
op_shape()
op_sigmoid()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
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op_unravel_index()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

`op_squareplus` *Squareplus activation function.*

Description

The Squareplus activation function is defined as:

`f(x) = (x + sqrt(x^2 + b)) / 2`

Usage

```
op_squareplus(x, b = 4L)
```

Arguments

`x`	Input tensor.
`b`	Smoothness parameter. Defaults to 4.

Value

A tensor with the same shape as `x`.

Examples

```
x <- op_array(c(-1.0, 0.0, 1.0))
op_squareplus(x)

## tf.Tensor([0.618034 1.       1.618034], shape=(3), dtype=float32)
```

See Also

Other nn ops:
`op_average_pool()`
`op_batch_normalization()`
`op_binary_crossentropy()`
`op_categorical_crossentropy()`
`op_celu()`
`op_conv()`
`op_conv_transpose()`
`op_ctc_loss()`
`op_depthwise_conv()`
`op_dot_product_attention()`
`op_elu()`
`op_gelu()`
`op_glu()`
`op_hard_shrink()`
`op_hard_sigmoid()`

op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_tanh_shrink()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()

op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()

op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_is_tensor()
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op_log_softmax()
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op_lstsq()
op_lu_factor()
op_map()
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op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_relu6()
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op_reshape()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_scatter()
op_scatter_update()
op_searchsorted()
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op_segment_sum()
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op_selu()
op_separable_conv()
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op_signbit()
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op_sin()
op_sinh()
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op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
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op_solve()
op_solve_triangular()
op_sort()
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op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
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op_std()
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op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()

op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_squeeze *Remove axes of length one from* x.

Description

Remove axes of length one from x.

Usage

```
op_squeeze(x, axis = NULL)
```

Arguments

x	Input tensor.
axis	Select a subset of the entries of length one in the shape.

Value

The input tensor with all or a subset of the dimensions of length 1 removed.

See Also

- https://keras.io/api/ops/numpy#squeeze-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
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op_full()

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op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
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op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()

op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()

op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()

op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
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op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()

op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
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op_sign()
op_signbit()
op_silu()
op_sin()
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op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
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op_sqrt()
op_square()
op_squareplus()
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op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()

op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_stack *Join a sequence of tensors along a new axis.*

Description

The axis parameter specifies the index of the new axis in the dimensions of the result.

Usage

```
op_stack(x, axis = 1L)
```

Arguments

x	A sequence of tensors.
axis	Axis along which to stack. Defaults to 1, the first axis.

Value

The stacked tensor.

See Also

- https://keras.io/api/ops/numpy#stack-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
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op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
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op_power()
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op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
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op_select()
op_sign()
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op_sinh()
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op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
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op_tri()
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op_triu()
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Other ops:
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op_bitwise_right_shift()

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op_expand_dims()
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op_greater_equal()
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op_hard_sigmoid()
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op_hard_tanh()
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op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
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op_log()
op_log10()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
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op_map()
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op_max()
op_max_pool()
op_maximum()
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op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
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op_outer()
op_pad()
op_polar()

op_power()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_std *Compute the standard deviation along the specified axis.*

Description

Compute the standard deviation along the specified axis.

Usage

```
op_std(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	Axis along which to compute standard deviation. Default is to compute the standard deviation of the flattened tensor.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

Value

Output tensor containing the standard deviation values.

See Also

- https://keras.io/api/ops/numpy#std-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()

op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()

op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()

op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_custom_gradient()
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op_det()

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op_diagflat()
op_diagonal()
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op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
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op_normalize()
op_not_equal()
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op_ones()
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op_scatter()
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op_slogdet()
op_soft_shrink()
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op_squareplus()
op_squeeze()
op_stack()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_stft *Short-Time Fourier Transform along the last axis of the input.*

Description

The STFT computes the Fourier transform of short overlapping windows of the input. This giving frequency components of the signal as they change over time.

Usage

```
op_stft(
  x,
  sequence_length,
  sequence_stride,
  fft_length,
  window = "hann",
  center = TRUE
)
```

Arguments

x Input tensor.

sequence_length
An integer representing the sequence length.

sequence_stride
An integer representing the sequence hop size.

fft_length An integer representing the size of the FFT to apply. If not specified, uses the smallest power of 2 enclosing sequence_length.

window	A string, a tensor of the window or NULL. If window is a string, available values are "hann" and "hamming". If window is a tensor, it will be used directly as the window and its length must be sequence_length. If window is NULL, no windowing is used. Defaults to "hann".
center	Whether to pad x on both sides so that the t-th sequence is centered at time t * sequence_stride. Otherwise, the t-th sequence begins at time t * sequence_stride. Defaults to TRUE.

Value

A list containing two tensors - the real and imaginary parts of the STFT output.

Examples

```
x <- op_array(c(0, 1, 2, 3, 4))
op_stft(x, 3, 2, 3)

## [[1]]
## tf.Tensor(
## [[ 0.  0.]
##  [ 2. -1.]
##  [ 4. -2.]], shape=(3, 2), dtype=float32)
##
## [[2]]
## tf.Tensor(
## [[ 0.         0.       ]
##  [ 0.        -1.7320508]
##  [ 0.        -3.4641016]], shape=(3, 2), dtype=float32)
```

See Also

- https://keras.io/api/ops/fft#stft-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()

op_segment_sum()
op_solve()
op_top_k()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()

op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()

op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()

op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()

op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stop_gradient()
op_subset()
op_subtract()

op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_stop_gradient *Stops gradient computation.*

Description

Stops gradient computation.

Usage

```
op_stop_gradient(variable)
```

Arguments

variable	A tensor variable for which the gradient computation is to be disabled.

Value

The variable with gradient computation disabled.

Examples

```
var <- op_convert_to_tensor(c(1, 2, 3), dtype="float32")
var <- op_stop_gradient(var)
```

See Also

- https://keras.io/api/ops/core#stopgradient-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()

op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()

op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()

op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()

op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_subset *Subset elements from a tensor*

Description

Extract elements from a tensor using common R-style `[` indexing idioms. This function can also be conveniently accessed via the syntax `tensor@r[...]`.

Usage

```
op_subset(x, ...)

op_subset(x, ...) <- value

op_subset_set(x, ..., value)
```

Arguments

`x`	Input tensor.
`...`	Indices specifying elements to extract. Each argument in `...` can be: • An integer scalar • A 1-d integer or logical vector • `NULL` or `newaxis` • The `..` symbol • A slice expression using `:` If only a single argument is supplied to `...`, then `..1` can also be: • A logical array with the same shape as `x` • An integer matrix where `ncol(..1) == op_rank(x)`
`value`	new value to replace the selected subset with.

Details

While the semantics are similar to R's `[`, there are some differences:

Value

A tensor containing the subset of elements.

Differences from R's `[`:

- Negative indices follow Python-style indexing, counting from the end of the array.
- `NULL` or `newaxis` adds a new dimension (equivalent to `op_expand_dims()`).
- If fewer indices than dimensions (`op_rank(x)`) are provided, missing dimensions are implicitly filled. For example, if `x` is a matrix, `x[1]` returns the first row.
- `..` or `all_dims()` expands to include all unspecified dimensions (see examples).
- Extended slicing syntax (`:`) is supported, including:
  - Strided steps: `x@r[start:end:step]`
  - `NA` values for `start` and `end`. `NA` for `start` defaults to `1`, and `NA` for `end` defaults to the axis size.
- A logical array matching the shape of `x` selects elements in row-wise order.

Similarities with R's `[`:

Similarities to R's `[` (differences from Python's `[`):

- Positive indices are 1-based.
- Slices (`x[start:end]`) are inclusive of `end`.
- 1-d logical/integer arrays subset along their respective axis. Multiple vectors provided for different axes return intersected subsets.
- A single integer matrix with `ncol(i) == op_rank(x)` selects elements by coordinates. Each row in the matrix specifies the location of one value, where each column corresponds to an axis in the tensor being subsetted. This means you use a 2-column matrix to subset a matrix, a 3-column matrix to subset a 3d array, and so on.

Examples

```
(x <- op_arange(5L) + 10L)

## tf.Tensor([11 12 13 14 15], shape=(5), dtype=int32)


# Basic example, get first element
op_subset(x, 1)

## tf.Tensor(11, shape=(), dtype=int32)
```

```
# Use `@r[` syntax
x@r[1]          # same as `op_subset(x, 1)`

## tf.Tensor(11, shape=(), dtype=int32)


x@r[1:2]        # get the first 2 elements

## tf.Tensor([11 12], shape=(2), dtype=int32)


x@r[c(1, 3)]    # first and third element

## tf.Tensor([11 13], shape=(2), dtype=int32)


# Negative indices
x@r[-1]         # last element

## tf.Tensor(15, shape=(), dtype=int32)


x@r[-2]         # second to last element

## tf.Tensor(14, shape=(), dtype=int32)


x@r[c(-1, -2)]  # last and second to last elements

## tf.Tensor([15 14], shape=(2), dtype=int32)


x@r[c(-2, -1)]  # second to last and last elements

## tf.Tensor([14 15], shape=(2), dtype=int32)


x@r[c(1, -1)]   # first and last elements

## tf.Tensor([11 15], shape=(2), dtype=int32)


# Slices
x@r[1:3]         # first 3 elements

## tf.Tensor([11 12 13], shape=(3), dtype=int32)
```

```
x@r[NA:3]         # first 3 elements

## tf.Tensor([11 12 13], shape=(3), dtype=int32)


x@r[1:5]          # all elements

## tf.Tensor([11 12 13 14 15], shape=(5), dtype=int32)


x@r[1:-1]         # all elements

## tf.Tensor([11 12 13 14 15], shape=(5), dtype=int32)


x@r[NA:NA]        # all elements

## tf.Tensor([11 12 13 14 15], shape=(5), dtype=int32)


x@r[]             # all elements

## tf.Tensor([11 12 13 14 15], shape=(5), dtype=int32)


x@r[1:-2]         # drop last element

## tf.Tensor([11 12 13 14], shape=(4), dtype=int32)


x@r[NA:-2]        # drop last element

## tf.Tensor([11 12 13 14], shape=(4), dtype=int32)


x@r[2:NA]         # drop first element

## tf.Tensor([12 13 14 15], shape=(4), dtype=int32)


# 2D array examples
xr <- array(1:12, c(3, 4))
x <- op_convert_to_tensor(xr)

# Basic subsetting
x@r[1, ]      # first row
```

```
## tf.Tensor([ 1  4  7 10], shape=(4), dtype=int32)


x@r[1]        # also first row! Missing axes are implicitly inserted

## tf.Tensor([ 1  4  7 10], shape=(4), dtype=int32)


x@r[-1]       # last row

## tf.Tensor([ 3  6  9 12], shape=(4), dtype=int32)


x@r[, 2]      # second column

## tf.Tensor([4 5 6], shape=(3), dtype=int32)


x@r[, 2:2]    # second column, but shape preserved (like [, drop=FALSE])

## tf.Tensor(
## [[4]
##  [5]
##  [6]], shape=(3, 1), dtype=int32)


# Subsetting with a boolean array
# Note: extracted elements are selected row-wise, not column-wise
mask <- x >= 6
x@r[mask]             # returns a 1D tensor

## tf.Tensor([ 7 10  8 11  6  9 12], shape=(7), dtype=int32)


x.r <- as.array(x)
mask.r <- as.array(mask)
# as.array(x)[mask] selects column-wise. Use `aperm()` to reverse search order.
all(aperm(x.r)[aperm(mask.r)] == as.array(x@r[mask]))

## [1] TRUE


# Subsetting with a matrix of index positions
indices <- rbind(c(1, 1), c(2, 2), c(3, 3))
x@r[indices] # get diagonal elements

## tf.Tensor([1 5 9], shape=(3), dtype=int32)
```

```
x.r[indices] # same as subsetting an R array

## [1] 1 5 9


# 3D array examples
# Image: 4x4 pixels, 3 colors (RGB)
# Tensor shape: (img_height, img_width, img_color_channels)
shp <- shape(4, 4, 3)
x <- op_arange(prod(shp)) |> op_reshape(shp)

# Convert to a batch of images by inserting a new axis
# New shape: (batch_size, img_height, img_width, img_color_channels)
x@r[newaxis, , , ] |> op_shape()

## shape(1, 4, 4, 3)


x@r[newaxis] |> op_shape()  # same as above

## shape(1, 4, 4, 3)


x@r[NULL] |> op_shape()     # same as above

## shape(1, 4, 4, 3)


x <- x@r[newaxis]
# Extract color channels
x@r[, , , 1]          # red channel

## tf.Tensor(
## [[[ 1.  4.  7. 10.]
##   [13. 16. 19. 22.]
##   [25. 28. 31. 34.]
##   [37. 40. 43. 46.]]], shape=(1, 4, 4), dtype=float32)


x@r[.., 1]            # red channel, same as above using .. shorthand

## tf.Tensor(
## [[[ 1.  4.  7. 10.]
##   [13. 16. 19. 22.]
##   [25. 28. 31. 34.]
##   [37. 40. 43. 46.]]], shape=(1, 4, 4), dtype=float32)
```

```
x@r[.., 2]            # green channel

## tf.Tensor(
## [[[ 2.  5.  8. 11.]
##   [14. 17. 20. 23.]
##   [26. 29. 32. 35.]
##   [38. 41. 44. 47.]]], shape=(1, 4, 4), dtype=float32)


x@r[.., 3]            # blue channel

## tf.Tensor(
## [[[ 3.  6.  9. 12.]
##   [15. 18. 21. 24.]
##   [27. 30. 33. 36.]
##   [39. 42. 45. 48.]]], shape=(1, 4, 4), dtype=float32)


# .. expands to all unspecified axes.
op_shape(x@r[])

## shape(1, 4, 4, 3)


op_shape(x@r[..])

## shape(1, 4, 4, 3)


op_shape(x@r[1, ..])

## shape(4, 4, 3)


op_shape(x@r[1, .., 1, 1])

## shape(4)


op_shape(x@r[1, 1, 1, .., 1])

## shape()


# op_subset<- uses the same semantics, but note that not all tensors
# support modification. E.g., TensorFlow constant tensors cannot be modified,
# while TensorFlow Variables can be.

(x <- tensorflow::tf$Variable(matrix(1, nrow = 2, ncol = 3)))
```

```
## <tf.Variable 'Variable:0' shape=(2, 3) dtype=float64, numpy=
## array([[1., 1., 1.],
##        [1., 1., 1.]])>
```

```
op_subset(x, 1) <- 9
x
```

```
## <tf.Variable 'UnreadVariable' shape=(2, 3) dtype=float64, numpy=
## array([[9., 9., 9.],
##        [1., 1., 1.]])>
```

```
x@r[1,1] <- 33
x
```

```
## <tf.Variable 'UnreadVariable' shape=(2, 3) dtype=float64, numpy=
## array([[33.,  9.,  9.],
##        [ 1.,  1.,  1.]])>
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
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Other ops:
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op_arccos()
op_arccosh()
op_arcsin()
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op_gelu()
op_get_item()
op_glu()
op_greater()
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op_quantile()
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op_relu()
op_relu6()
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op_rms_normalization()
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op_rot90()
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---

op_subtract *Subtract arguments element-wise.*

Description

Note that this function is automatically called when using the R operator - with a tensor.

```
x <- op_ones(c(3))
op_subtract(x, x)

## tf.Tensor([0. 0. 0.], shape=(3), dtype=float32)
```

```
x - x
```

```
## tf.Tensor([0. 0. 0.], shape=(3), dtype=float32)
```

Usage

```
op_subtract(x1, x2)
```

Arguments

x1	First input tensor.
x2	Second input tensor.

Value

Output tensor, element-wise difference of x1 and x2.

See Also

- https://keras.io/api/ops/numpy#subtract-function

Other numpy ops:
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op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
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op_ceil()
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op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()

op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
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op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
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op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
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op_stop_gradient()
op_subset()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()

op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_sum *Sum of a tensor over the given axes.*

Description

Sum of a tensor over the given axes.

