

Package ‘doBy’

June 29, 2025

Version 4.7.0

Title Groupwise Statistics, LSmeans, Linear Estimates, Utilities

Description Utility package containing: Main categories: Working with grouped data: 'do' something to data when stratified 'by' some variables. General linear estimates. Data handling utilities. Functional programming, in particular restrict functions to a smaller domain. Miscellaneous functions for data handling. Model stability in connection with model selection. Miscellaneous other tools.

Encoding UTF-8

VignetteBuilder knitr

LazyData true

LazyDataCompression xz

URL <https://github.com/hojsgaard/doBy>

License GPL (>= 2)

Depends R (>= 4.2.0), methods

Imports boot, broom, cowplot, Deriv, dplyr, ggplot2, MASS, Matrix, modelr, microbenchmark, rlang, tibble, tidyr,

Suggests geepack, knitr, lme4, markdown, multcomp, pbkrtest (>= 0.5.2), survival, testthat (>= 2.1.0)

RoxygenNote 7.3.2

NeedsCompilation no

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Repository CRAN

Date/Publication 2025-06-29 20:50:02 UTC

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.rhsf2list

*Convert right hand sided formula to a list***Description**

Convert right hand sided formula to a list

Usage

```
.rhsf2list(f)
```

Arguments

f A right hand sided formula

add_int	<i>Add interaction columns to data frame</i>
---------	--

Description

Add interaction columns to data frame

Usage

```
add_int(.data, .formula)
```

Arguments

.data dataframe
.formula right hand sided formula

Value

dataframe

Author(s)

Søren Højsgaard

add_pred	<i>Add predicted values of different types to dataframe</i>
----------	---

Description

Add predicted values of different types to dataframe

Usage

```
add_pred(data, model, var = "pred", type = NULL, transformation = NULL)
```

Arguments

data	dataframe or tibble
model	model object
var	name of new variable in dataframe / tibble
type	type of predicted value
transformation	A possible transformation of predicted variable, e.g. reciprocal(), log() etc

Value

dataframe / tibble

Author(s)

Søren Højsgaard

Examples

```
data(cars)
lm1 <- lm(dist ~ speed + I(speed^2), data=cars)
lm1 |> response() |> head()
cars <- cars |> add_pred(lm1)
cars |> head()
cars <- cars |> add_resid(lm1)
cars
```

add_resid

Add residuals of different types to dataframe

Description

Add residuals of different types to dataframe

Usage

```
add_resid(data, model, var = "resid", type)
```

Arguments

data	dataframe or tibble
model	model object
var	name of new variable in dataframe / tibble
type	type of residual value

Value

dataframe / tibble

Author(s)

Søren Højsgaard

Examples

```
data(cars)
lm1 <- lm(dist ~ speed + I(speed^2), data=cars)
lm1 |> response() |> head()
cars <- cars |> add_pred(lm1)
cars |> head()
cars <- cars |> add_resid(lm1)
cars
```

beets	<i>beets data</i>
-------	-------------------

Description

Yield and sugar percentage in sugar beets from a split plot experiment. Data is obtained from a split plot experiment. There are 3 blocks and in each of these the harvest time defines the "whole plot" and the sowing time defines the "split plot". Each plot was 25 square meters and the yield is recorded in kg. See 'details' for the experimental layout.

Usage

beets

Format

The format is: chr "beets"

Details

Experimental plan

Sowing times	1	4. april
	2	12. april
	3	21. april
	4	29. april
	5	18. may
Harvest times	1	2. october
	2	21. october

Plot allocation:

	Block 1	Block 2	Block 3	
	+-----+ -----+ -----+			
Plot	1 1 1 1 1	2 2 2 2 2	1 1 1 1 1	Harvest time
1-15	3 4 5 2 1	3 2 4 5 1	5 2 3 4 1	Sowing time
	-----+ -----+ -----+			

Plot	2 2 2 2 2	1 1 1 1 1	2 2 2 2 2	Harvest time
16-30	2 1 5 4 3	4 1 3 2 5	1 4 3 2 5	Sowing time
	+-----+	+-----+	+-----+	

References

Ulrich Halekoh, Søren Højsgaard (2014)., A Kenward-Roger Approximation and Parametric Bootstrap Methods for Tests in Linear Mixed Models - The R Package pbkrtest., Journal of Statistical Software, 58(10), 1-30., <https://www.jstatsoft.org/v59/i09/>

Examples

```
data(beets)

beets$bh <- with(beets, interaction(block, harvest))
summary(aov(yield ~ block + sow + harvest + Error(bh), beets))
summary(aov(sugpct ~ block + sow + harvest + Error(bh), beets))
```

binomial_to_bernoulli_data
<i>Convert binomial data to bernoulli data</i>

Description

Convert binomial data to bernoulli data by expanding dataset.