Usage

```
op_sum(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	Axis or axes along which the sum is computed. The default is to compute the sum of the flattened tensor.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

Value

Output tensor containing the sum.

See Also

- https://keras.io/api/ops/numpy#sum-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()

op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()

op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()

op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_sin()
op_sinh()
op_size()
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op_split()
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op_tanh()
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op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()

op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
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op_add()
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op_get_item()
op_glu()
op_greater()
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op_hard_tanh()
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op_image_pad()
op_image_perspective_transform()
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op_image_rgb_to_hsv()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
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op_polar()
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op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()

op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_signbit()
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op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()

op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_svd *Computes the singular value decomposition of a matrix.*

Description

Computes the singular value decomposition of a matrix.

Usage

```
op_svd(x, full_matrices = TRUE, compute_uv = TRUE)
```

Arguments

`x`	Input tensor of shape `(..., M, N)`.
`full_matrices`	Logical
`compute_uv`	Logical

Value

A list of three tensors:

- a tensor of shape `(..., M, M)` containing the left singular vectors,
- a tensor of shape `(..., M, N)` containing the singular values and
- a tensor of shape `(..., N, N)` containing the right singular vectors.

See Also

- `https://www.tensorflow.org/api_docs/python/tf/keras/ops/svd`

Other linear algebra ops:
`op_cholesky()`
`op_det()`
`op_eig()`
`op_eigh()`
`op_inv()`
`op_lstsq()`
`op_lu_factor()`
`op_norm()`
`op_slogdet()`
`op_solve_triangular()`

Other ops:
`op_abs()`
`op_add()`
`op_all()`
`op_any()`
`op_append()`
`op_arange()`
`op_arccos()`
`op_arccosh()`
`op_arcsin()`
`op_arcsinh()`
`op_arctan()`
`op_arctan2()`
`op_arctanh()`
`op_argmax()`
`op_argmin()`
`op_argpartition()`
`op_argsort()`
`op_array()`

op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()

op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()

op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_leaky_relu()
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op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
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op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
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op_max_pool()
op_maximum()
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op_meshgrid()
op_min()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()

op_ndim()
op_negative()
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op_norm()
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op_not_equal()
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op_ones()
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op_outer()
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op_polar()
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op_ravel()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()

op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()

op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_swapaxes *Interchange two axes of a tensor.*

Description

Interchange two axes of a tensor.

Usage

```
op_swapaxes(x, axis1, axis2)
```

Arguments

x	Input tensor.
axis1	First axis.
axis2	Second axis.

Value

A tensor with the axes swapped.

See Also

- https://keras.io/api/ops/numpy#swapaxes-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()

op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()

op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
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op_celu()
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op_clip()
op_concatenate()
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op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()

op_correlate()
op_cos()
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op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
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op_full()
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op_gelu()
op_get_item()
op_glu()
op_greater()

op_greater_equal()
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op_hard_silu()
op_hard_tanh()
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op_hstack()
op_identity()
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op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
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op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
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op_logical_xor()

op_logspace()
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op_lstsq()
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op_sparse_plus()
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op_subset()
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op_sum()
op_svd()

op_switch()
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op_take_along_axis()
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op_while_loop()
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op_zeros_like()

op_switch *Apply exactly one of the* branches *given by* index.

Description

If index is out of bounds, it is clamped to within bounds.

The semantics of switch are given roughly by this implementation:

```
op_switch <- function(index, branches, ...) {
  index <- op_clip(index, 1, length(branches))
  branches[[index]](...)
}
```

Usage

```
op_switch(index, branches, ...)
```

Arguments

index	An integer scalar indicating which branch function to apply (1-based).
branches	A list of functions to be applied based on index.
...	Inputs to whichever branch is applied.

Value

The outputs of branch(...) for the branch that was selected based on index.

Examples

```
add_fn <- function(x, y) x + y + 100
subtract_fn <- function(x, y) x - y - 100
x <- op_array(2)
y <- op_array(0.5)
branches <- list(add_fn, subtract_fn)
op_switch(0, branches, x, y) # +

## tf.Tensor(102.5, shape=(), dtype=float32)


op_switch(1, branches, x, y) # +

## tf.Tensor(102.5, shape=(), dtype=float32)


op_switch(2, branches, x, y) # -

## tf.Tensor(-98.5, shape=(), dtype=float32)


op_switch(3, branches, x, y) # -

## tf.Tensor(-98.5, shape=(), dtype=float32)
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()

op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
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op_hard_silu()
op_hard_tanh()
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op_reciprocal()
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op_rms_normalization()
op_roll()
op_rot90()
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op_saturate_cast()
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op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_take *Take elements from a tensor along an axis.*

Description

Take elements from a tensor along an axis.

Usage

```
op_take(x, indices, axis = NULL, zero_indexed = FALSE)
```

Arguments

x	Source tensor.
indices	The indices of the values to extract.
axis	The axis over which to select values. By default, the flattened input tensor is used.
zero_indexed	If TRUE, treats indices as zero-based (0 encodes to first position); if FALSE (default), treats indices as one-based (1 encodes to first position).

Value

The corresponding tensor of values.

See Also

- https://keras.io/api/ops/numpy#take-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()

op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
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op_full()
op_full_like()
op_get_item()
op_greater()
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op_histogram()
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op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()

op_rot90()
op_round()
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op_select()
op_sign()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()

op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_take_along_axis *Select values from* x *at the 1-D* indices *along the given axis.*

Description

Select values from x at the 1-D indices along the given axis.

Usage

```
op_take_along_axis(x, indices, axis = NULL, zero_indexed = FALSE)
```

Arguments

x	Source tensor.
indices	The indices of the values to extract.
axis	The axis over which to select values. By default, the flattened input tensor is used.
zero_indexed	If TRUE, treats indices as zero-based (0 encodes to first position); if FALSE (default), treats indices as one-based (1 encodes to first position).

Value

The corresponding tensor of values.

See Also

- https://keras.io/api/ops/numpy#takealongaxis-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_tan *Compute tangent, element-wise.*

Description

Compute tangent, element-wise.

Usage

```
op_tan(x)
```

Arguments

x	Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/numpy#tan-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()

op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()

op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()

op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()

op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()

op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()

op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()

op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()

op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_tanh *Hyperbolic tangent, element-wise.*

Description

Hyperbolic tangent, element-wise.

Usage

```
op_tanh(x)
```

Arguments

x	Input tensor.

Value

Output tensor of same shape as x.

See Also

- https://keras.io/api/ops/nn#tanh-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()

op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
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op_clip()
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op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_correlate()
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op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
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op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
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op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()

op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
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op_logspace()
op_logsumexp()
op_lstsq()
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op_multi_hot()
op_multiply()
op_nan_to_num()
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op_norm()
op_normalize()
op_not_equal()
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op_relu()
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op_repeat()
op_reshape()
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op_right_shift()
op_rms_normalization()
op_roll()
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op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stop_gradient()
op_subset()
op_subtract()

op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
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op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
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op_triu()
op_trunc()
op_unravel_index()
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op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_tanh_shrink *Applies the tanh shrink function element-wise.*

Description

It is defined as:

`f(x) = x - tanh(x)`.

Usage

```
op_tanh_shrink(x)
```

Arguments

x Input tensor.

Value

Output tensor of the same shape as x, where each element is transformed according to the tanh shrink operation.

Examples

```
x <- op_array(c(-1., 0., 1.))
op_tanh_shrink(x)

## tf.Tensor([-0.23840582  0.          0.23840582], shape=(3), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()

op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_threshold()
op_unravel_index()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average_pool()
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op_diagonal()
op_diff()
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op_flip()
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op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
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op_softplus()
op_softsign()
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op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()

op_square()
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op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
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op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_tensordot *Compute the tensor dot product along specified axes.*

Description

Compute the tensor dot product along specified axes.

Usage

```
op_tensordot(x1, x2, axes = 3L)
```

Arguments

x1	First tensor.
x2	Second tensor.
axes	• If an integer, N, sum over the last N axes of x1 and the first N axes of x2 in order. The sizes of the corresponding axes must match. • Or, a list of axes to be summed over, first sequence applying to x1, second to x2. Both sequences must be of the same length.

Value

The tensor dot product of the inputs.

See Also

- https://keras.io/api/ops/numpy#tensordot-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()

op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
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op_isnan()
op_left_shift()
op_less()

op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()

op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
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Other ops:
op_abs()
op_add()
op_all()
op_any()
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op_arange()
op_arccos()
op_arccosh()
op_arcsin()
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op_arctanh()

op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
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op_batch_normalization()
op_binary_crossentropy()
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op_soft_shrink()
op_softmax()
op_softplus()
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op_zeros()
op_zeros_like()

---

op_threshold *Threshold activation function.*

Description

The function thresholds the input x as follows: f(x) = x if x > threshold, f(x) = default_value otherwise.

Usage

```
op_threshold(x, threshold, default_value)
```

Arguments

x	Input tensor.
threshold	The value that decides when to retain or replace x.
default_value	Value to assign when x <= threshold.

Value

A tensor with the same shape as x.

Examples

```
x <- op_array(c(-1.0, 0.0, 1.0, 2.0))
op_threshold(x, 1, 0)

## tf.Tensor([0. 0. 0. 2.], shape=(4), dtype=float32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
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op_psnr()
op_relu()
op_relu6()
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op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_unravel_index()

Other ops:

op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()

op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()

op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()

op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
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op_not_equal()
op_one_hot()
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op_ones_like()
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op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()

op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()

op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_tile *Repeat* x *the number of times given by* repeats.

Description

If repeats has length d, the result will have dimension of max(d, x.ndim).

If x.ndim < d, x is promoted to be d-dimensional by prepending new axes.

If x.ndim > d, repeats is promoted to x.ndim by prepending 1's to it.

Usage

```
op_tile(x, repeats)
```

Arguments

x	Input tensor.
repeats	The number of repetitions of x along each axis.

Value

The tiled output tensor.

See Also

- https://keras.io/api/ops/numpy#tile-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
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op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
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op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()

op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
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op_zeros_like()

Other ops:
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op_arccosh()
op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
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op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
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op_bitwise_invert()

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op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
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op_cumsum()
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op_depthwise_conv()
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op_diagflat()
op_diagonal()
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op_divide_no_nan()
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op_dot_product_attention()
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op_einsum()
op_elu()
op_empty()
op_equal()

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op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
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op_full_like()
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op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_top_k	*Finds the top-k values and their indices in a tensor.*

Description

Finds the top-k values and their indices in a tensor.

Usage

```
op_top_k(x, k, sorted = TRUE, zero_indexed = FALSE)
```

Arguments

x	Input tensor.
k	An integer representing the number of top elements to retrieve.
sorted	A boolean indicating whether to sort the output in descending order. Defaults to `TRUE`.
zero_indexed	If `TRUE`, the returned indices are zero-based (`0` encodes to first position); if `FALSE` (default), the returned indices are one-based (`1` encodes to first position).

Value

A list containing two tensors. The first tensor contains the top-k values, and the second tensor contains the indices of the top-k values in the input tensor.

Examples

```
x <- op_array(c(5, 2, 7, 1, 9, 3), "int32")
op_top_k(x, k = 3)

## $values
## tf.Tensor([9 7 5], shape=(3), dtype=int32)
##
## $indices
## tf.Tensor([5 3 1], shape=(3), dtype=int32)


c(values, indices) %<-% op_top_k(x, k = 3)
values

## tf.Tensor([9 7 5], shape=(3), dtype=int32)


indices

## tf.Tensor([5 3 1], shape=(3), dtype=int32)
```

See Also

- https://keras.io/api/ops/core#topk-function

Other math ops:
op_erf()
op_erfinv()
op_extract_sequences()
op_fft()
op_fft2()
op_ifft2()
op_in_top_k()
op_irfft()
op_istft()
op_logsumexp()
op_qr()
op_rfft()
op_rsqrt()
op_segment_max()
op_segment_sum()
op_solve()
op_stft()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()

op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()

op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()

op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
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op_lu_factor()
op_map()
op_matmul()
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op_meshgrid()
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op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()

op_ones()
op_ones_like()
op_outer()
op_pad()
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op_prod()
op_psnr()
op_qr()
op_quantile()
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op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
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op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
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op_searchsorted()
op_segment_max()
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op_select()
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op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()

op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
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op_squeeze()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_trace	*Return the sum along diagonals of the tensor.*

Description

If x is 2-D, the sum along its diagonal with the given offset is returned, i.e., the sum of elements x[i, i+offset] for all i.

If a has more than two dimensions, then the axes specified by axis1 and axis2 are used to determine the 2-D sub-arrays whose traces are returned.

The shape of the resulting tensor is the same as that of x with axis1 and axis2 removed.

Usage

```
op_trace(x, offset = 0L, axis1 = 1L, axis2 = 2L)
```

Arguments

x	Input tensor.
offset	Offset of the diagonal from the main diagonal. Can be both positive and negative. Defaults to 0.
axis1	Axis to be used as the first axis of the 2-D sub-arrays. Defaults to 1. (first axis).
axis2	Axis to be used as the second axis of the 2-D sub-arrays. Defaults to 2. (second axis).

Value

If x is 2-D, the sum of the diagonal is returned. If x has larger dimensions, then a tensor of sums along diagonals is returned.

See Also

- https://keras.io/api/ops/numpy#trace-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()

op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()

op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()

op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()

op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()

op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()

op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()

op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_transpose *Returns a tensor with* axes *transposed.*

Description

Returns a tensor with axes transposed.

Usage

```
op_transpose(x, axes = NULL)
```

Arguments

x	Input tensor.
axes	Sequence of integers. Permutation of the dimensions of x. By default, the order of the axes are reversed.

Value

x with its axes permuted.

See Also

- https://keras.io/api/ops/numpy#transpose-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
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op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()

op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()

op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()

op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_tri — *Return a tensor with ones at and below a diagonal and zeros elsewhere.*

Description

Return a tensor with ones at and below a diagonal and zeros elsewhere.

Usage

```
op_tri(N, M = NULL, k = 0L, dtype = NULL)
```

Arguments

N	Number of rows in the tensor.
M	Number of columns in the tensor.
k	The sub-diagonal at and below which the array is filled. k = 0 is the main diagonal, while k < 0 is below it, and k > 0 is above. The default is 0.
dtype	Data type of the returned tensor. The default is "float32".

Value

Tensor with its lower triangle filled with ones and zeros elsewhere. T[i, j] == 1 for j <= i + k, 0 otherwise.

See Also

- https://keras.io/api/ops/numpy#tri-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()

op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()

op_all()
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op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
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op_bitwise_or()
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op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_tril *Return lower triangle of a tensor.*

Description

For tensors with ndim exceeding 2, tril will apply to the final two axes.

Usage

```
op_tril(x, k = 0L)
```

Arguments

x	Input tensor.
k	Diagonal above which to zero elements. Defaults to 0. the main diagonal. k < 0 is below it, and k > 0 is above it.

Value

Lower triangle of x, of same shape and data type as x.

See Also

- https://keras.io/api/ops/numpy#tril-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()

op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_triu *Return upper triangle of a tensor.*

Description

For tensors with `ndim` exceeding 2, `triu` will apply to the final two axes.

Usage

```
op_triu(x, k = 0L)
```

Arguments

`x`	Input tensor.
`k`	Diagonal below which to zero elements. Defaults to `0`. the main diagonal. `k < 0` is below it, and `k > 0` is above it.

Value

Upper triangle of `x`, of same shape and data type as `x`.

See Also

- https://keras.io/api/ops/numpy#triu-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()

op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()

op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()

op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()

op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()

op_tril()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_trunc *Return the truncated value of the input, element-wise.*

Description

The truncated value of the scalar x is the nearest integer i which is closer to zero than x is. In short, the fractional part of the signed number x is discarded.

Usage

```
op_trunc(x)
```

Arguments

x	Input tensor.

Value

The truncated value of each element in x.

Examples

```
x <- op_array(c(-1.7, -1.5, -0.2, 0.2, 1.5, 1.7, 2.0))
op_trunc(x)


## tf.Tensor([-1. -1. -0.  0.  1.  1.  2.], shape=(7), dtype=float32)
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()

op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()

op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()

op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_var()
op_vdot()
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op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()

op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
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op_cosh()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()

op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
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op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
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op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
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op_maximum()
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op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()

op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()

op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
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op_sum()
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op_swapaxes()
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op_tanh()
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op_tensordot()
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op_triu()
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op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_unravel_index *Convert flat indices to coordinate arrays in a given array shape.*

Description

Convert flat indices to coordinate arrays in a given array shape.

Usage

```
op_unravel_index(indices, shape)
```

Arguments

indices	An integer or array of integers representing flat indices.
shape	The shape of the array to unravel into.

Value

Tuple of arrays for each dimension with unraveled indices.

Examples

```
indices <- c(1, 5)
shape <- array(c(3, 3))
op_unravel_index(indices, shape)

## [[1]]
## tf.Tensor([0 1], shape=(2), dtype=int32)
##
## [[2]]
## tf.Tensor([0 1], shape=(2), dtype=int32)
```

See Also

Other nn ops:
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_categorical_crossentropy()
op_celu()
op_conv()
op_conv_transpose()
op_ctc_loss()
op_depthwise_conv()
op_dot_product_attention()
op_elu()
op_gelu()
op_glu()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()

op_leaky_relu()
op_log_sigmoid()
op_log_softmax()
op_max_pool()
op_moments()
op_multi_hot()
op_normalize()
op_one_hot()
op_polar()
op_psnr()
op_relu()
op_relu6()
op_rms_normalization()
op_selu()
op_separable_conv()
op_sigmoid()
op_silu()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_squareplus()
op_tanh_shrink()
op_threshold()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()

op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
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op_cos()
op_cosh()
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op_cross()
op_ctc_decode()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()

op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
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op_erfinv()
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op_expm1()
op_extract_sequences()
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op_floor_divide()
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op_full()
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op_get_item()
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op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
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op_imag()
op_image_affine_transform()
op_image_crop()
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op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()

op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
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op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()

op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
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op_soft_shrink()
op_softmax()
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op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unstack()
op_var()
op_vdot()
op_vectorize()

op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_unstack — *Unpacks the given dimension of a rank-R tensor into rank-(R-1) tensors.*

Description

Unpacks the given dimension of a rank-R tensor into rank-(R-1) tensors.

Usage

```
op_unstack(x, num = NULL, axis = 1L)
```

Arguments

x	The input tensor.
num	The length of the dimension axis. Automatically inferred if NULL.
axis	The axis along which to unpack.

Value

A list of tensors unpacked along the given axis.

Examples

```
x <- op_array(rbind(c(1, 2),
                    c(3, 4)))
op_unstack(x, axis=1)

## [[1]]
## tf.Tensor([1. 2.], shape=(2), dtype=float64)
##
## [[2]]
## tf.Tensor([3. 4.], shape=(2), dtype=float64)


op_unstack(x, axis=2)
```

```
## [[1]]
## tf.Tensor([1. 3.], shape=(2), dtype=float64)
##
## [[2]]
## tf.Tensor([2. 4.], shape=(2), dtype=float64)
```

```
all.equal(op_unstack(x),
          op_unstack(x, axis = 1))
```

```
## [1] TRUE
```

```
all.equal(op_unstack(x, axis = -1),
          op_unstack(x, axis = 2))
```

```
## [1] TRUE
```

```
# [array([1, 2)), array([3, 4))]
```

[3, 4))]: R:3,%204))

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_vectorized_map()

op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
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op_arctan2()
op_arctanh()
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op_argmin()
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op_argsort()
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op_binary_crossentropy()
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op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()

op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
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op_diff()
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op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
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op_erfinv()
op_exp()
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op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
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op_full_like()
op_gelu()
op_get_item()
op_glu()

op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
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op_imag()
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op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
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op_log()
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op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
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op_logical_and()
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op_logsumexp()
op_lstsq()
op_lu_factor()
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op_max()
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op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
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op_outer()
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op_polar()
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op_reciprocal()
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op_repeat()
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op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()

op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_var *Compute the variance along the specified axes.*

Description

Compute the variance along the specified axes.

Usage

```
op_var(x, axis = NULL, keepdims = FALSE)
```

Arguments

x	Input tensor.
axis	Axis or axes along which the variance is computed. The default is to compute the variance of the flattened tensor.
keepdims	If this is set to TRUE, the axes which are reduced are left in the result as dimensions with size one.

Value

Output tensor containing the variance.

See Also

- https://keras.io/api/ops/numpy#var-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()

op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()

op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()

op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()

op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()

op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()

op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()

op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

op_vdot — *Return the dot product of two vectors.*

Description

If the first argument is complex, the complex conjugate of the first argument is used for the calculation of the dot product.

Multidimensional tensors are flattened before the dot product is taken.

Usage

```
op_vdot(x1, x2)
```

Arguments

`x1`	First input tensor. If complex, its complex conjugate is taken before calculation of the dot product.
`x2`	Second input tensor.

Value

Output tensor.

See Also

- https://keras.io/api/ops/numpy#vdot-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()

op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()

op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()

op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vectorize()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()

op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()

op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()

op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()

op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()

op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()

op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_vectorize *Turn a function into a vectorized function.*

Description

Turn a function into a vectorized function.

Usage

```
op_vectorize(func, ..., excluded = NULL, signature = NULL)
```

Arguments

func	Callable of a single tensor argument.
...	For forward/backward compatability.
excluded	Optional set of integers representing positional arguments for which the function will not be vectorized. These will be passed directly to func unmodified.
signature	Optional generalized universal function signature, e.g., "(m,n),(n)->(m)" for vectorized matrix-vector multiplication. If provided, func will be called with (and expected to return) arrays with shapes given by the size of corresponding core dimensions. By default, func is assumed to take scalar tensors as input and output.

Value

A new function that applies `func` to every element of its input along axis 1 (the batch axis, the first axis).

Examples

```
# currently does not work w/ tensorflow backend
if(config_backend() != "tensorflow") {

  myfunc <- function(a, b) a + b

  vfunc <- op_vectorize(myfunc)
  y <- vfunc(c(1, 2, 3, 4), 2)
  print(y)
  # with Jax backend, y is:
  # Array([3., 4., 5., 6.], dtype=float32)
}
```

See Also

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()

op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()

op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()

op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()

op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()

op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
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op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()

op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()

op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
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op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()

op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
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op_vectorized_map()
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op_while_loop()
op_zeros()
op_zeros_like()

---

op_vectorized_map *Parallel map of function* f *on the first axis of tensor(s)* elements.

Description

Schematically, op_vectorized_map() maps over the first dimension of the provided tensors. If elements is a list of tensors, then each of the tensors are required to have the same size first dimension, and they are iterated over together.

Usage

```
op_vectorized_map(elements, f)
```

Arguments

elements	see description
f	A function taking either a tensor, or list of tensors.

Value

A tensor or list of tensors, the result of mapping f across elements.

Examples

```
(x <- op_arange(12L) |> op_reshape(c(3, 4)))

## tf.Tensor(
## [[ 1  2  3  4]
##  [ 5  6  7  8]
##  [ 9 10 11 12]], shape=(3, 4), dtype=int32)
```

```
x |> op_vectorized_map(\(row) {row + 10})

## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)


list(x, x, x) |> op_vectorized_map(\(rows) Reduce(`+`, rows))

## tf.Tensor(
## [[ 3  6  9 12]
##  [15 18 21 24]
##  [27 30 33 36]], shape=(3, 4), dtype=int32)
```

Note that `f` may be traced and compiled. Meaning, the R function may only evaluated once with symbolic tensors if using Jax or TensorFlow backends, and not with eager tensors. See the output from `str()` in these examples:

```
# simplest case, map f over rows of x,
# where .x is 1 row of x
input <- x
output <- op_vectorized_map(input, function(.x) {
  str(.x)
  .x + 10
})

## <tf.Tensor 'loop_body/GatherV2:0' shape=(4) dtype=int32>


output

## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)


# map f over two tensors simultaneously. Here, # `.x` is a list of two
# tensors. The return values from each call of `f(row)` are stacked to form the
# final output
input <- list(x, x)
output <- op_vectorized_map(input, function(.x) {
  str(.x)
  .x[[1]] + 10
})
```

```
## List of 2
##  $ :<tf.Tensor 'loop_body/GatherV2:0' shape=(4) dtype=int32>
##  $ :<tf.Tensor 'loop_body/GatherV2_1:0' shape=(4) dtype=int32>
```

```
output
```

```
## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)
```

```
# same as above, but now returning two tensors in the final output
output <- op_vectorized_map(input, function(.x) {
  str(.x)
  c(.x1, .x2) %<-% .x
  list(.x1+10, .x2+20)
})
```

```
## List of 2
##  $ :<tf.Tensor 'loop_body/GatherV2:0' shape=(4) dtype=int32>
##  $ :<tf.Tensor 'loop_body/GatherV2_1:0' shape=(4) dtype=int32>
```

```
output
```

```
## [[1]]
## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)
##
## [[2]]
## tf.Tensor(
## [[21 22 23 24]
##  [25 26 27 28]
##  [29 30 31 32]], shape=(3, 4), dtype=int32)
```

```
# passing named lists.
# WARNING: if passing a named list, the order of elements of `.x` supplied
# to `f` is not stable. Only retrieve elements by name.
input <- list(name1 = x, name2 = x)
output <- op_vectorized_map(input, function(.x) {
  str(.x)
  list(outname1 = .x$name1 + 10,
       outname2 = .x$name2 + 20)
})
```

```
## List of 2
##  $ name1:<tf.Tensor 'loop_body/GatherV2:0' shape=(4) dtype=int32>
##  $ name2:<tf.Tensor 'loop_body/GatherV2_1:0' shape=(4) dtype=int32>
```

```
output
```

```
## $outname1
## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)
##
## $outname2
## tf.Tensor(
## [[21 22 23 24]
##  [25 26 27 28]
##  [29 30 31 32]], shape=(3, 4), dtype=int32)
```

```
# passing a tuple() is equivalent to passing an unnamed list()
input <- tuple(x, x)
output <- op_vectorized_map(input, function(.x) {
  str(.x)
  list(.x[[1]] + 10)
})
```

```
## List of 2
##  $ :<tf.Tensor 'loop_body/GatherV2:0' shape=(4) dtype=int32>
##  $ :<tf.Tensor 'loop_body/GatherV2_1:0' shape=(4) dtype=int32>
```

```
output
```

```
## [[1]]
## tf.Tensor(
## [[11 12 13 14]
##  [15 16 17 18]
##  [19 20 21 22]], shape=(3, 4), dtype=int32)
```

Debugging `f`

Even in eager contexts, `op_vectorized_map()` may trace `f`. In that case, if you want to eagerly debug `f` (e.g., with `browser()`), you can swap in a manual (slow) implementation of `op_vectorized_map()`. Note this example debug implementation does not handle all the same edge cases as `op_vectorized_map()`, in particular, if `f` returns a structure of multiple tensors.

```
op_vectorized_map_debug <- function(elements, fn) {

  if (!is.list(elements)) {
    # `elements` is a single tensor
    batch_size <- op_shape(elements)[[1]]
    out <- elements |>
      op_split(batch_size) |>
      lapply(fn) |>
      op_stack()
    return(out)
  }

  # `elements` is a list of tensors
  batch_size <- elements[[1]] |> op_shape() |> _[[1]]
  elements |>
    lapply(\(e) op_split(e, batch_size)) |>
    zip_lists() |>
    lapply(fn) |>
    op_stack()

}
```

See Also

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()
op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_while_loop()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()

op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()

op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()

op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()

op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()

op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_vstack *Stack tensors in sequence vertically (row wise).*

Description

Stack tensors in sequence vertically (row wise).

Usage

```
op_vstack(xs, ...)
```

Arguments

xs, ...	Sequence of tensors.

Value

Tensor formed by stacking the given tensors.

See Also

- https://keras.io/api/ops/numpy#vstack-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()

op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
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op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
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op_log1p()
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op_logdet()
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op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
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op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
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op_tanh()
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op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()

op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()

op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()

op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_where()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_where *Return elements chosen from* x1 *or* x2 *depending on* condition.

Description

Return elements chosen from x1 or x2 depending on condition.

Usage

```
op_where(condition, x1 = NULL, x2 = NULL)
```

Arguments

condition	Where TRUE, yield x1, otherwise yield x2.
x1	Values from which to choose when condition is TRUE.
x2	Values from which to choose when condition is FALSE.

Value

A tensor with elements from x1 where condition is TRUE, and elements from x2 where condition is FALSE.

See Also

- https://keras.io/api/ops/numpy#where-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()

op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()
op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()

op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()

op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()
op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
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op_vdot()
op_vectorize()
op_vstack()
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op_zeros_like()

Other ops:
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op_arcsin()
op_arcsinh()
op_arctan()

op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
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op_conv()
op_conv_transpose()
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op_convert_to_tensor()
op_copy()
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op_cos()
op_cosh()
op_count_nonzero()
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op_cumprod()
op_cumsum()
op_custom_gradient()
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op_det()
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op_diagflat()
op_diagonal()
op_diff()
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op_image_perspective_transform()
op_image_resize()
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op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
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op_is_tensor()
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op_isnan()
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op_log1p()
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op_log_softmax()
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op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
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op_map()
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op_max()
op_max_pool()
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op_min()

op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
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op_one_hot()
op_ones()
op_ones_like()
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op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
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op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()

op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
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op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()

op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_while_loop()
op_zeros()
op_zeros_like()

---

op_while_loop *While loop implementation.*

Description

While loop implementation.

Usage

```
op_while_loop(cond, body, loop_vars, maximum_iterations = NULL)
```

Arguments

cond: A callable that represents the termination condition of the loop. Must accept a `loop_vars` like structure as an argument. If `loop_vars` is a tuple or unnamed list, each element of `loop_vars` will be passed positionally to the callable.

body: A callable that represents the loop body. Must accept a `loop_vars` like structure as an argument, and return update value with the same structure. If `loop_vars` is a tuple or unnamed list, each element of `loop_vars` will be passed positionally to the callable.

loop_vars: An arbitrary nested structure of tensor state to persist across loop iterations.

maximum_iterations: Optional maximum number of iterations of the while loop to run. If provided, the cond output is AND-ed with an additional condition ensuring the number of iterations executed is no greater than `maximum_iterations`.

Value

A list of tensors, has the same shape and dtype as `loop_vars`.

Examples

```
i <- 0
loop_vars <- list(i)

# cond() must return a scalar bool
cond <- function(i) i < 10L

# body must return same shape as loop_vars
body <- function(i) list(i + 1L)

op_while_loop(cond, body, loop_vars)

## [[1]]
## tf.Tensor(10.0, shape=(), dtype=float32)


x <- 0; y <- 1
cond <- \(x, y) x < 10
body <- \(x, y) list(x+1, y+1)
op_while_loop(cond, body, list(x, y))

## [[1]]
## tf.Tensor(10.0, shape=(), dtype=float32)
##
## [[2]]
## tf.Tensor(11.0, shape=(), dtype=float32)
```

See Also

- https://keras.io/api/ops/core#whileloop-function

Other core ops:
op_associative_scan()
op_cast()
op_cond()
op_convert_to_numpy()
op_convert_to_tensor()
op_custom_gradient()
op_dtype()
op_fori_loop()
op_is_tensor()
op_map()
op_rearrange()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_shape()

op_slice()
op_slice_update()
op_stop_gradient()
op_subset()
op_switch()
op_unstack()
op_vectorized_map()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()

op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()

op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()

op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()

op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
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op_sinh()
op_size()
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op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()

op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_zeros()
op_zeros_like()

---

op_zeros *Return a new tensor of given shape and type, filled with zeros.*

Description

Return a new tensor of given shape and type, filled with zeros.

Usage

```
op_zeros(shape, dtype = NULL)
```

Arguments

shape	Shape of the new tensor.
dtype	Desired data type of the tensor.

Value

Tensor of zeros with the given shape and dtype.

See Also

- https://keras.io/api/ops/numpy#zeros-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()

op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
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op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()

op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()
op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
op_signbit()
op_sin()
op_sinh()
op_size()
op_sort()
op_split()
op_sqrt()

op_square()
op_squeeze()
op_stack()
op_std()
op_subtract()
op_sum()
op_swapaxes()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros_like()

Other ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()

op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()

op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()
op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()

op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()
op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()

op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()
op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()

op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()
op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()

op_vstack()
op_where()
op_while_loop()
op_zeros_like()

---

op_zeros_like *Return a tensor of zeros with the same shape and type as* x.

Description

Return a tensor of zeros with the same shape and type as x.

Usage