Usage

```
binomial_to_bernoulli_data(
  data.,
  y,
  size,
  type = c("rest", "total"),
  response_name = "response",
  rest_name = NULL
)
```

Arguments

data.	A dataframe
y	Column with 'successes' in binomial distribution $y \sim \text{bin}(\text{size}, p)$
size	Column with 'failures', i.e. $\text{size} - y$ or 'total', i.e. size.
type	Whether size is rest (i.e. 'failures') or 'total'
response_name	Name of response variable in output dataset.
rest_name	Name of 'failures' in column response_name.

Examples

```

dat <- budworm
dat <- dat[dat$dose %in% c(1,2), ]
dat$ntotal <- 5
dat
dat.a <- dat |>
  binomial_to_bernoulli_data(ndeath, ntotal, type="total")
dat.b <- dat |>
  dplyr::mutate(nalive=ntotal-ndeath) |> dplyr::select(-ntotal) |>
  binomial_to_bernoulli_data(ndeath, nalive, type="rest")

m0 <- glm(cbind(ndeath, ntotal-ndeath) ~ dose + sex, data=dat, family=binomial())
m1 <- glm(ndeath / ntotal ~ dose + sex, data=dat, weight=ntotal, family=binomial())
ma <- glm(response ~ dose + sex, data=dat.a, family=binomial())
mb <- glm(response ~ dose + sex, data=dat.b, family=binomial())

dat.a$response
dat.b$response ## Not same and therefore the following do not match

all.equal(coef(m0), coef(ma))
all.equal(coef(m0), coef(mb))
all.equal(coef(m1), coef(ma))
all.equal(coef(m1), coef(mb))

```

bquote_fun_list

*Backquote a list of functions***Description**

Backquote a list of functions

Usage

```
bquote_fun_list(fun_list)
```

Arguments

fun_list List of functions

See Also

[base::bquote\(\)](#), [set_default\(\)](#), [section_fun\(\)](#)

Examples

```

## Evaluate a list of functions
f1 <- function(x){x + 1}
f2 <- function(x){x + 8}

```



```

f1_ <- set_default(f1, list(x=10))
f2_ <- set_default(f2, list(x=10))

f1_(); f2_()

fn_list <- list(f1_, f2_)
fn_list_ <- bquote_fun_list(fn_list)

eval(fn_list[[1]])    ## No
sapply(fn_list, eval) ## No

eval(fn_list_[[1]])   ## Yes
sapply(fn_list_, eval) ## Yes

```

by-lapply

*Formula based version of lapply and sapply***Description**

This function is a wrapper for calling lapply on the list resulting from first calling splitBy.

Usage

```

lapply_by(data, formula, FUN, ...)

lapplyBy(formula, data = parent.frame(), FUN, ...)

sapply_by(data, formula, FUN, ..., simplify = TRUE, USE.NAMES = TRUE)

sapplyBy(
  formula,
  data = parent.frame(),
  FUN,
  ...,
  simplify = TRUE,
  USE.NAMES = TRUE
)

```

Arguments

data	A dataframe.
formula	A formula describing how data should be split.
FUN	A function to be applied to each element in the split list, see 'Examples' below.
...	optional arguments to FUN.
simplify	Same as for sapply
USE.NAMES	Same as for sapply

Value

A list.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[splitBy](#), [split_by](#)

Examples

```
fun <- function(x) range(x$uptake)
lapplyBy(~Treatment + Type, data=CO2, FUN=fun)
sapplyBy(~Treatment + Type, data=CO2, FUN=fun)

# Same as
lapply(splitBy(~Treatment + Type, data=CO2), FUN=fun)
```

by-lmby

List of lm objects with a common model

Description

The data is split into strata according to the levels of the grouping factors and individual lm fits are obtained for each stratum.

Usage

```
lm_by(data., formula., id = NULL, ...)

lmBy(formula., data., id = NULL, ...)
```

Arguments

data.	A dataframe
formula.	A linear model formula object of the form $y \sim x_1 + \dots + x_n \mid g_1 + \dots + g_m$. In the formula object, y represents the response, $x_1, \dots, x_n$ the covariates, and the grouping factors specifying the partitioning of the data according to which different lm fits should be performed.
id	A formula describing variables from data which are to be available also in the output.
...	Additional arguments passed on to <code>lm()</code> .