```
op_zeros_like(x, dtype = NULL)
```

Arguments

x	Input tensor.
dtype	Overrides the data type of the result.

Value

A tensor of zeros with the same shape and type as x.

See Also

- https://keras.io/api/ops/numpy#zeroslike-function

Other numpy ops:
op_abs()
op_add()
op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()

op_array()
op_average()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_ceil()
op_clip()
op_concatenate()
op_conj()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()
op_cross()
op_ctc_decode()
op_cumprod()
op_cumsum()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_einsum()
op_empty()
op_equal()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_eye()
op_flip()
op_floor()
op_floor_divide()
op_full()
op_full_like()
op_get_item()
op_greater()
op_greater_equal()

op_histogram()
op_hstack()
op_identity()
op_imag()
op_inner()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_logaddexp()
op_logdet()
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op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_lstsq()
op_matmul()
op_max()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moveaxis()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_not_equal()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_power()
op_prod()
op_quantile()

op_ravel()
op_real()
op_reciprocal()
op_repeat()
op_reshape()
op_right_shift()
op_roll()
op_rot90()
op_round()
op_saturate_cast()
op_select()
op_sign()
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op_swapaxes()
op_take()
op_take_along_axis()
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op_tensordot()
op_tile()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_var()
op_vdot()
op_vectorize()
op_vstack()
op_where()
op_zeros()

Other ops:
op_abs()
op_add()

op_all()
op_any()
op_append()
op_arange()
op_arccos()
op_arccosh()
op_arcsin()
op_arcsinh()
op_arctan()
op_arctan2()
op_arctanh()
op_argmax()
op_argmin()
op_argpartition()
op_argsort()
op_array()
op_associative_scan()
op_average()
op_average_pool()
op_batch_normalization()
op_binary_crossentropy()
op_bincount()
op_bitwise_and()
op_bitwise_invert()
op_bitwise_left_shift()
op_bitwise_not()
op_bitwise_or()
op_bitwise_right_shift()
op_bitwise_xor()
op_broadcast_to()
op_cast()
op_categorical_crossentropy()
op_ceil()
op_celu()
op_cholesky()
op_clip()
op_concatenate()
op_cond()
op_conj()
op_conv()
op_conv_transpose()
op_convert_to_numpy()
op_convert_to_tensor()
op_copy()
op_correlate()
op_cos()
op_cosh()
op_count_nonzero()

op_cross()
op_ctc_decode()
op_ctc_loss()
op_cumprod()
op_cumsum()
op_custom_gradient()
op_depthwise_conv()
op_det()
op_diag()
op_diagflat()
op_diagonal()
op_diff()
op_digitize()
op_divide()
op_divide_no_nan()
op_dot()
op_dot_product_attention()
op_dtype()
op_eig()
op_eigh()
op_einsum()
op_elu()
op_empty()
op_equal()
op_erf()
op_erfinv()
op_exp()
op_exp2()
op_expand_dims()
op_expm1()
op_extract_sequences()
op_eye()
op_fft()
op_fft2()
op_flip()
op_floor()
op_floor_divide()
op_fori_loop()
op_full()
op_full_like()
op_gelu()
op_get_item()
op_glu()
op_greater()
op_greater_equal()
op_hard_shrink()
op_hard_sigmoid()
op_hard_silu()

op_hard_tanh()
op_histogram()
op_hstack()
op_identity()
op_ifft2()
op_imag()
op_image_affine_transform()
op_image_crop()
op_image_extract_patches()
op_image_gaussian_blur()
op_image_hsv_to_rgb()
op_image_map_coordinates()
op_image_pad()
op_image_perspective_transform()
op_image_resize()
op_image_rgb_to_grayscale()
op_image_rgb_to_hsv()
op_in_top_k()
op_inner()
op_inv()
op_irfft()
op_is_tensor()
op_isclose()
op_isfinite()
op_isinf()
op_isnan()
op_istft()
op_leaky_relu()
op_left_shift()
op_less()
op_less_equal()
op_linspace()
op_log()
op_log10()
op_log1p()
op_log2()
op_log_sigmoid()
op_log_softmax()
op_logaddexp()
op_logdet()
op_logical_and()
op_logical_not()
op_logical_or()
op_logical_xor()
op_logspace()
op_logsumexp()
op_lstsq()
op_lu_factor()

op_map()
op_matmul()
op_max()
op_max_pool()
op_maximum()
op_mean()
op_median()
op_meshgrid()
op_min()
op_minimum()
op_mod()
op_moments()
op_moveaxis()
op_multi_hot()
op_multiply()
op_nan_to_num()
op_ndim()
op_negative()
op_nonzero()
op_norm()
op_normalize()
op_not_equal()
op_one_hot()
op_ones()
op_ones_like()
op_outer()
op_pad()
op_polar()
op_power()
op_prod()
op_psnr()
op_qr()
op_quantile()
op_ravel()
op_real()
op_rearrange()
op_reciprocal()
op_relu()
op_relu6()
op_repeat()
op_reshape()
op_rfft()
op_right_shift()
op_rms_normalization()
op_roll()
op_rot90()
op_round()
op_rsqrt()

op_saturate_cast()
op_scan()
op_scatter()
op_scatter_update()
op_searchsorted()
op_segment_max()
op_segment_sum()
op_select()
op_selu()
op_separable_conv()
op_shape()
op_sigmoid()
op_sign()
op_signbit()
op_silu()
op_sin()
op_sinh()
op_size()
op_slice()
op_slice_update()
op_slogdet()
op_soft_shrink()
op_softmax()
op_softplus()
op_softsign()
op_solve()
op_solve_triangular()
op_sort()
op_sparse_categorical_crossentropy()
op_sparse_plus()
op_sparsemax()
op_split()
op_sqrt()
op_square()
op_squareplus()
op_squeeze()
op_stack()
op_std()
op_stft()
op_stop_gradient()
op_subset()
op_subtract()
op_sum()
op_svd()
op_swapaxes()
op_switch()
op_take()
op_take_along_axis()

op_tan()
op_tanh()
op_tanh_shrink()
op_tensordot()
op_threshold()
op_tile()
op_top_k()
op_trace()
op_transpose()
op_tri()
op_tril()
op_triu()
op_trunc()
op_unravel_index()
op_unstack()
op_var()
op_vdot()
op_vectorize()
op_vectorized_map()
op_vstack()
op_where()
op_while_loop()
op_zeros()

---

pad_sequences *Pads sequences to the same length.*

Description

This function transforms a list (of length num_samples) of sequences (lists of integers) into a 2D NumPy array of shape (num_samples, num_timesteps). num_timesteps is either the maxlen argument if provided, or the length of the longest sequence in the list.

Sequences that are shorter than num_timesteps are padded with value until they are num_timesteps long.

Sequences longer than num_timesteps are truncated so that they fit the desired length.

The position where padding or truncation happens is determined by the arguments padding and truncating, respectively. Pre-padding or removing values from the beginning of the sequence is the default.

```
sequence <- list(c(1), c(2, 3), c(4, 5, 6))
pad_sequences(sequence)
```

```
##      [,1] [,2] [,3]
## [1,]    0    0    1
```

```
## [2,]    0    2    3
## [3,]    4    5    6


pad_sequences(sequence, value=-1)

##      [,1] [,2] [,3]
## [1,]   -1   -1    1
## [2,]   -1    2    3
## [3,]    4    5    6


pad_sequences(sequence, padding='post')

##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]    2    3    0
## [3,]    4    5    6


pad_sequences(sequence, maxlen=2)

##      [,1] [,2]
## [1,]    0    1
## [2,]    2    3
## [3,]    5    6
```

Usage

```
pad_sequences(
  sequences,
  maxlen = NULL,
  dtype = "int32",
  padding = "pre",
  truncating = "pre",
  value = 0
)
```

Arguments

`sequences`	List of sequences (each sequence is a list of integers).
`maxlen`	Optional Int, maximum length of all sequences. If not provided, sequences will be padded to the length of the longest individual sequence.
`dtype`	(Optional, defaults to `"int32"`). Type of the output sequences. To pad sequences with variable length strings, you can use `object`.
`padding`	String, "pre" or "post" (optional, defaults to `"pre"`): pad either before or after each sequence.

truncating	String, "pre" or "post" (optional, defaults to "pre"): remove values from sequences larger than maxlen, either at the beginning or at the end of the sequences.
value	Float or String, padding value. (Optional, defaults to 0)

Value

Array with shape (len(sequences), maxlen)

See Also

- https://keras.io/api/data_loading/timeseries#padsequences-function

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

plot.keras.src.models.model.Model

Plot a Keras model

Description

Plot a Keras model

Usage

```
## S3 method for class 'keras.src.models.model.Model'
plot(
  x,
  show_shapes = FALSE,
  show_dtype = FALSE,
  show_layer_names = FALSE,
  ...,
  rankdir = "TB",
  expand_nested = FALSE,
  dpi = 200,
  layer_range = NULL,
  show_layer_activations = FALSE,
  show_trainable = NA,
  to_file = NULL
)
```

Arguments

x	A Keras model instance
show_shapes	whether to display shape information.
show_dtype	whether to display layer dtypes.
show_layer_names	whether to display layer names.
...	passed on to Python keras.utils.model_to_dot(). Used for forward and backward compatibility.
rankdir	a string specifying the format of the plot: 'TB' creates a vertical plot; 'LR' creates a horizontal plot. (argument passed to PyDot)
expand_nested	Whether to expand nested models into clusters.
dpi	Dots per inch. Increase this value if the image text appears excessively pixelated.
layer_range	list containing two character strings, which is the starting layer name and ending layer name (both inclusive) indicating the range of layers for which the plot will be generated. It also accepts regex patterns instead of exact name. In such case, start predicate will be the first element it matches to layer_range[1] and the end predicate will be the last element it matches to layer_range[2]. By default NULL which considers all layers of model. Note that you must pass range such that the resultant subgraph must be complete.
show_layer_activations	Display layer activations (only for layers that have an activation property).
show_trainable	whether to display if a layer is trainable.
to_file	File name of the plot image. If NULL (the default), the model is drawn on the default graphics device. Otherwise, a file is saved.

Value

Nothing, called for it's side effects.

Raises

ValueError: if `plot(model)` is called before the model is built, unless a `input_shape =` argument was supplied to `keras_model_sequential()`.

Requirements

This function requires pydot and graphviz. `pydot` is by default installed by `install_keras()`, but if you installed keras by other means, you can install `pydot` directly with :

```
reticulate::py_install("pydot", pip = TRUE)
```

You can install graphviz directly from here: https://graphviz.gitlab.io/download/

On most Linux platforms, can install graphviz via the package manager. For example, on Ubuntu/Debian you can install with

```
sudo apt install graphviz
```

In a conda environment, you can install graphviz with:

```
reticulate::conda_install(packages = "graphviz")
# Restart the R session after install.
```

`plot.keras_training_history`
Plot training history

Description

Plots metrics recorded during training.

Usage

```
## S3 method for class 'keras_training_history'
plot(
  x,
  y,
  metrics = NULL,
  method = c("auto", "ggplot2", "base"),
  smooth = getOption("keras.plot.history.smooth", TRUE),
  theme_bw = getOption("keras.plot.history.theme_bw", FALSE),
  ...
)
```

Arguments

x	Training history object returned from fit.keras.src.models.model.Model().
y	Unused.
metrics	One or more metrics to plot (e.g. c('loss', 'accuracy')). Defaults to plotting all captured metrics.
method	Method to use for plotting. The default "auto" will use **ggplot2** if available, and otherwise will use base graphics.
smooth	Whether a loess smooth should be added to the plot, only available for the ggplot2 method. If the number of epochs is smaller than ten, it is forced to false.
theme_bw	Use ggplot2::theme_bw() to plot the history in black and white.
...	Additional parameters to pass to the plot() method.

Value

if method == "ggplot2", the ggplot object is returned. If method == "base", then this function will draw to the graphics device and return NULL, invisibly.

---

pop_layer *Remove the last layer in a Sequential model*

Description

Remove the last layer in a Sequential model

Usage

```
pop_layer(object, rebuild = TRUE)
```

Arguments

object	Sequential keras model object
rebuild	bool. Whether to rebuild the model after removing the layer. Defaults to TRUE.

Value

The removed layer.

See Also

Other model functions:
get_config()
get_layer()
get_state_tree()
keras_model()
keras_model_sequential()
set_state_tree()
summary.keras.src.models.model.Model()

---

predict.keras.src.models.model.Model
Generates output predictions for the input samples.

Description

Generates output predictions for the input samples.

Usage

```
## S3 method for class 'keras.src.models.model.Model'
predict(
  object,
  x,
  ...,
  batch_size = NULL,
  verbose = getOption("keras.verbose", default = "auto"),
  steps = NULL,
  callbacks = NULL
)
```

Arguments

object	Keras model object
x	Input samples. It can be: • A array (or array-like), or a list of arrays (in case the model has multiple inputs). • A backend-native tensor, or a list of tensors (in case the model has multiple inputs). • A TF Dataset. • A Python generator function.
...	For forward/backward compatability.
batch_size	Integer or NULL. Number of samples per batch of computation. If unspecified, batch_size will default to 32. Do not specify the batch_size if your input data x is in the form of a TF Dataset or a generator (since they generate batches).

verbose	"auto", 0, 1, or 2. Verbosity mode. 0 = silent, 1 = progress bar, 2 = one line per epoch. "auto" becomes 1 for most cases, 2 if in a knitr render or running on a distributed training server. Note that the progress bar is not particularly useful when logged to a file, so verbose=2 is recommended when not running interactively (e.g., in a production environment). Defaults to "auto".
steps	Total number of steps (batches of samples) to draw before declaring the prediction round finished. If steps is NULL, predict() will run until x is exhausted. In the case of an infinitely repeating dataset, predict() will run indefinitely.
callbacks	List of Callback instances. List of callbacks to apply during prediction.

Details

Computation is done in batches. This method is designed for batch processing of large numbers of inputs. It is not intended for use inside of loops that iterate over your data and process small numbers of inputs at a time.

For small numbers of inputs that fit in one batch, directly call the model model$call for faster execution, e.g., model(x), or model(x, training = FALSE) if you have layers such as BatchNormalization that behave differently during inference.

Value

R array(s) of predictions.

Note

See this FAQ entry for more details about the difference between Model methods predict() and call().

See Also

- https://keras.io/api/models/model_training_apis#predict-method

Other model training:
compile.keras.src.models.model.Model()
evaluate.keras.src.models.model.Model()
predict_on_batch()
test_on_batch()
train_on_batch()

---

predict_on_batch *Returns predictions for a single batch of samples.*

Description

Returns predictions for a single batch of samples.

Usage

```
predict_on_batch(object, x)
```

Arguments

object	Keras model object
x	Input data. It must be array-like.

Value

Array(s) of predictions.

See Also

- https://keras.io/api/models/model_training_apis#predictonbatch-method

Other model training:
compile.keras.src.models.model.Model()
evaluate.keras.src.models.model.Model()
predict.keras.src.models.model.Model()
test_on_batch()
train_on_batch()

---

process_utils *Preprocessing and postprocessing utilities*

Description

These functions are used to preprocess and postprocess inputs and outputs of Keras applications.

Usage

```
application_preprocess_inputs(model, x, ..., data_format = NULL)

application_decode_predictions(model, preds, top = 5L, ...)
```

Arguments

model	A Keras model initialized using any `application_` function.
x	A batch of inputs to the model. If `x` is missing, then the `preprocess_input` function appropriate for `model` is returned.
...	Additional arguments passed to the preprocessing or decoding function.
data_format	Optional data format of the image tensor/array. `NULL` means the global setting `config_image_data_format()` is used (unless you changed it, it uses `"channels_last"`). Defaults to `NULL`.
preds	A batch of outputs from the model.
top	The number of top predictions to return.

Value

- A list of decoded predictions in case of `application_decode_predictions()`.
- A batch of preprocessed inputs in case of `application_preprocess_inputs()`.

Functions

- `application_preprocess_inputs()`: Pre-process inputs to be used in the model
- `application_decode_predictions()`: Decode predictions from the model

Examples

```
## Not run:
model <- application_convnext_tiny()

inputs <- random_normal(c(32, 224, 224, 3))
processed_inputs <- application_preprocess_inputs(model, inputs)

preds <- random_normal(c(32, 1000))
decoded_preds <- application_decode_predictions(model, preds)


## End(Not run)
```

`quantize_weights` *Quantize the weights of a model.*

Description

Note that the model must be built first before calling this method. `quantize_weights()` will recursively call `layer$quantize(mode)` in all layers and will be skipped if the layer doesn't implement the function.

Currently only `Dense` and `EinsumDense` layers support quantization.

Usage

```
quantize_weights(object, mode, ...)
```

Arguments

`object`	A Keras Model or Layer.
`mode`	The mode of the quantization. Only 'int8' is supported at this time.
`...`	Passed on to the `object` quantization method.

Value

`model`, invisibly. Note this is just a convenience for usage with `|>`, the model is modified in-place.

See Also

Other layer methods:
count_params()
get_config()
get_weights()
reset_state()

---

random_beta *Draw samples from a Beta distribution.*

Description

The values are drawn from a Beta distribution parametrized by alpha and beta.

Usage

```
random_beta(shape, alpha, beta, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
alpha	Float or an array of floats representing the first parameter alpha. Must be broadcastable with beta and shape.
beta	Float or an array of floats representing the second parameter beta. Must be broadcastable with alpha and shape.
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, config_floatx() is used, which defaults to "float32" unless you configured it otherwise (via config_set_floatx(float_dtype)).
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor of random values.