Value

A list of lm fits.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
lm_lst <- lmBy(1 / uptake ~ log(conc) | Treatment, data=C02)
coef(lm_lst)

fitted(lm_lst)
residuals(lm_lst)

summary(lm_lst)
coef(summary(lm_lst))
coef(summary(lm_lst), simplify=TRUE)
```

by-order

Ordering (sorting) rows of a data frame

Description

Ordering (sorting) rows of a data frame by the certain variables in the data frame. This function is essentially a wrapper for the `order()` function - the important difference being that variables to order by can be given by a model formula.

Usage

```
order_by(data, formula)

orderBy(formula, data)
```

Arguments

data	A dataframe
formula	The right hand side of a formula

Details

The sign of the terms in the formula determines whether sorting should be ascending or decreasing; see examples below

Value

The ordered data frame

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk> and Kevin Wright

See Also

[transformBy](#), [transform_by](#), [splitBy](#), [split_by](#)

Examples

```
orderBy(~ conc + Treatment, C02)
## Sort decreasingly by conc
orderBy(~ - conc + Treatment, C02)
## Same as:
order_by(C02, c("conc", "Treatment"))
order_by(C02, c("-conc", "Treatment"))
```

by-sample

Sampling from a data frame

Description

A data frame is split according to some variables in a formula, and a sample of a certain fraction of each is drawn.

Usage

```
sample_by(data, formula, frac = 0.1, replace = FALSE, systematic = FALSE)

sampleBy(
  formula,
  frac = 0.1,
  replace = FALSE,
  data = parent.frame(),
  systematic = FALSE
)
```

Arguments

<code>data</code>	A data frame.
<code>formula</code>	A formula defining the grouping of the data frame.
<code>frac</code>	The part of data to be sampled.
<code>replace</code>	Is the sampling with replacement.
<code>systematic</code>	Should sampling be systematic.

Details

If `systematic=FALSE` (default) then `frac` gives the fraction of data sampled. If `systematic=TRUE` and `frac=.2` then every 1/.2 i.e. every 5th observation is taken out.

Value

A dataframe.

See Also

[orderBy](#), [order_by](#), [splitBy](#), [split_by](#), [summaryBy](#), [summary_by](#), [transformBy](#), [transform_by](#)

Examples

```
data(dietox)
sampleBy(formula = ~ Evit + Cu, frac=.1, data = dietox)
```

by-split

Split a data frame into groups defined by variable(s)

Description

Split a dataframe according to the levels of variables in the dataframe. Uses `vpars()` to interpret flexible input.

Usage

```
split_by(data., ..., omit = TRUE)

splitBy(formula, data, omit = TRUE)

## S3 method for class 'splitByData'
head(x, n = 6L, ...)

## S3 method for class 'splitByData'
tail(x, n = 6L, ...)

split_by.legacy(data, formula, drop = TRUE)

splitBy.legacy(formula, data = parent.frame(), drop = TRUE)
```

Arguments

<code>data.</code>	A data frame (or tibble) to split
<code>...</code>	Variables defining the groups
<code>omit</code>	If TRUE (default), group-defining variables are omitted in each split group
<code>formula</code>	A right hand sided formula (for the old interface)
<code>data</code>	A data frame (for the old interface)
<code>x</code>	A <code>splitByData</code> object.
<code>n</code>	An integer vector.
<code>drop</code>	Obsolete

Value

An object of class `"splitByData"` (a named list with group attributes)

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[orderBy](#), [order_by](#), [summaryBy](#), [summary_by](#), [transformBy](#), [transform_by](#)

Examples

```
split_by(CO2, ~Treatment+Type)
split_by(CO2, Treatment, Type)
split_by(CO2, c("Treatment", "Type"))
split_by(CO2, "Treatment", "Type")

x <- split_by(CO2, "Treatment", "Type")
head(x, 3)
tail(x, 3)

## Via wrapper:
foo2 <- function(x) {
  x <- rlang::enquo(x)
  split_by(CO2, !!x)
}
foo2(~Treatment)

## The "Old" interface
splitBy(~Treatment + Type, CO2)
splitBy(~Treatment + Type, data=CO2)
splitBy(c("Treatment", "Type"), data=CO2)
```

by-subset

Finds subsets of a dataframe which is split by variables in a formula.

Description

A data frame is split by a formula into groups. Then subsets are found within each group, and the result is collected into a data frame.

Usage

```
subset_by(data, formula, subset, select, drop = FALSE, join = TRUE, ...)

subsetBy(
  formula,
```

```
subset,  
data = parent.frame(),  
select,  
drop = FALSE,  
join = TRUE,  
...  
)
```

Arguments

data	A data frame.
formula	A right hand sided formula or a character vector of variables to split by.
subset	logical expression indicating elements or rows to keep: missing values are taken as false.
select	expression, indicating columns to select from a data frame.
drop	passed on to [indexing operator.
join	If FALSE the result is a list of data frames (as defined by 'formula'); if TRUE one data frame is returned.
...	further arguments to be passed to or from other methods.

Value

A data frame.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[splitBy](#), [split_by](#)

Examples