See Also

Other random:
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

---

random_binomial *Draw samples from a Binomial distribution.*

Description

The values are drawn from a Binomial distribution with specified trial count and probability of success.

Usage

```
random_binomial(shape, counts, probabilities, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
counts	A number or array of numbers representing the number of trials. It must be broadcastable with probabilities.
probabilities	A float or array of floats representing the probability of success of an individual event. It must be broadcastable with counts.
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, config_floatx() is used, which defaults to "float32" unless you configured it otherwise (via config_set_floatx(float_dtype)).
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor of random values.

See Also

- https://www.tensorflow.org/api_docs/python/tf/keras/random/binomial

Other random:
random_beta()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

---

random_categorical *Draws samples from a categorical distribution.*

Description

This function takes as input `logits`, a 2-D input tensor with shape (batch_size, num_classes). Each row of the input represents a categorical distribution, with each column index containing the log-probability for a given class.

The function will output a 2-D tensor with shape (batch_size, num_samples), where each row contains samples from the corresponding row in `logits`. Each column index contains an independent samples drawn from the input distribution.

```
x <- matrix(c(100, .1, 99), nrow = 1)
random_categorical(x, num_samples = 5, seed = 1234)

## tf.Tensor([[3 1 1 3 3]], shape=(1, 5), dtype=int32)


random_categorical(x, num_samples = 5, seed = 1234,
                   zero_indexed = TRUE)

## tf.Tensor([[2 0 0 2 2]], shape=(1, 5), dtype=int32)


op_take(x, random_categorical(x, num_samples = 5, seed = 1234))
```

```
## tf.Tensor([[ 99. 100. 100.  99.  99.]], shape=(1, 5), dtype=float64)


op_take(x, random_categorical(x, num_samples = 5, seed = 1234,
                              zero_indexed = TRUE),
        zero_indexed = TRUE)


## tf.Tensor([[ 99. 100. 100.  99.  99.]], shape=(1, 5), dtype=float64)
```

Usage

```
random_categorical(
  logits,
  num_samples,
  dtype = "int32",
  seed = NULL,
  zero_indexed = FALSE
)
```

Arguments

logits	2-D Tensor with shape (batch_size, num_classes). Each row should define a categorical distribution with the unnormalized log-probabilities for all classes.
num_samples	Int, the number of independent samples to draw for each row of the input. This will be the second dimension of the output tensor's shape.
dtype	Optional dtype of the output tensor.
seed	Optional R integer or instance of `random_seed_generator()`. By default, the `seed` argument is `NULL`, and an internal global `random_seed_generator()` is used. The `seed` argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the `seed` value will produce the same random values for each call. To generate different random values for repeated calls, an instance of `random_seed_generator()` must be provided as the `seed` value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global `random_seed_generator()` is not supported. Therefore, during tracing the default value `seed=NULL` will produce an error, and a `seed` argument must be provided.
zero_indexed	If `TRUE`, the returned indices are zero-based (`0` encodes to first position); if `FALSE` (default), the returned indices are one-based (`1` encodes to first position).

Value

A 2-D tensor with (batch_size, num_samples).

See Also

Other random:
random_beta()
random_binomial()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

---

random_dropout *Randomly set some values in a tensor to 0.*

Description

Randomly set some portion of values in the tensor to 0.

Usage

```
random_dropout(inputs, rate, noise_shape = NULL, seed = NULL)
```

Arguments

inputs	A tensor
rate	numeric
noise_shape	A shape() value
seed	Initial seed for the random number generator

Value

A tensor that is a copy of inputs with some values set to 0.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_gamma()
random_integer()
random_normal()
random_seed_generator()

random_shuffle()
random_truncated_normal()
random_uniform()

---

random_gamma — *Draw random samples from the Gamma distribution.*

Description

Draw random samples from the Gamma distribution.

Usage

```
random_gamma(shape, alpha, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
alpha	Float, the parameter of the distribution.
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, config_floatx() is used, which defaults to float32 unless you configured it otherwise (via config_set_floatx(float_dtype)).
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor of random values.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()

random_integer()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

---

random_integer *Draw random integers from a uniform distribution.*

Description

The generated values follow a uniform distribution in the range [minval, maxval). The lower bound minval is included in the range, while the upper bound maxval is excluded.

dtype must be an integer type.

Usage

```
random_integer(shape, minval, maxval, dtype = "int32", seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
minval	integer, lower bound of the range of random values to generate (inclusive).
maxval	integer, upper bound of the range of random values to generate (exclusive).
dtype	Optional dtype of the tensor. Only integer types are supported. If not specified, "int32" is used.
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor of random values.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

`random_normal` *Draw random samples from a normal (Gaussian) distribution.*

Description

Draw random samples from a normal (Gaussian) distribution.

Usage

```
random_normal(shape, mean = 0, stddev = 1, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
mean	Float, defaults to 0. Mean of the random values to generate.
stddev	Float, defaults to 1. Standard deviation of the random values to generate.
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, `config_floatx()` is used, which defaults to `float32` unless you configured it otherwise (via `config_set_floatx(float_dtype)`).
seed	Optional R integer or instance of `random_seed_generator()`. By default, the `seed` argument is `NULL`, and an internal global `random_seed_generator()` is used. The `seed` argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the `seed` value will produce the same random values for each call. To generate different random values for repeated calls, an instance of `random_seed_generator()` must be provided as the `seed` value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global `random_seed_generator()` is not supported. Therefore, during tracing the default value `seed=NULL` will produce an error, and a `seed` argument must be provided.

Value

A tensor of random values.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_seed_generator()
random_shuffle()
random_truncated_normal()
random_uniform()

---

random_seed_generator *Generates variable seeds upon each call to a function generating random numbers.*

Description

In Keras, all random number generators (such as random_normal()) are stateless, meaning that if you pass an integer seed to them (such as seed=42), they will return the same values for repeated calls. To get different values for each call, a SeedGenerator providing the state of the random generator has to be used.

Note that all the random number generators have a default seed of NULL, which implies that an internal global SeedGenerator is used. If you need to decouple the RNG from the global state you can provide a local StateGenerator with either a deterministic or random initial state.

Remark concerning the JAX backen: Note that the use of a local StateGenerator as seed argument is required for JIT compilation of RNG with the JAX backend, because the use of global state is not supported.

Usage

```
random_seed_generator(seed = NULL, name = NULL, ...)
```

Arguments

seed	Initial seed for the random number generator
name	String, name for the object
...	For forward/backward compatability.

Value

A SeedGenerator instance, which can be passed as the seed = argument to other random tensor generators.

Examples

```
seed_gen <- random_seed_generator(seed = 42)
values <- random_normal(shape = c(2, 3), seed = seed_gen)
new_values <- random_normal(shape = c(2, 3), seed = seed_gen)
```

Usage in a layer:

```
layer_dropout2 <- new_layer_class(
  "dropout2",
  initialize = function(...) {
    super$initialize(...)
    self$seed_generator <- random_seed_generator(seed = 1337)
  },
  call = function(x, training = FALSE) {
    if (training) {
      return(random_dropout(x, rate = 0.5, seed = self$seed_generator))
    }
    return(x)
  }
)

out <- layer_dropout(rate = 0.8)
out(op_ones(10), training = TRUE)
```

```
## tf.Tensor([0. 5. 5. 0. 0. 0. 0. 0. 0. 0.], shape=(10), dtype=float32)
```

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_shuffle()
random_truncated_normal()
random_uniform()

random_shuffle *Shuffle the elements of a tensor uniformly at random along an axis.*

Description

Shuffle the elements of a tensor uniformly at random along an axis.

Usage

```
random_shuffle(x, axis = 1L, seed = NULL)
```

Arguments

x	The tensor to be shuffled.
axis	An integer specifying the axis along which to shuffle. Defaults to 0.
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor, a copy of x with the axis axis shuffled.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_seed_generator()
random_truncated_normal()
random_uniform()

random_truncated_normal

Draw samples from a truncated normal distribution.

Description

The values are drawn from a normal distribution with specified mean and standard deviation, discarding and re-drawing any samples that are more than two standard deviations from the mean.

Usage

```
random_truncated_normal(shape, mean = 0, stddev = 1, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
mean	Float, defaults to 0. Mean of the random values to generate.
stddev	Float, defaults to 1. Standard deviation of the random values to generate.
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, `config_floatx()` is used, which defaults to `float32` unless you configured it otherwise (via `config_set_floatx(float_dtype)`)
seed	Optional R integer or instance of `random_seed_generator()`. By default, the `seed` argument is `NULL`, and an internal global `random_seed_generator()` is used. The `seed` argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the `seed` value will produce the same random values for each call. To generate different random values for repeated calls, an instance of `random_seed_generator()` must be provided as the `seed` value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global `random_seed_generator()` is not supported. Therefore, during tracing the default value `seed=NULL` will produce an error, and a `seed` argument must be provided.

Value

A tensor of random values.

See Also

Other random:
`random_beta()`
`random_binomial()`
`random_categorical()`
`random_dropout()`
`random_gamma()`
`random_integer()`

random_normal()
random_seed_generator()
random_shuffle()
random_uniform()

---

random_uniform *Draw samples from a uniform distribution.*

Description

The generated values follow a uniform distribution in the range [minval, maxval). The lower bound minval is included in the range, while the upper bound maxval is excluded.

dtype must be a floating point type, the default range is [0, 1).

Usage

```
random_uniform(shape, minval = 0, maxval = 1, dtype = NULL, seed = NULL)
```

Arguments

shape	The shape of the random values to generate.
minval	Float, defaults to 0. Lower bound of the range of random values to generate (inclusive).
maxval	Float, defaults to 1. Upper bound of the range of random values to generate (exclusive).
dtype	Optional dtype of the tensor. Only floating point types are supported. If not specified, config_floatx() is used, which defaults to float32 unless you configured it otherwise (via config_set_floatx(float_dtype))
seed	Optional R integer or instance of random_seed_generator(). By default, the seed argument is NULL, and an internal global random_seed_generator() is used. The seed argument can be used to ensure deterministic (repeatable) random number generation. Note that passing an integer as the seed value will produce the same random values for each call. To generate different random values for repeated calls, an instance of random_seed_generator() must be provided as the seed value. Remark concerning the JAX backend: When tracing functions with the JAX backend the global random_seed_generator() is not supported. Therefore, during tracing the default value seed=NULL will produce an error, and a seed argument must be provided.

Value

A tensor of random values.

See Also

Other random:
random_beta()
random_binomial()
random_categorical()
random_dropout()
random_gamma()
random_integer()
random_normal()
random_seed_generator()
random_shuffle()
random_truncated_normal()

---

register_keras_serializable

Registers a custom object with the Keras serialization framework.

Description

This function registers a custom class or function with the Keras custom object registry, so that it can be serialized and deserialized without needing an entry in the user-provided `custom_objects` argument. It also injects a function that Keras will call to get the object's serializable string key.

Note that to be serialized and deserialized, classes must implement the `get_config()` method. Functions do not have this requirement.

The object will be registered under the key `'package>name'` where `name`, defaults to the object name if not passed.

Usage

```
register_keras_serializable(object, name = NULL, package = NULL)
```

Arguments

`object`	A keras object.
`name`	The name to serialize this class under in this package.
`package`	The package that this class belongs to. This is used for the `key` (which is `"package>name"`) to identify the class. Defaults to the current package name, or `"Custom"` outside of a package.

Value

`object` is returned invisibly, for convenient piping. This is primarily called for side effects.

Examples

```
# Note that `'my_package'` is used as the `package` argument here, and since
# the `name` argument is not provided, `'MyDense'` is used as the `name`.
layer_my_dense <- Layer("MyDense")
register_keras_serializable(layer_my_dense, package = "my_package")

MyDense <- environment(layer_my_dense)$`__class__` # the python class obj
stopifnot(exprs = {
  get_registered_object('my_package>MyDense') == MyDense
  get_registered_name(MyDense) == 'my_package>MyDense'
})
```

See Also

Other saving and loading functions:
export_savedmodel.keras.src.models.model.Model()
layer_tfsm()
load_model()
load_model_weights()
save_model()
save_model_config()
save_model_weights()
with_custom_object_scope()

Other serialization utilities:
deserialize_keras_object()
get_custom_objects()
get_registered_name()
get_registered_object()
serialize_keras_object()
with_custom_object_scope()

---

regularizer_l1 — *A regularizer that applies a L1 regularization penalty.*

Description

The L1 regularization penalty is computed as: `loss = l1 * reduce_sum(abs(x))`

L1 may be passed to a layer as a string identifier:

```
dense <- layer_dense(units = 3, kernel_regularizer = 'l1')
```

In this case, the default value used is `l1=0.01`.

Usage

```
regularizer_l1(l1 = 0.01)
```

Arguments

l1	float, L1 regularization factor.

Value

A Regularizer instance that can be passed to layer constructors or used as a standalone object.

See Also

- https://keras.io/api/layers/regularizers#l1-class

Other regularizers:
regularizer_l1_l2()
regularizer_l2()
regularizer_orthogonal()

---

regularizer_l1_l2 *A regularizer that applies both L1 and L2 regularization penalties.*

Description

The L1 regularization penalty is computed as: loss = l1 * reduce_sum(abs(x))

The L2 regularization penalty is computed as loss = l2 * reduce_sum(square(x))

L1L2 may be passed to a layer as a string identifier:

```
dense <- layer_dense(units = 3, kernel_regularizer = 'L1L2')
```

In this case, the default values used are l1=0.01 and l2=0.01.

Usage

```
regularizer_l1_l2(l1 = 0, l2 = 0)
```

Arguments

l1	float, L1 regularization factor.
l2	float, L2 regularization factor.

Value

A Regularizer instance that can be passed to layer constructors or used as a standalone object.

See Also

- https://keras.io/api/layers/regularizers#l1l2-class

Other regularizers:
regularizer_l1()
regularizer_l2()
regularizer_orthogonal()

`regularizer_l2` *A regularizer that applies a L2 regularization penalty.*

Description

The L2 regularization penalty is computed as: `loss = l2 * reduce_sum(square(x))`

L2 may be passed to a layer as a string identifier:

```
dense <- layer_dense(units = 3, kernel_regularizer='l2')
```

In this case, the default value used is `l2=0.01`.

Usage

```
regularizer_l2(l2 = 0.01)
```

Arguments

`l2`	float, L2 regularization factor.

Value

A `Regularizer` instance that can be passed to layer constructors or used as a standalone object.

See Also

- https://keras.io/api/layers/regularizers#l2-class

Other regularizers:
regularizer_l1()
regularizer_l1_l2()
regularizer_orthogonal()

regularizer_orthogonal
Regularizer that encourages input vectors to be orthogonal to each other.

Description

It can be applied to either the rows of a matrix (`mode="rows"`) or its columns (`mode="columns"`). When applied to a `Dense` kernel of shape `(input_dim, units)`, rows mode will seek to make the feature vectors (i.e. the basis of the output space) orthogonal to each other.

Usage

```
regularizer_orthogonal(factor = 0.01, mode = "rows")
```

Arguments

`factor`	Float. The regularization factor. The regularization penalty will be proportional to `factor` times the mean of the dot products between the L2-normalized rows (if `mode="rows"`, or columns if `mode="columns"`) of the inputs, excluding the product of each row/column with itself. Defaults to `0.01`.
`mode`	String, one of `{"rows", "columns"}`. Defaults to `"rows"`. In rows mode, the regularization effect seeks to make the rows of the input orthogonal to each other. In columns mode, it seeks to make the columns of the input orthogonal to each other.

Value

A `Regularizer` instance that can be passed to layer constructors or used as a standalone object.

Examples