```
data(dietox)  
subsetBy(~Evit, Weight < mean(Weight), data=dietox)
```

Description

Computes summary statistics by groups, similar to the summary procedure in SAS. A more flexible alternative to base R's [aggregate](#).

Usage

```
summary_by(
  data,
  formula,
  id = NULL,
  FUN = mean,
  keep.names = FALSE,
  p2d = FALSE,
  order = TRUE,
  full.dimension = FALSE,
  var.names = NULL,
  fun.names = NULL,
  ...
)

summaryBy(
  formula,
  data = parent.frame(),
  id = NULL,
  FUN = mean,
  keep.names = FALSE,
  p2d = FALSE,
  order = TRUE,
  full.dimension = FALSE,
  var.names = NULL,
  fun.names = NULL,
  ...
)
```

Arguments

<code>data</code>	A data frame.
<code>formula</code>	A formula specifying response and grouping variables.
<code>id</code>	A formula indicating variables to retain (not grouped by).
<code>FUN</code>	A function or list of functions to apply to the response variables.
<code>keep.names</code>	Logical; keep original variable names if only one function is applied.
<code>p2d</code>	Replace parentheses in output names with dots?
<code>order</code>	Logical; should result be ordered by grouping variables?
<code>full.dimension</code>	Logical; if TRUE, repeat rows so output matches input size.
<code>var.names</code>	Optional custom names for response variables.
<code>fun.names</code>	Optional custom names for functions applied.
<code>...</code>	Additional arguments passed to functions in FUN.

Details

Extra arguments in `...` are passed to all functions in FUN. If needed, wrap functions to handle these consistently (e.g., for `na.rm = TRUE`).

Value

A data frame of grouped summary statistics.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[aggregate](#), [orderBy](#), [transformBy](#), [splitBy](#)

Examples

```
data(CO2)

# Simple groupwise mean
summaryBy(uptake ~ Type + Treatment, data = CO2, FUN = mean)
summaryBy(cbind(uptake, conc) ~ Type + Treatment, data = CO2, FUN = mean)

# Compare with
aggregate(cbind(uptake, conc) ~ Type + Treatment, data = CO2, FUN = mean)

## Using '.' on the right hand side of a formula means to stratify by
## all variables not used elsewhere:
summaryBy(uptake ~ ., data = CO2, FUN = mean)

# Multiple functions using a custom summary function
myfun <- function(x, ...)
  c(m = mean(x, na.rm = TRUE), v = var(x, na.rm = TRUE), n = length(x))
summaryBy(uptake ~ Type + Treatment, data = CO2, FUN = myfun)

# Summary on transformed variables
# works:
summaryBy(cbind(lu=log(uptake), conc) ~ Type, data = CO2, FUN = mean)
# fails:
#summaryBy(cbind(log(uptake), conc) ~ Type, data = CO2, FUN = mean)
```

by-transform

Function to make groupwise transformations

Description

Function to make groupwise transformations of data by applying the transform function to subsets of data.

Usage

```
transform_by(data, formula, ...)
```

```
transformBy(formula, data, ...)
```

Arguments

- data A data frame
- formula A formula with only a right hand side, see examples below
- ... Further arguments of the form tag=value

Details

The ... arguments are tagged vector expressions, which are evaluated in the data frame data. The tags are matched against names(data), and for those that match, the value replace the corresponding variable in data, and the others are appended to data.

Value

The modified value of the dataframe data.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[orderBy](#), [order_by](#), [summaryBy](#), [summary_by](#), [splitBy](#), [split_by](#)

Examples

```
data(dietox)
transformBy(~Pig, data=dietox, minW=min(Weight), maxW=max(Weight),
  gain=diff(range(Weight)))
```

carcass	<i>Lean meat contents of 344 pig carcasses</i>
---------	--

Description

Measurement of lean meat percentage of 344 pig carcasses together with auxiliary information collected at three Danish slaughter houses

Usage

carcass

Format

carcassall: A data frame with 344 observations on the following 17 variables.

weight Weight of carcass

lengthc Length of carcass from back toe to head (when the carcass hangs in the back legs)

lengthf Length of carcass from back toe to front leg (that is, to the shoulder)

lengthp Length of carcass from back toe to the pelvic bone

Fat02, Fat03, Fat11, Fat12, Fat13, Fat14, Fat16 Thickness of fat layer at different locations on the back of the carcass (FatXX refers to thickness at (or rather next to) rib no. XX. Notice that 02 is closest to the head

Meat11, Meat12, Meat13 Thickness of meat layer at different locations on the back of the carcass, see description above

LeanMeat Lean meat percentage determined by dissection

slhouse Slaughter house; a factor with levels slh1 and slh2.

sex Sex of the pig; a factor with levels castrate and female.

size Size of the carcass; a factor with levels normal and large. Here, normal refers to carcass weight under 80 kg; large refers to carcass weights between 80 and 110 kg.

Details

: Notice that there were slaughtered large pigs only at one slaughter house.

Note

carcass: Contains only the variables Fat11, Fat12, Fat13, Meat11, Meat12, Meat13, LeanMeat

Source

Busk, H., Olsen, E. V., Brøndum, J. (1999) Determination of lean meat in pig carcasses with the Autofom classification system, Meat Science, 52, 307-314

Examples