```
regularizer <- regularizer_orthogonal(factor=0.01)
layer <- layer_dense(units=4, kernel_regularizer=regularizer)
```

See Also

- https://keras.io/api/layers/regularizers#orthogonalregularizer-class

Other regularizers:
`regularizer_l1()`
`regularizer_l1_l2()`
`regularizer_l2()`

`reset_state` *Reset the state for a model, layer or metric.*

Description

Reset the state for a model, layer or metric.

Usage

```
reset_state(object)
```

Arguments

`object`	Model, Layer, or Metric instance Not all Layers have resettable state (E.g., `adapt()`-able preprocessing layers and rnn layers have resettable state, but a `layer_dense()` does not). Calling this on a Layer instance without any resettable-state will error.

Value

`object`, invisibly.

See Also

Other layer methods:
`count_params()`
`get_config()`
`get_weights()`
`quantize_weights()`

`rnn_cells_stack` *Wrapper allowing a stack of RNN cells to behave as a single cell.*

Description

Used to implement efficient stacked RNNs.

Usage

```
rnn_cells_stack(cells, ...)
```

Arguments

`cells`	List of RNN cell instances.
`...`	Unnamed arguments are treated as additional `cells`. Named arguments are passed on to the underlying layer.

Value

A Layer instance, which is intended to be used with layer_rnn().

Example

```
batch_size <- 3
sentence_length <- 5
num_features <- 2
new_shape <- c(batch_size, sentence_length, num_features)
x <- array(1:30, dim = new_shape)

rnn_cells <- lapply(1:2, function(x) rnn_cell_lstm(units = 128))
stacked_lstm <- rnn_cells_stack(rnn_cells)
lstm_layer <- layer_rnn(cell = stacked_lstm)

result <- lstm_layer(x)
str(result)

## <tf.Tensor: shape=(3, 128), dtype=float32, numpy=. . .>
```

See Also

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()

layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()

layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()

layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cell_simple()

---

rnn_cell_gru *Cell class for the GRU layer.*

Description

This class processes one step within the whole time sequence input, whereas layer_gru() processes the whole sequence.

Usage

```
rnn_cell_gru(
  units,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
```

```
  bias_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  reset_after = TRUE,
  seed = NULL,
  ...
)
```

Arguments

`units` Positive integer, dimensionality of the output space.

`activation` Activation function to use. Default: hyperbolic tangent (`tanh`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).

`recurrent_activation`
Activation function to use for the recurrent step. Default: sigmoid (`sigmoid`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).

`use_bias` Boolean, (default `TRUE`), whether the layer should use a bias vector.

`kernel_initializer`
Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs. Default: `"glorot_uniform"`.

`recurrent_initializer`
Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state. Default: `"orthogonal"`.

`bias_initializer`
Initializer for the bias vector. Default: `"zeros"`.

`kernel_regularizer`
Regularizer function applied to the `kernel` weights matrix. Default: `NULL`.

`recurrent_regularizer`
Regularizer function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.

`bias_regularizer`
Regularizer function applied to the bias vector. Default: `NULL`.

`kernel_constraint`
Constraint function applied to the `kernel` weights matrix. Default: `NULL`.

`recurrent_constraint`
Constraint function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.

`bias_constraint`
Constraint function applied to the bias vector. Default: `NULL`.

`dropout` Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.

`recurrent_dropout`
Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.

reset_after	GRU convention (whether to apply reset gate after or before matrix multiplication). FALSE = "before", TRUE = "after" (default and cuDNN compatible).
seed	Random seed for dropout.
...	For forward/backward compatability.

Value

A Layer instance, which is intended to be used with layer_rnn().

Call Arguments

- inputs: A 2D tensor, with shape (batch, features).
- states: A 2D tensor with shape (batch, units), which is the state from the previous time step.
- training: Python boolean indicating whether the layer should behave in training mode or in inference mode. Only relevant when dropout or recurrent_dropout is used.

Examples

```
inputs <- random_uniform(c(32, 10, 8))
outputs <- inputs |> layer_rnn(rnn_cell_gru(4))
shape(outputs)

## shape(32, 4)


rnn <- layer_rnn(
   cell = rnn_cell_gru(4),
   return_sequences=TRUE,
   return_state=TRUE)
c(whole_sequence_output, final_state) %<-% rnn(inputs)
shape(whole_sequence_output)

## shape(32, 10, 4)


shape(final_state)

## shape(32, 4)
```

See Also

Other rnn cells:
layer_rnn()
rnn_cell_lstm()
rnn_cell_simple()

Other gru rnn layers:
layer_gru()

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()

layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()

layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()

layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_lstm()
rnn_cell_simple()
rnn_cells_stack()

---

rnn_cell_lstm *Cell class for the LSTM layer.*

Description

This class processes one step within the whole time sequence input, whereas layer_lstm() processes the whole sequence.

Usage

```
rnn_cell_lstm(
  units,
  activation = "tanh",
  recurrent_activation = "sigmoid",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  unit_forget_bias = TRUE,
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  ...
)
```

Arguments

units Positive integer, dimensionality of the output space.

activation Activation function to use. Default: hyperbolic tangent (tanh). If you pass NULL, no activation is applied (ie. "linear" activation: a(x) = x).

recurrent_activation
Activation function to use for the recurrent step. Default: sigmoid (sigmoid). If you pass NULL, no activation is applied (ie. "linear" activation: a(x) = x).

use_bias Boolean, (default TRUE), whether the layer should use a bias vector.

kernel_initializer
Initializer for the kernel weights matrix, used for the linear transformation of the inputs. Default: "glorot_uniform".

recurrent_initializer
Initializer for the recurrent_kernel weights matrix, used for the linear transformation of the recurrent state. Default: "orthogonal".

bias_initializer
Initializer for the bias vector. Default: "zeros".

unit_forget_bias
Boolean (default TRUE). If TRUE, add 1 to the bias of the forget gate at initialization. Setting it to TRUE will also force bias_initializer="zeros". This is recommended in Jozefowicz et al.

kernel_regularizer
Regularizer function applied to the kernel weights matrix. Default: NULL.

recurrent_regularizer
Regularizer function applied to the recurrent_kernel weights matrix. Default: NULL.

bias_regularizer
Regularizer function applied to the bias vector. Default: NULL.

kernel_constraint
Constraint function applied to the kernel weights matrix. Default: NULL.

recurrent_constraint
Constraint function applied to the recurrent_kernel weights matrix. Default: NULL.

bias_constraint
Constraint function applied to the bias vector. Default: NULL.

dropout Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.

recurrent_dropout
Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.

seed Random seed for dropout.

... For forward/backward compatability.

Value

A Layer instance, which is intended to be used with layer_rnn().

Call Arguments

- inputs: A 2D tensor, with shape (batch, features).
- states: A 2D tensor with shape (batch, units), which is the state from the previous time step.
- training: Boolean indicating whether the layer should behave in training mode or in inference mode. Only relevant when dropout or recurrent_dropout is used.

Examples

```
inputs <- random_uniform(c(32, 10, 8))
output <- inputs |>
  layer_rnn(cell = rnn_cell_lstm(4))
shape(output)

## shape(32, 4)


rnn <- layer_rnn(cell = rnn_cell_lstm(4),
                 return_sequences = T,
                 return_state = T)
c(whole_sequence_output, ...final_state) %<-% rnn(inputs)
str(whole_sequence_output)

## <tf.Tensor: shape=(32, 10, 4), dtype=float32, numpy=...>


str(final_state)

## List of 2
##  $ :<tf.Tensor: shape=(32, 4), dtype=float32, numpy=...>
##  $ :<tf.Tensor: shape=(32, 4), dtype=float32, numpy=...>
```

See Also

Other rnn cells:
layer_rnn()
rnn_cell_gru()
rnn_cell_simple()

Other lstm rnn layers:
layer_lstm()

Other rnn layers:
layer_bidirectional()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_simple()

rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()
layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()

layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()
layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()

layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_simple()
rnn_cells_stack()

---

rnn_cell_simple *Cell class for SimpleRNN.*

Description

This class processes one step within the whole time sequence input, whereas layer_simple_rnn() processes the whole sequence.

Usage

```
rnn_cell_simple(
  units,
  activation = "tanh",
  use_bias = TRUE,
  kernel_initializer = "glorot_uniform",
  recurrent_initializer = "orthogonal",
  bias_initializer = "zeros",
  kernel_regularizer = NULL,
  recurrent_regularizer = NULL,
  bias_regularizer = NULL,
  kernel_constraint = NULL,
  recurrent_constraint = NULL,
  bias_constraint = NULL,
  dropout = 0,
  recurrent_dropout = 0,
  seed = NULL,
  ...
)
```

Arguments

`units`	Positive integer, dimensionality of the output space.
`activation`	Activation function to use. Default: hyperbolic tangent (`tanh`). If you pass `NULL`, no activation is applied (ie. "linear" activation: `a(x) = x`).
`use_bias`	Boolean, (default `TRUE`), whether the layer should use a bias vector.
`kernel_initializer`	Initializer for the `kernel` weights matrix, used for the linear transformation of the inputs. Default: `"glorot_uniform"`.
`recurrent_initializer`	Initializer for the `recurrent_kernel` weights matrix, used for the linear transformation of the recurrent state. Default: `"orthogonal"`.
`bias_initializer`	Initializer for the bias vector. Default: `"zeros"`.
`kernel_regularizer`	Regularizer function applied to the `kernel` weights matrix. Default: `NULL`.
`recurrent_regularizer`	Regularizer function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.
`bias_regularizer`	Regularizer function applied to the bias vector. Default: `NULL`.
`kernel_constraint`	Constraint function applied to the `kernel` weights matrix. Default: `NULL`.
`recurrent_constraint`	Constraint function applied to the `recurrent_kernel` weights matrix. Default: `NULL`.

bias_constraint
: Constraint function applied to the bias vector. Default: NULL.

dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the inputs. Default: 0.

recurrent_dropout
: Float between 0 and 1. Fraction of the units to drop for the linear transformation of the recurrent state. Default: 0.

seed
: Random seed for dropout.

...
: For forward/backward compatability.

Value

A Layer instance, which is intended to be used with layer_rnn().

Call Arguments

- sequence: A 2D tensor, with shape (batch, features).
- states: A 2D tensor with shape (batch, units), which is the state from the previous time step.
- training: Python boolean indicating whether the layer should behave in training mode or in inference mode. Only relevant when dropout or recurrent_dropout is used.

Examples

```
inputs <- random_uniform(c(32, 10, 8))
rnn <- layer_rnn(cell = rnn_cell_simple(units = 4))
output <- rnn(inputs)  # The output has shape `(32, 4)`.
rnn <- layer_rnn(
    cell = rnn_cell_simple(units = 4),
    return_sequences=TRUE,
    return_state=TRUE
)
# whole_sequence_output has shape `(32, 10, 4)`.
# final_state has shape `(32, 4)`.
c(whole_sequence_output, final_state) %<-% rnn(inputs)
```

See Also

Other rnn cells:
layer_rnn()
rnn_cell_gru()
rnn_cell_lstm()

Other simple rnn layers:
layer_simple_rnn()

Other rnn layers:
layer_bidirectional()

layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_gru()
layer_lstm()
layer_rnn()
layer_simple_rnn()
layer_time_distributed()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cells_stack()

Other layers:
Layer()
layer_activation()
layer_activation_elu()
layer_activation_leaky_relu()
layer_activation_parametric_relu()
layer_activation_relu()
layer_activation_softmax()
layer_activity_regularization()
layer_add()
layer_additive_attention()
layer_alpha_dropout()
layer_attention()
layer_aug_mix()
layer_auto_contrast()
layer_average()
layer_average_pooling_1d()
layer_average_pooling_2d()
layer_average_pooling_3d()
layer_batch_normalization()
layer_bidirectional()
layer_category_encoding()
layer_center_crop()
layer_concatenate()
layer_conv_1d()
layer_conv_1d_transpose()
layer_conv_2d()
layer_conv_2d_transpose()
layer_conv_3d()
layer_conv_3d_transpose()
layer_conv_lstm_1d()
layer_conv_lstm_2d()
layer_conv_lstm_3d()
layer_cropping_1d()
layer_cropping_2d()
layer_cropping_3d()

layer_cut_mix()
layer_dense()
layer_depthwise_conv_1d()
layer_depthwise_conv_2d()
layer_discretization()
layer_dot()
layer_dropout()
layer_einsum_dense()
layer_embedding()
layer_equalization()
layer_feature_space()
layer_flatten()
layer_flax_module_wrapper()
layer_gaussian_dropout()
layer_gaussian_noise()
layer_global_average_pooling_1d()
layer_global_average_pooling_2d()
layer_global_average_pooling_3d()
layer_global_max_pooling_1d()
layer_global_max_pooling_2d()
layer_global_max_pooling_3d()
layer_group_normalization()
layer_group_query_attention()
layer_gru()
layer_hashed_crossing()
layer_hashing()
layer_identity()
layer_integer_lookup()
layer_jax_model_wrapper()
layer_lambda()
layer_layer_normalization()
layer_lstm()
layer_masking()
layer_max_num_bounding_boxes()
layer_max_pooling_1d()
layer_max_pooling_2d()
layer_max_pooling_3d()
layer_maximum()
layer_mel_spectrogram()
layer_minimum()
layer_mix_up()
layer_multi_head_attention()
layer_multiply()
layer_normalization()
layer_permute()
layer_rand_augment()
layer_random_brightness()
layer_random_color_degeneration()

layer_random_color_jitter()
layer_random_contrast()
layer_random_crop()
layer_random_erasing()
layer_random_flip()
layer_random_gaussian_blur()
layer_random_grayscale()
layer_random_hue()
layer_random_invert()
layer_random_perspective()
layer_random_posterization()
layer_random_rotation()
layer_random_saturation()
layer_random_sharpness()
layer_random_shear()
layer_random_translation()
layer_random_zoom()
layer_repeat_vector()
layer_rescaling()
layer_reshape()
layer_resizing()
layer_rms_normalization()
layer_rnn()
layer_separable_conv_1d()
layer_separable_conv_2d()
layer_simple_rnn()
layer_solarization()
layer_spatial_dropout_1d()
layer_spatial_dropout_2d()
layer_spatial_dropout_3d()
layer_spectral_normalization()
layer_stft_spectrogram()
layer_string_lookup()
layer_subtract()
layer_text_vectorization()
layer_tfsm()
layer_time_distributed()
layer_torch_module_wrapper()
layer_unit_normalization()
layer_upsampling_1d()
layer_upsampling_2d()
layer_upsampling_3d()
layer_zero_padding_1d()
layer_zero_padding_2d()
layer_zero_padding_3d()
rnn_cell_gru()
rnn_cell_lstm()
rnn_cells_stack()

save_model *Saves a model as a .keras file.*

Description

Saves a model as a `.keras` file.

Usage

```
save_model(model, filepath = NULL, overwrite = FALSE, zipped = NULL, ...)
```

Arguments

`model`	A keras model.
`filepath`	string, Path where to save the model. Must end in `.keras`.
`overwrite`	Whether we should overwrite any existing model at the target location, or instead ask the user via an interactive prompt.
`zipped`	Whether to save the model as a zipped `.keras` archive (default when saving locally), or as an unzipped directory (default when saving on the Hugging Face Hub).
`...`	For forward/backward compatability.

Value

If `filepath` is provided, then this function is called primarily for side effects, and `model` is returned invisibly. If `filepath` is not provided or `NULL`, then the serialized model is returned as an R raw vector.

Examples

```
model <- keras_model_sequential(input_shape = c(3)) |>
  layer_dense(5) |>
  layer_activation_softmax()

model |> save_model("model.keras")
loaded_model <- load_model("model.keras")

x <- random_uniform(c(10, 3))
stopifnot(all.equal(
  model |> predict(x),
  loaded_model |> predict(x)
))
```

The saved `.keras` file is a `zip` archive that contains:

- The model's configuration (architecture)
- The model's weights
- The model's optimizer's state (if any)

Thus models can be reinstantiated in the exact same state.

```
zip::zip_list("model.keras")[, "filename"]
```

```
## [1] "metadata.json"    "config.json"      "model.weights.h5"
```

See Also

load_model()

Other saving and loading functions:
export_savedmodel.keras.src.models.model.Model()
layer_tfsm()
load_model()
load_model_weights()
register_keras_serializable()
save_model_config()
save_model_weights()
with_custom_object_scope()

---

save_model_config   *Save and load model configuration as JSON*

Description

Save and re-load models configurations as JSON. Note that the representation does not include the weights, only the architecture.

Usage

```
save_model_config(model, filepath = NULL, overwrite = FALSE)

load_model_config(filepath, custom_objects = NULL)
```

Arguments

model	Model object to save
filepath	path to json file with the model config.
overwrite	Whether we should overwrite any existing model configuration json at filepath, or instead ask the user via an interactive prompt.
custom_objects	Optional named list mapping names to custom classes or functions to be considered during deserialization.

Details

Note: `save_model_config()` serializes the model to JSON using `serialize_keras_object()`, not `get_config()`. `serialize_keras_object()` returns a superset of `get_config()`, with additional information needed to create the class object needed to restore the model. See example for how to extract the `get_config()` value from a saved model.

Value

This is called primarily for side effects. `model` is returned, invisibly, to enable usage with the pipe.

Example

```
model <- keras_model_sequential(input_shape = 10) |> layer_dense(10)
file <- tempfile("model-config-", fileext = ".json")
save_model_config(model, file)

# load a new model instance with the same architecture but different weights
model2 <- load_model_config(file)

stopifnot(exprs = {
  all.equal(get_config(model), get_config(model2))

  # To extract the `get_config()` value from a saved model config:
  all.equal(
      get_config(model),
      structure(jsonlite::read_json(file)$config,
                "__class__" = keras_model_sequential()$`__class__`)
  )
})
```

See Also

Other saving and loading functions:
`export_savedmodel.keras.src.models.model.Model()`
`layer_tfsm()`
`load_model()`
`load_model_weights()`
`register_keras_serializable()`
`save_model()`
`save_model_weights()`
`with_custom_object_scope()`

save_model_weights — *Saves all layer weights to a `.weights.h5` file.*

Description

Saves all layer weights to a `.weights.h5` file.

Usage

```
save_model_weights(model, filepath, overwrite = FALSE)
```

Arguments

`model`	A keras Model object
`filepath`	string. Path where to save the model. Must end in `.weights.h5`.
`overwrite`	Whether we should overwrite any existing model at the target location, or instead ask the user via an interactive prompt.

Value

This is called primarily for side effects. `model` is returned, invisibly, to enable usage with the pipe.

See Also

- https://keras.io/api/models/model_saving_apis/weights_saving_and_loading#saveweights-method

Other saving and loading functions:
`export_savedmodel.keras.src.models.model.Model()`
`layer_tfsm()`
`load_model()`
`load_model_weights()`
`register_keras_serializable()`
`save_model()`
`save_model_config()`
`with_custom_object_scope()`

serialize_keras_object — *Retrieve the full config by serializing the Keras object.*

Description

`serialize_keras_object()` serializes a Keras object to a named list that represents the object, and is a reciprocal function of `deserialize_keras_object()`. See `deserialize_keras_object()` for more information about the full config format.

Usage

```
serialize_keras_object(obj)
```

Arguments

obj	the Keras object to serialize.

Value

A named list that represents the object config. The config is expected to contain simple types only, and can be saved as json. The object can be deserialized from the config via `deserialize_keras_object()`.

See Also

- https://keras.io/api/models/model_saving_apis/serialization_utils#serializekerasobject-function

Other serialization utilities:
`deserialize_keras_object()`
`get_custom_objects()`
`get_registered_name()`
`get_registered_object()`
`register_keras_serializable()`
`with_custom_object_scope()`

`set_random_seed` *Sets all random seeds (Python, NumPy, and backend framework, e.g. TF).*

Description

You can use this utility to make almost any Keras program fully deterministic. Some limitations apply in cases where network communications are involved (e.g. parameter server distribution), which creates additional sources of randomness, or when certain non-deterministic cuDNN ops are involved.

This sets:

- the R session seed: `set.seed()`
- the Python session seed: `import random; random.seed(seed)`
- the Python NumPy seed: `import numpy; numpy.random.seed(seed)`
- the TensorFlow seed: `tf$random$set_seed(seed)` (only if TF is installed)
- The Torch seed: `import("torch")$manual_seed(seed)` (only if the backend is torch)
- and disables Python hash randomization.

Note that the TensorFlow seed is set even if you're not using TensorFlow as your backend framework, since many workflows leverage `tf$data` pipelines (which feature random shuffling). Likewise many workflows might leverage NumPy APIs.

Usage

```
set_random_seed(seed)
```

Arguments

seed	Integer, the random seed to use.

Value

No return value, called for side effects.

See Also

- https://keras.io/api/utils/python_utils#setrandomseed-function

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

set_state_tree — *Assigns values to variables of the model.*

Description

This method takes a dictionary (named list) of nested variable values, which represents the state tree of the model, and assigns them to the corresponding variables of the model. The keys (list names) represent the variable names (e.g., `'trainable_variables'`, `'optimizer_variables'`), and the values are nested dictionaries containing the variable paths and their corresponding values.

Usage

```
set_state_tree(object, state_tree)
```

Arguments

`object`	A keras model.
`state_tree`	A dictionary representing the state tree of the model. The keys are the variable names, and the values are nested dictionaries representing the variable paths and their values.

See Also

Other model functions:
`get_config()`
`get_layer()`
`get_state_tree()`
`keras_model()`
`keras_model_sequential()`
`pop_layer()`
`summary.keras.src.models.model.Model()`

---

shape *Tensor shape utility*

Description

This function can be used to get or create a tensor shape.

Usage

```
shape(...)

## S3 method for class 'keras_shape'
format(x, ..., prefix = TRUE)

## S3 method for class 'keras_shape'
print(x, ...)

## S3 method for class 'keras_shape'
```

```
x[...]

## S3 method for class 'keras_shape'
as.integer(x, ...)

## S3 method for class 'keras_shape'
Summary(..., na.rm = FALSE)

## S3 method for class 'keras_shape'
as.list(x, ...)

## S3 method for class 'keras_shape'
x == y

## S3 method for class 'keras_shape'
x != y
```

Arguments

`...`	A shape specification. Numerics, `NULL` and tensors are valid. `NULL`, `NA`, and `-1L` can be used to specify an unspecified dim size. Tensors are dispatched to `op_shape()` to extract the tensor shape. Values wrapped in `I()` are used asis (see examples). All other objects are coerced via `as.integer()`.
`x, y`	A `keras_shape` object.
`prefix`	Whether to format the shape object with a prefix. Defaults to `"shape"`.
`na.rm`	passed on to Summary group generics like `prod()`. Unknown axes are treated as `NA`.

Value

A list with a `"keras_shape"` class attribute. Each element of the list will be either a) `NULL`, b) an R integer or c) a scalar integer tensor (e.g., when supplied a TF tensor with an unspecified dimension in a function being traced).

Examples

```
shape(1, 2, 3)
```

```
## shape(1, 2, 3)
```

3 ways to specify an unknown dimension

```
shape(NA,   2, 3)
shape(NULL, 2, 3)
shape(-1,   2, 3)
```

```
## shape(NA, 2, 3)
## shape(NA, 2, 3)
## shape(NA, 2, 3)
```

Most functions that take a 'shape' argument also coerce with shape()

```
layer_input(c(1, 2, 3))
layer_input(shape(1, 2, 3))
```

```
## <KerasTensor shape=(None, 1, 2, 3), dtype=float32, sparse=False, ragged=False, name=keras_tensor>
## <KerasTensor shape=(None, 1, 2, 3), dtype=float32, sparse=False, ragged=False, name=keras_tensor_1>
```

You can also use shape() to get the shape of a tensor (excepting scalar integer tensors).

```
symbolic_tensor <- layer_input(shape(1, 2, 3))
shape(symbolic_tensor)
```

```
## shape(NA, 1, 2, 3)
```

```
eager_tensor <- op_ones(c(1,2,3))
shape(eager_tensor)
```

```
## shape(1, 2, 3)
```

```
op_shape(eager_tensor)
```

```
## shape(1, 2, 3)
```

Combine or expand shapes

```
shape(symbolic_tensor, 4)
```

```
## shape(NA, 1, 2, 3, 4)
```

```
shape(5, symbolic_tensor, 4)
```

```
## shape(5, NA, 1, 2, 3, 4)
```

Scalar integer tensors are treated as axis values. These are most commonly encountered when tracing a function in graph mode, where an axis size might be unknown.

```
tfn <- tensorflow::tf_function(function(x) {
  print(op_shape(x))
  x
},
input_signature = list(tensorflow::tf$TensorSpec(shape(1, NA, 3))))
invisible(tfn(op_ones(shape(1, 2, 3))))

## shape(1, Tensor("strided_slice:0", shape=(), dtype=int32), 3)
```

A useful pattern is to unpack the shape() with %<-%, like this:

```
c(batch_size, seq_len, channels) %<-% shape(x)

# `%<-%` also has support for skipping values
# during unpacking with `.` and `...`. For example,
# To retrieve just the first and/or last dim:
c(batch_size, ...) %<-% shape(x)
c(batch_size, ., .) %<-% shape(x)
c(..., channels) %<-% shape(x)
c(batch_size, ..., channels) %<-% shape(x)
c(batch_size, ., channels) %<-% shape(x)

echo_print <- function(x) {
  message("> ", deparse(substitute(x)));
  if(!is.null(x)) print(x)
}
tfn <- tensorflow::tf_function(function(x) {
  c(axis1, axis2, axis3) %<-% shape(x)
  echo_print(str(list(axis1 = axis1, axis2 = axis2, axis3 = axis3)))

  echo_print(shape(axis1))               # use axis1 tensor as axis value
  echo_print(shape(axis1, axis2, axis3)) # use axis1 tensor as axis value

  # use shape() to compose a new shape, e.g., in multihead attention
  n_heads <- 4
  echo_print(shape(axis1, axis2, n_heads, axis3/n_heads))

  x
},
input_signature = list(tensorflow::tf$TensorSpec(shape(NA, 4, 16))))
invisible(tfn(op_ones(shape(2, 4, 16))))

## > str(list(axis1 = axis1, axis2 = axis2, axis3 = axis3))

## List of 3
##  $ axis1:<tf.Tensor 'strided_slice:0' shape=() dtype=int32>
##  $ axis2: int 4
##  $ axis3: int 16
```

```
## > shape(axis1)

## shape(Tensor("strided_slice:0", shape=(), dtype=int32))


## > shape(axis1, axis2, axis3)

## shape(Tensor("strided_slice:0", shape=(), dtype=int32), 4, 16)


## > shape(axis1, axis2, n_heads, axis3/n_heads)

## shape(Tensor("strided_slice:0", shape=(), dtype=int32), 4, 4, 4)
```

If you want to resolve the shape of a tensor that can potentially be a scalar integer, you can wrap the tensor in `I()`, or use `op_shape()`.

```
(x <- op_convert_to_tensor(2L))

## tf.Tensor(2, shape=(), dtype=int32)


# by default, shape() treats scalar integer tensors as axis values
shape(x)

## shape(tf.Tensor(2, shape=(), dtype=int32))


# to access the shape of a scalar integer,
# call `op_shape()`, or protect with `I()`
op_shape(x)

## shape()


shape(I(x))

## shape()
```

See Also

`op_shape()`

split_dataset *Splits a dataset into a left half and a right half (e.g. train / test).*

Description

Splits a dataset into a left half and a right half (e.g. train / test).

Usage

```
split_dataset(
  dataset,
  left_size = NULL,
  right_size = NULL,
  shuffle = FALSE,
  seed = NULL
)
```

Arguments

`dataset`	A `tf$data$Dataset`, a `torch$utils$data$Dataset` object, or a list of arrays with the same length.
`left_size`	If float (in the range `[0, 1]`), it signifies the fraction of the data to pack in the left dataset. If integer, it signifies the number of samples to pack in the left dataset. If `NULL`, defaults to the complement to `right_size`. Defaults to `NULL`.
`right_size`	If float (in the range `[0, 1]`), it signifies the fraction of the data to pack in the right dataset. If integer, it signifies the number of samples to pack in the right dataset. If `NULL`, defaults to the complement to `left_size`. Defaults to `NULL`.
`shuffle`	Boolean, whether to shuffle the data before splitting it.
`seed`	A random seed for shuffling.

Value

A list of two `tf$data$Dataset` objects: the left and right splits.

Examples

```
data <- random_uniform(c(1000, 4))
c(left_ds, right_ds) %<-% split_dataset(list(data$numpy()), left_size = 0.8)
left_ds$cardinality()

## tf.Tensor(800, shape=(), dtype=int64)


right_ds$cardinality()

## tf.Tensor(200, shape=(), dtype=int64)
```

See Also

- https://keras.io/api/utils/python_utils#splitdataset-function

Other dataset utils:
audio_dataset_from_directory()
image_dataset_from_directory()
text_dataset_from_directory()
timeseries_dataset_from_array()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()
zip_lists()

---

summary.keras.src.models.model.Model

Print a summary of a Keras Model

Description

Print a summary of a Keras Model

Usage

```
## S3 method for class 'keras.src.models.model.Model'
summary(object, ...)

## S3 method for class 'keras.src.models.model.Model'
format(
  x,
  line_length = min(getOption("width"), 180),
  positions = NULL,
  expand_nested = FALSE,
  show_trainable = NA,
  ...,
  layer_range = NULL,
  compact = TRUE
)

## S3 method for class 'keras.src.models.model.Model'
print(x, ...)
```

Arguments

object, x	Keras model instance
...	for summary() and print(), passed on to format(). For format(), passed on to model$summary().
line_length	Total length of printed lines
positions	Relative or absolute positions of log elements in each line. If not provided, defaults to c(0.33, 0.55, 0.67, 1.0).
expand_nested	Whether to expand the nested models. If not provided, defaults to FALSE.
show_trainable	Whether to show if a layer is trainable. If not provided, defaults to FALSE.
layer_range	a list, tuple, or vector of 2 strings, which is the starting layer name and ending layer name (both inclusive) indicating the range of layers to be printed in summary. It also accepts regex patterns instead of exact name. In such case, start predicate will be the first element it matches to layer_range[[1]] and the end predicate will be the last element it matches to layer_range[[1]]. By default NULL which considers all layers of model.
compact	Whether to remove white-space only lines from the model summary. (Default TRUE)

Value

format() returns a length 1 character vector. print() returns the model object invisibly. summary() returns the output of format() invisibly after printing it.

Enabling color output in Knitr (RMarkdown, Quarto)

In order to enable color output in a quarto or rmarkdown document with an html output format (include revealjs presentations), then you will need to do the following in a setup chunk:

```
```{r setup, include = FALSE}
options(cli.num_colors = 256)
fansi::set_knit_hooks(knitr::knit_hooks)
options(width = 75) # adjust as needed for format
```
```

See Also

Other model functions:
get_config()
get_layer()
get_state_tree()
keras_model()
keras_model_sequential()
pop_layer()
set_state_tree()

`test_on_batch` *Test the model on a single batch of samples.*

Description

Test the model on a single batch of samples.

Usage

```
test_on_batch(object, x, y = NULL, sample_weight = NULL, ...)
```

Arguments

object	Keras model object
x	Input data. Must be array-like.
y	Target data. Must be array-like.
sample_weight	Optional array of the same length as x, containing weights to apply to the model's loss for each sample. In the case of temporal data, you can pass a 2D array with shape (samples, sequence_length), to apply a different weight to every timestep of every sample.
...	for forward/backward compatability

Value

A scalar loss value (when no metrics), or a named list of loss and metric values (if there are metrics).

See Also

- https://keras.io/api/models/model_training_apis#testonbatch-method

Other model training:
compile.keras.src.models.model.Model()
evaluate.keras.src.models.model.Model()
predict.keras.src.models.model.Model()
predict_on_batch()
train_on_batch()

---

text_dataset_from_directory
Generates a tf.data.Dataset *from text files in a directory.*

Description

If your directory structure is:

```
main_directory/
...class_a/
......a_text_1.txt
......a_text_2.txt
...class_b/
......b_text_1.txt
......b_text_2.txt
```

Then calling `text_dataset_from_directory(main_directory, labels='inferred')` will return a `tf.data.Dataset` that yields batches of texts from the subdirectories `class_a` and `class_b`, together with labels 0 and 1 (0 corresponding to `class_a` and 1 corresponding to `class_b`).

Only `.txt` files are supported at this time.

Usage