```
data(carcass)
head(carcass)
```

child_growth	<i>Berkeley Growth Study data</i>
--------------	-----------------------------------

Description

dataframe with heights of 39 boys and 54 girls from age 1 to 18 and the ages at which they were collected.

Format:

gender: Gender of child age: Age at time of data recording subject: Identification for each child
height: Height of child

Usage

```
child_growth
```

Format

An object of class `tbl_df` (inherits from `tbl`, `data.frame`) with 2883 rows and 4 columns.

Details

Notice that the ages are not equally spaced. Data are taken from the `fda` package (`growth`) but put in long format here.

References

Ramsay, James O., Hooker, Giles, and Graves, Spencer (2009), `_Functional data analysis with R and Matlab_`, Springer, New York.

Ramsay, James O., and Silverman, Bernard W. (2005), `_Functional Data Analysis, 2nd ed._`, Springer, New York.

Ramsay, James O., and Silverman, Bernard W. (2002), `_Applied Functional Data Analysis_`, Springer, New York.

Tuddenham, R. D., and Snyder, M. M. (1954) "Physical growth of California boys and girls from birth to age 18", `_University of California Publications in Child Development_`, 1, 183-364.

codstom

*Diet of Atlantic cod in the Gulf of St. Lawrence (Canada)***Description**

Stomach content data for Atlantic cod (*Gadus morhua*) in the Gulf of St. Lawrence, Eastern Canada. Note: many prey items were of no interest for this analysis and were regrouped into the "Other" category.

Usage

codstom

Format

A data frame with 10000 observations on the following 10 variables.

region a factor with levels SGSL NGSL representing the southern and northern Gulf of St. Lawrence, respectively

ship.type a factor with levels 2 3 31 34 90 99

ship.id a factor with levels 11558 11712 136148 136885 136902 137325 151225 151935 99433

trip a factor with levels 10 11 12 179 1999 2 2001 20020808 3 4 5 6 7 8 88 9 95

set a numeric vector

fish.id a numeric vector

fish.length a numeric vector, length in mm

prey.mass a numeric vector, mass of item in stomach, in g

prey.type a factor with levels Ammodytes_sp Argis_dent Chion_opil Detritus Empty Eualus_fab Eualus_mac Gadus_mor Hyas_aran Hyas_coar Lebbeus_gro Lebbeus_pol Leptocl_mac Mallot_vil Megan_norv Ophiuroidea Other Paguridae Pandal_bor Pandal_mon Pasiph_mult Sabin_sept Sebastes_sp Them_abys Them_comp Them_lib

Details

Cod are collected either by contracted commercial fishing vessels (ship.type 90 or 99) or by research vessels. Commercial vessels are identified by a unique ship.id.

Either one research vessel or several commercial vessels conduct a survey (trip), during which a trawl, gillnets or hooked lines are set several times. Most trips are random stratified surveys (depth-based stratification).

Each trip takes place within one of the regions. The trip label is only guaranteed to be unique within a region and the set label is only guaranteed to be unique within a trip.

For each fish caught, the fish.length is recorded and the fish is allocated a fish.id, but the fish.id is only guaranteed to be unique within a set. A subset of the fish caught are selected for stomach analysis (stratified random selection according to fish length; unit of stratification is the

set for research surveys, the combination ship.id and stratum for surveys conducted by commercial vessels, although strata are not shown in codstom).

The basic experimental unit in this data set is a cod stomach (one stomach per fish). Each stomach is uniquely identified by a combination of region, ship.type, ship.id, trip, set, and fish.id. For each prey item found in a stomach, the species and mass of the prey item are recorded, so there can be multiple observations per stomach. There may also be several prey items with the same prey.type in the one stomach (for example many prey.types have been recoded Other, which produced many instances of Other in the same stomach).

If a stomach is empty, a single observation is recorded with prey.type Empty and a prey.mass of zero.

Source

Small subset from a larger dataset (more stomachs, more variables, more prey.types) collected by D. Chabot and M. Hanson, Fisheries & Oceans Canada <chabotd@dfpo-mpo.gc.ca>.

Examples

```
data(codstom)
str(codstom)
# removes multiple occurrences of same prey.type in stomachs
codstom1 <- summaryBy(preymass ~
  region + ship.type + ship.id + trip + set + fish.id + prey.type,
  data = codstom,
  FUN = sum)

# keeps a single line per stomach with the total mass of stomach content
codstom2 <- summaryBy(preymass ~ region + ship.type + ship.id + trip + set + fish.id,
  data = codstom,
  FUN = sum)

# mean prey mass per stomach for each trip
codstom3 <- summaryBy(preymass.sum ~ region + ship.type + ship.id + trip,
  data = codstom2, FUN = mean)

## Not run:
# wide version, one line per stomach, one column per prey type
library(reshape)
codstom4 <- melt(codstom, id = c(1:7, 9))
codstom5 <- cast(codstom4,
  region + ship.type + ship.id + trip + set + fish.id + fish.length ~
  prey.type, sum)
k <- length(names(codstom5))
prey_col <- 8:k
out <- codstom5[,prey_col]
out[is.na(out)] <- 0
codstom5[,prey_col] <- out
codstom5$total.content <- rowSums(codstom5[, prey_col])

## End(Not run)
```

`crickets`*crickets data*

Description

Mating songs of male tree crickets.

Usage

```
crickets
```

Format

This data frame contains:

species: Species, (exis, nius), see details

temp: temperature

pps: pulse per second

Details

Walker (1962) studied the mating songs of male tree crickets. Each wingstroke by a cricket produces a pulse of song, and females may use the number of pulses per second to identify males of the correct species. Walker (1962) wanted to know whether the chirps of the crickets *Oecanthus exclamationis* (abbreviated exis) and *Oecanthus niveus* (abbreviated nius) had different pulse rates. See the biostatshandbook for details. (The abbreviations are made from the the first two and last two letters of the species.) Walker measured the pulse rate of the crickets (variable pps) at a variety of temperatures (temp):

Examples

```
data(crickets)
coplot(pps ~ temp | species, data=crickets)
```

`crimeRate`*crimeRate*

Description

Crime rates per 100,000 inhabitants in states of the USA for different crime types in 1977.

Usage

```
crimeRate
```

Format

This data frame contains:

state: State of the USA

murder: crime of murder

rape:

robbery:

assault:

burglary: residential theft

larceny: unlawful taking of personal property (pocket picking)

autotheft:

Examples

```
data(crimeRate)
```

crime_rate

crimeRate

Description

Crime rates per 100,000 inhabitants in states of the USA for different crime types in 1977.

Usage

```
crime_rate
```

Format

This data frame contains:

murder: crime of murder

rape:

robbery:

assault:

burglary: residential theft

larceny: unlawful taking of personal property (pocket picking)

autotheft:

Examples

```
data(crime_rate)
```

cropyield	<i>Yield from Danish agricultural production of grain and root crop.</i>
-----------	--

Description

Yield from Danish agricultural production of grain and root crop.

Usage

```
cropyield
```

Format

A dataframe with 97 rows and 7 columns.

year From 1901 to 1997.

precip Milimeter precipitation.

yield Million feed units (see details).

area Area in 1000 ha for grains and root crop.

fertil 1000 tons fertilizer.

avgtmp1 Average temperature April-June (3 months).

avgtmp2 Average temperature July-October (4 months).

Details

A feed unit is the amount of energy in a kg of barley.

References

Danmarks statistik (Statistics Denmark).

cv_glm_fitlist	<i>Cross-validation for list of glm objects</i>
----------------	---

Description

Cross-validation for list of glm objects

Usage

```
cv_glm_fitlist(data., fit_list, K = 10)
```

Arguments

data. A data frame

fit_list A list of glm objects

K Number of folds

data-wine

*Chemical composition of wine***Description**

Using chemical analysis determine the origin of wines

Usage

```
data(wine)
```

Format

A data frame with 178 observations on the following 14 variables.

Cult a factor with levels v1 v2 v3: 3 different grape varieties

Alch Alcohol

Malca Malic acid

Ash Ash

Alca Alkalinity of ash

Mgns Magnesium

Ttlp Total phenols

Flvn Flavanoids

Nnfp Nonflavanoid phenols

Prnt Proanthocyanins

Clri Color intensity

Hue Hue

Oodw OD280/OD315 of diluted wines

Prln Proline

Details

Data comes from the UCI Machine Learning Repository. The grape variety Cult is the class identifier.

Source

Frank, A. & Asuncion, A. (2010). UCI Machine Learning Repository <https://archive.ics.uci.edu/ml/>. Irvine, CA: University of California, School of Information and Computer Science.

References

See references at <https://archive.ics.uci.edu/ml/datasets/Wine/>

Examples