```
text_dataset_from_directory(
  directory,
  labels = "inferred",
  label_mode = "int",
  class_names = NULL,
  batch_size = 32L,
  max_length = NULL,
  shuffle = TRUE,
  seed = NULL,
  validation_split = NULL,
  subset = NULL,
  follow_links = FALSE,
  verbose = TRUE
)
```

Arguments

- `directory` — Directory where the data is located. If `labels` is `"inferred"`, it should contain subdirectories, each containing text files for a class. Otherwise, the directory structure is ignored.
- `labels` — Either `"inferred"` (labels are generated from the directory structure), `NULL` (no labels), or a list/tuple of integer labels of the same size as the number of text files found in the directory. Labels should be sorted according to the alphanumeric order of the text file paths (obtained via `os.walk(directory)` in Python).
- `label_mode` — String describing the encoding of `labels`. Options are:
  - `"int"`: means that the labels are encoded as integers (e.g. for `sparse_categorical_crossentropy` loss).
  - `"categorical"` means that the labels are encoded as a categorical vector (e.g. for `categorical_crossentropy` loss).
  - `"binary"` means that the labels (there can be only 2) are encoded as `float32` scalars with values 0 or 1 (e.g. for `binary_crossentropy`).
  - `NULL` (no labels).
- `class_names` — Only valid if `"labels"` is `"inferred"`. This is the explicit list of class names (must match names of subdirectories). Used to control the order of the classes (otherwise alphanumerical order is used).
- `batch_size` — Size of the batches of data. If `NULL`, the data will not be batched (the dataset will yield individual samples). Defaults to `32`.
- `max_length` — Maximum size of a text string. Texts longer than this will be truncated to `max_length`.
- `shuffle` — Whether to shuffle the data. If set to `FALSE`, sorts the data in alphanumeric order. Defaults to `TRUE`.
- `seed` — Optional random seed for shuffling and transformations.
- `validation_split` — Optional float between 0 and 1, fraction of data to reserve for validation.
- `subset` — Subset of the data to return. One of `"training"`, `"validation"` or `"both"`. Only used if `validation_split` is set. When `subset="both"`, the utility returns a tuple of two datasets (the training and validation datasets respectively).
- `follow_links` — Whether to visits subdirectories pointed to by symlinks. Defaults to `FALSE`.
- `verbose` — Whether to display number information on classes and number of files found. Defaults to `TRUE`.

Value

A `tf.data.Dataset` object.

- If `label_mode` is `NULL`, it yields `string` tensors of shape `(batch_size,)`, containing the contents of a batch of text files.
- Otherwise, it yields a tuple `(texts, labels)`, where `texts` has shape `(batch_size,)` and `labels` follows the format described below.

Rules regarding labels format:

- if `label_mode` is `int`, the labels are an `int32` tensor of shape `(batch_size,)`.
- if `label_mode` is `binary`, the labels are a `float32` tensor of 1s and 0s of shape `(batch_size, 1)`.
- if `label_mode` is `categorical`, the labels are a `float32` tensor of shape `(batch_size, num_classes)`, representing a one-hot encoding of the class index.

See Also

- https://keras.io/api/data_loading/text#textdatasetfromdirectory-function

Other dataset utils:
`audio_dataset_from_directory()`
`image_dataset_from_directory()`
`split_dataset()`
`timeseries_dataset_from_array()`

Other utils:
`audio_dataset_from_directory()`
`clear_session()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`get_file()`
`get_source_inputs()`
`image_array_save()`
`image_dataset_from_directory()`
`image_from_array()`
`image_load()`
`image_smart_resize()`
`image_to_array()`
`layer_feature_space()`
`normalize()`
`pad_sequences()`
`set_random_seed()`
`split_dataset()`
`timeseries_dataset_from_array()`
`to_categorical()`
`zip_lists()`

Other preprocessing:
`image_dataset_from_directory()`
`image_smart_resize()`
`timeseries_dataset_from_array()`

timeseries_dataset_from_array
Creates a dataset of sliding windows over a timeseries provided as array.

Description

This function takes in a sequence of data-points gathered at equal intervals, along with time series parameters such as length of the sequences/windows, spacing between two sequence/windows, etc., to produce batches of timeseries inputs and targets.

Usage

```
timeseries_dataset_from_array(
  data,
  targets,
  sequence_length,
  sequence_stride = 1L,
  sampling_rate = 1L,
  batch_size = 128L,
  shuffle = FALSE,
  seed = NULL,
  start_index = NULL,
  end_index = NULL
)
```

Arguments

`data`	array or eager tensor containing consecutive data points (timesteps). The first dimension is expected to be the time dimension.
`targets`	Targets corresponding to timesteps in `data`. `targets[i]` should be the target corresponding to the window that starts at index `i` (see example 2 below). Pass `NULL` if you don't have target data (in this case the dataset will only yield the input data).
`sequence_length`	Length of the output sequences (in number of timesteps).
`sequence_stride`	Period between successive output sequences. For stride `s`, output samples would start at index `data[i]`, `data[i + s]`, `data[i + 2 * s]`, etc.
`sampling_rate`	Period between successive individual timesteps within sequences. For rate `r`, timesteps `data[i], data[i + r], ... data[i + sequence_length]` are used for creating a sample sequence.
`batch_size`	Number of timeseries samples in each batch (except maybe the last one). If `NULL`, the data will not be batched (the dataset will yield individual samples).
`shuffle`	Whether to shuffle output samples, or instead draw them in chronological order.

seed Optional int; random seed for shuffling.

start_index Optional int; data points earlier (exclusive) than start_index will not be used in the output sequences. This is useful to reserve part of the data for test or validation.

end_index Optional int; data points later (exclusive) than end_index will not be used in the output sequences. This is useful to reserve part of the data for test or validation.

Value

A tf$data$Dataset instance. If targets was passed, the dataset yields list (batch_of_sequences, batch_of_targets). If not, the dataset yields only batch_of_sequences.

Example 1:

Consider indices [0, 1, ... 98]. With sequence_length=10, sampling_rate=2, sequence_stride=3, shuffle=FALSE, the dataset will yield batches of sequences composed of the following indices:

```
First sequence:  [0  2  4  6  8 10 12 14 16 18]
Second sequence: [3  5  7  9 11 13 15 17 19 21]
Third sequence:  [6  8 10 12 14 16 18 20 22 24]
...
Last sequence:   [78 80 82 84 86 88 90 92 94 96]
```

In this case the last 2 data points are discarded since no full sequence can be generated to include them (the next sequence would have started at index 81, and thus its last step would have gone over 98).

Example 2: Temporal regression.

Consider an array data of scalar values, of shape (steps,). To generate a dataset that uses the past 10 timesteps to predict the next timestep, you would use:

```
data <- op_array(1:20)
input_data <- data[1:10]
targets <- data[11:20]
dataset <- timeseries_dataset_from_array(
  input_data, targets, sequence_length=10)
iter <- reticulate::as_iterator(dataset)
reticulate::iter_next(iter)

## [[1]]
## tf.Tensor([[ 1  2  3  4  5  6  7  8  9 10]], shape=(1, 10), dtype=int32)
##
## [[2]]
## tf.Tensor([11], shape=(1), dtype=int32)
```

Example 3: Temporal regression for many-to-many architectures.

Consider two arrays of scalar values X and Y, both of shape (100,). The resulting dataset should consist samples with 20 timestamps each. The samples should not overlap. To generate a dataset that uses the current timestamp to predict the corresponding target timestep, you would use:

```
X <- op_array(1:100)
Y <- X*2

sample_length <- 20
input_dataset <- timeseries_dataset_from_array(
    X, NULL, sequence_length=sample_length, sequence_stride=sample_length)
target_dataset <- timeseries_dataset_from_array(
    Y, NULL, sequence_length=sample_length, sequence_stride=sample_length)


inputs <- reticulate::as_iterator(input_dataset) %>% reticulate::iter_next()
targets <- reticulate::as_iterator(target_dataset) %>% reticulate::iter_next()
```

See Also

- https://keras.io/api/data_loading/timeseries#timeseriesdatasetfromarray-function

Other dataset utils:
audio_dataset_from_directory()
image_dataset_from_directory()
split_dataset()
text_dataset_from_directory()

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
to_categorical()
zip_lists()

Other preprocessing:
image_dataset_from_directory()
image_smart_resize()
text_dataset_from_directory()

---

to_categorical *Converts a class vector (integers) to binary class matrix.*

Description

E.g. for use with loss_categorical_crossentropy().

Usage

```
to_categorical(x, num_classes = NULL)
```

Arguments

x	Array-like with class values to be converted into a matrix (integers from 0 to num_classes - 1). R factors are coerced to integer and offset to be 0-based, i.e., as.integer(x) - 1L.
num_classes	Total number of classes. If NULL, this would be inferred as max(x) + 1. Defaults to NULL.

Value

A binary matrix representation of the input as an R array. The class axis is placed last.

Examples

```
a <- to_categorical(c(0, 1, 2, 3), num_classes=4)
print(a)

##      [,1] [,2] [,3] [,4]
## [1,]    1    0    0    0
## [2,]    0    1    0    0
## [3,]    0    0    1    0
## [4,]    0    0    0    1


b <- array(c(.9, .04, .03, .03,
              .3, .45, .15, .13,
              .04, .01, .94, .05,
              .12, .21, .5, .17),
              dim = c(4, 4))
loss <- op_categorical_crossentropy(a, b)
loss
```

```
## tf.Tensor([0.41284522 0.45601739 0.54430155 0.80437282], shape=(4), dtype=float64)
```

```
loss <- op_categorical_crossentropy(a, a)
loss
```

```
## tf.Tensor([1.00000005e-07 1.00000005e-07 1.00000005e-07 1.00000005e-07], shape=(4), dtype=float64)
```

See Also

- `op_one_hot()`, which does the same operation as `to_categorical()`, but operating on tensors.
- `loss_sparse_categorical_crossentropy()`, which can accept labels (`y_true`) as an integer vector, instead of as a dense one-hot matrix.
- https://keras.io/api/utils/python_utils#tocategorical-function

Other numerical utils:
`normalize()`

Other utils:
`audio_dataset_from_directory()`
`clear_session()`
`config_disable_interactive_logging()`
`config_disable_traceback_filtering()`
`config_enable_interactive_logging()`
`config_enable_traceback_filtering()`
`config_is_interactive_logging_enabled()`
`config_is_traceback_filtering_enabled()`
`get_file()`
`get_source_inputs()`
`image_array_save()`
`image_dataset_from_directory()`
`image_from_array()`
`image_load()`
`image_smart_resize()`
`image_to_array()`
`layer_feature_space()`
`normalize()`
`pad_sequences()`
`set_random_seed()`
`split_dataset()`
`text_dataset_from_directory()`
`timeseries_dataset_from_array()`
`zip_lists()`

`train_on_batch` *Runs a single gradient update on a single batch of data.*

Description

Runs a single gradient update on a single batch of data.

Usage

```
train_on_batch(object, x, y = NULL, sample_weight = NULL, class_weight = NULL)
```

Arguments

object	Keras model object
x	Input data. Must be array-like.
y	Target data. Must be array-like.
sample_weight	Optional array of the same length as x, containing weights to apply to the model's loss for each sample. In the case of temporal data, you can pass a 2D array with shape (samples, sequence_length), to apply a different weight to every timestep of every sample.
class_weight	Optional named list mapping class indices (integers, 0-based) to a weight (float) to apply to the model's loss for the samples from this class during training. This can be useful to tell the model to "pay more attention" to samples from an under-represented class. When class_weight is specified and targets have a rank of 2 or greater, either y must be one-hot encoded, or an explicit final dimension of 1 must be included for sparse class labels.

Value

A scalar loss value (when no metrics), or a named list of loss and metric values (if there are metrics). The property `model$metrics_names` will give you the display labels for the scalar outputs.

See Also

- https://keras.io/api/models/model_training_apis#trainonbatch-method

Other model training:
`compile.keras.src.models.model.Model()`
`evaluate.keras.src.models.model.Model()`
`predict.keras.src.models.model.Model()`
`predict_on_batch()`
`test_on_batch()`

use_backend — *Configure a Keras backend*

Description

Configure a Keras backend

Usage

```
use_backend(backend, gpu = NA)
```

Arguments

backend	string, can be "tensorflow", "jax", "numpy", or "torch".
gpu	bool, whether to use the GPU. If NA (default), it will attempt to detect GPU availability on Linux. On M-series Macs, it defaults to FALSE for TensorFlow and TRUE for JAX. On Windows, it defaults to FALSE.

Details

These functions allow configuring which backend keras will use. Note that only one backend can be configured at a time.

The function should be called after `library(keras3)` and before calling other functions within the package (see below for an example).

There is experimental support for changing the backend after keras has initialized. using `config_set_backend()`.

```
library(keras3)
use_backend("tensorflow")
```

Value

Called primarily for side effects. Returns the provided backend, invisibly.

with_custom_object_scope — *Provide a scope with mappings of names to custom objects*

Description

Provide a scope with mappings of names to custom objects

Usage

```
with_custom_object_scope(objects, expr)
```

Arguments

`objects`	Named list of objects
`expr`	Expression to evaluate

Details

There are many elements of Keras models that can be customized with user objects (e.g. losses, metrics, regularizers, etc.). When loading saved models that use these functions you typically need to explicitly map names to user objects via the `custom_objects` parameter.

The `with_custom_object_scope()` function provides an alternative that lets you create a named alias for a user object that applies to an entire block of code, and is automatically recognized when loading saved models.

Value

The result from evaluating `expr` within the custom object scope.

Examples

```
# define custom metric
metric_top_3_categorical_accuracy <-
  custom_metric("top_3_categorical_accuracy", function(y_true, y_pred) {
    metric_top_k_categorical_accuracy(y_true, y_pred, k = 3)
  })

with_custom_object_scope(c(top_k_acc = sparse_top_k_cat_acc), {

  # ...define model...

  # compile model (refer to "top_k_acc" by name)
  model |> compile(
    loss = "binary_crossentropy",
    optimizer = optimizer_nadam(),
    metrics = c("top_k_acc")
  )

  # save the model
  model |> save_model("my_model.keras")

  # loading the model within the custom object scope doesn't
  # require explicitly providing the custom_object
  reloaded_model <- load_model("my_model.keras")
})
```

See Also

Other saving and loading functions:
`export_savedmodel.keras.src.models.model.Model()`

layer_tfsm()
load_model()
load_model_weights()
register_keras_serializable()
save_model()
save_model_config()
save_model_weights()

Other serialization utilities:
deserialize_keras_object()
get_custom_objects()
get_registered_name()
get_registered_object()
register_keras_serializable()
serialize_keras_object()

---

zip_lists *Zip lists*

Description

This is conceptually similar to `zip()` in Python, or R functions `purrr::transpose()` and `data.table::transpose()` (albeit, accepting elements in `...` instead of a single list), with one crucial difference: if the provided objects are named, then matching is done by names, not positions.

Usage

```
zip_lists(...)
```

Arguments

`...`	R lists or atomic vectors, optionally named.

Details

All arguments supplied must be of the same length. If positional matching is required, then all arguments provided must be unnamed. If matching by names, then all arguments must have the same set of names, but they can be in different orders.

Value

A inverted list

See Also

Other utils:
audio_dataset_from_directory()
clear_session()
config_disable_interactive_logging()
config_disable_traceback_filtering()
config_enable_interactive_logging()
config_enable_traceback_filtering()
config_is_interactive_logging_enabled()
config_is_traceback_filtering_enabled()
get_file()
get_source_inputs()
image_array_save()
image_dataset_from_directory()
image_from_array()
image_load()
image_smart_resize()
image_to_array()
layer_feature_space()
normalize()
pad_sequences()
set_random_seed()
split_dataset()
text_dataset_from_directory()
timeseries_dataset_from_array()
to_categorical()

Examples

```
gradients <- list("grad_for_wt_1", "grad_for_wt_2", "grad_for_wt_3")
weights <- list("weight_1", "weight_2", "weight_3")
str(zip_lists(gradients, weights))
str(zip_lists(gradient = gradients, weight = weights))

names(gradients) <- names(weights) <- paste0("layer_", 1:3)
str(zip_lists(gradients, weights[c(3, 1, 2)]))

names(gradients) <- paste0("gradient_", 1:3)
try(zip_lists(gradients, weights)) # error, names don't match
# call unname directly for positional matching
str(zip_lists(unname(gradients), unname(weights)))
```

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