```
data(wine)
## maybe str(wine) ; plot(wine) ...
```

data_breastcancer	<i>Gene expression signatures for p53 mutation status in 250 breast cancer samples</i>
-------------------	--

Description

Perturbations of the p53 pathway are associated with more aggressive and therapeutically refractory tumours. We preprocessed the data using Robust Multichip Analysis (RMA). Dataset has been truncated to the 1000 most informative genes (as selected by Wilcoxon test statistics) to simplify computation. The genes have been standardized to have zero mean and unit variance (i.e. z-scored).

Usage

```
breastcancer
```

Format

A data frame with 250 observations on 1001 variables. The first 1000 columns are numerical variables; the last column (named code) is a factor with levels case and control.

Details

The factor code defines whether there was a mutation in the p53 sequence (code=case) or not (code=control).

Source

Chris Holmes, <c.holmes@stats.ox.ac.uk>

References

Miller et al (2005, PubMed ID:16141321)

Examples

```
data(breastcancer)
bc <- breastcancer
pairs(bc[,1:5], col=bc$code)

train <- sample(1:nrow(bc), 50)
table(bc$code[train])
## Not run:
library(MASS)
```

```

z <- lda(code ~ ., data=bc, prior = c(1, 1) / 2, subset = train)
pc <- predict(z, bc[-train, ])$class
pc
bc[-train, "code"]
table(pc, bc[-train, "code"])

## End(Not run)

```

data_budworm

Budworm data

Description

Experiment on the toxicity to the tobacco budworm *Heliothis virescens* of doses of the pyrethroid trans-cypermethrin to which the moths were beginning to show resistance. Batches of 20 moths of each sex were exposed for three days to the pyrethroid and the number in each batch that were dead or knocked down was recorded. Data is reported in Collett (1991, p. 75).

Usage

```
budworm
```

Format

This data frame contains 12 rows and 4 columns:

sex: sex of the budworm.

dose: dose of the insecticide trans-cypermethrin (in micro grams).

ndead: budworms killed in a trial.

ntotal: total number of budworms exposed per trial.

Source

Collett, D. (1991) Modelling Binary Data, Chapman & Hall, London, Example 3.7

References

Venables, W.N; Ripley, B.D.(1999) Modern Applied Statistics with S-Plus, Heidelberg, Springer, 3rd edition, chapter 7.2

Examples

```

data(budworm)

## function to calculate the empirical logits
empirical.logit<- function(nevent,ntotal) {
  y <- log((nevent + 0.5) / (ntotal - nevent + 0.5))
  y
}

# plot the empirical logits against log-dose

log.dose <- log(budworm$dose)
emp.logit <- empirical.logit(budworm$ndead, budworm$ntotal)
plot(log.dose, emp.logit, type='n', xlab='log-dose',ylab='emprirical logit')
title('budworm: emprirical logits of probability to die ')
male <- budworm$sex=='male'
female <- budworm$sex=='female'
lines(log.dose[male], emp.logit[male], type='b', lty=1, col=1)
lines(log.dose[female], emp.logit[female], type='b', lty=2, col=2)
legend(0.5, 2, legend=c('male', 'female'), lty=c(1,2), col=c(1,2))

## Not run:
* SAS example;
data budworm;
infile 'budworm.txt' firstobs=2;
input sex dose ndead ntotal;
run;

## End(Not run)

```

data_cad

*Coronary artery disease data***Description**

A cross classified table with observational data from a Danish heart clinic. The response variable is CAD (coronary artery disease, some times called heart attack).

Usage

```
data(cad1)
```

Format

A data frame with 236 observations on the following 14 variables.

Sex Sex; a factor with levels Female Male

AngPec Angina pectoris (chest pain attacks); a factor with levels Atypical None Typical

AMI Acute myocardic infarct; a factor with levels Definite NotCertain

QWave A reading from an electrocardiogram; a factor with levels No Yes; Yes means pathological and is a sign of previous myocardial infarction.

QWavecode a factor with levels Nonusable Usable. An assesment of whether QWave is reliable.

STcode a factor with levels Nonusable Usable. An assesment of whether STchange is reliable.

STchange A reading from an electrocardiogram; a factor with levels No Yes. An STchange indicates a blockage of the coronary artery.

SuffHeartF Sufficient heart frequency; a factor with levels No, Yes

Hypertrophi a factor with levels No, Yes. Hypertrophy refers to an increased size of the heart muscle due to exercise.

Hyperchol a factor with levels No Yes. Hypercholesterolemia, also called high cholesterol, is the presence of high levels of cholesterol in the blood.

Smoker Is the patient a smoker; a factor with levels No, Yes.

Inherit Hereditary predispositions for CAD; a factor with levels No, Yes.

Heartfail Previous heart failures; a factor with levels No Yes

CAD Coronary Artery Disease; a factor with levels No Yes. CAD refers to a reduction of blood flow to the heart muscle (commonly known as a heart attack). The diagnosis made from biopsies.

Details

Notice that data are collected at a heart clinic, so data do not represent the population, but are conditional on patients having ended up at the clinic.

- cad1: Complete dataset, 236 cases.
- cad2: Incomplete dataset, 67 cases. Information on (some of) the variables 'Hyperchol', 'Smoker' and 'Inherit' is missing.

References

Hansen, J. F. (1980). The clinical diagnosis of ischaemic heart disease due to coronary artery disease. Danish Medical Bulletin

Højsgaard, Søren and Thiesson, Bo (1995). BIFROST - Block recursive models Induced From Relevant knowledge, Observations and Statistical Techniques. Computational Statistics and Data Analysis, vol. 19, p. 155-175

Examples

```
data(cad1)
## maybe str(cad1) ; plot(cad1) ...
```

data_mathmark	<i>Mathematics marks for students</i>
---------------	---------------------------------------

Description

The mathmark data frame has 88 rows and 5 columns.

Usage

```
data(mathmark)
```

Format

This data frame contains the following columns: mechanics, vectors, algebra, analysis, statistics.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

References

David Edwards, An Introduction to Graphical Modelling, Second Edition, Springer Verlag, 2000

Examples

```
data(mathmark)
```

data_personality	<i>Personality traits</i>
------------------	---------------------------

Description

The peronality dataframe has 240 rows and 32 columns

Usage

```
data(personality)
```

Format

This dataframe has recordings on the following 32 variables: distant, talkatv, carelss, hardwrk, anxious, agreebl, tense, kind, opposng, relaxed, disorgn, outgoin, approvn, shy, discipl, harsh, persevr, friendl, worryin, respnsi, contrar, sociabl, lazy, coopera, quiet, organiz, criticl, lax, laidbck, withdrw, givinup, easygon

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

References

Origin unclear

Examples

```
data(personality)
str(personality)
```

descStat

Computing simple descriptive statistics of a numeric vector.

Description

Computing simple descriptive statistics of a numeric vector - not unlike what proc means of SAS does

Usage

```
descStat(x, na.rm = TRUE)
```

Arguments

x	A numeric vector
na.rm	Should missing values be removed

Value

A vector with named elements.

Author(s)

Gregor Gorjanc; <gregor.gorjanc@bf.uni-lj.si>

See Also

[summaryBy](#), [summary_by](#)

Examples

```
x <- c(1, 2, 3, 4, NA, NaN)
descStat(x)
```

dietox*Growth curves of pigs in a 3x3 factorial experiment*

Description

The dietox data frame has 861 rows and 7 columns.

Usage

```
dietox
```

Format

This data frame contains the following columns:

Weight Weight in Kg

Feed Cumulated feed intake in Kg

Time Time (in weeks) in the experiment

Pig Factor; id of each pig

Evit Factor; vitamin E dose; see 'details'.

Cu Factor, copper dose; see 'details'

Start Start weight in experiment, i.e. weight at week 1.

Litter Factor, id of litter of each pig

Details

Data contains weight of slaughter pigs measured weekly for 12 weeks. Data also contains the start weight (i.e. the weight at week 1). The treatments are 3 different levels of Evit = vitamin E (dose: 0, 100, 200 mg dl-alpha-tocopheryl acetat /kg feed) in combination with 3 different levels of Cu=copper (dose: 0, 35, 175 mg/kg feed) in the feed. The cumulated feed intake is also recorded. The pigs are litter mates.

Source

Lauridsen, C., Højsgaard, S., Sørensen, M.T. C. (1999) Influence of Dietary Rapeseed Oli, Vitamin E, and Copper on Performance and Antioxidant and Oxidative Status of Pigs. J. Anim. Sci. 77:906-916

Examples

```
data(dietox)
head(dietox)
coplot(Weight ~ Time | Evit * Cu, data=dietox)
```

esticon

Contrasts for lm, glm, lme, and geeglm objects

Description

Computes linear functions (i.e. weighted sums) of the estimated regression parameters. Can also test the hypothesis, that such a function is equal to a specific value.

Usage

```
esticon(obj, L, beta0, conf.int = TRUE, level = 0.95, joint.test = FALSE, ...)

## S3 method for class 'esticon_class'
coef(object, ...)

## S3 method for class 'esticon_class'
summary(object, ...)

## S3 method for class 'esticon_class'
confint(object, parm, level = 0.95, ...)

## S3 method for class 'esticon_class'
vcov(object, ...)
```

Arguments

obj	Regression object (of type lm, glm, lme, geeglm).
L	Matrix (or vector) specifying linear functions of the regression parameters (one linear function per row). The number of columns must match the number of fitted regression parameters in the model. See 'details' below.
beta0	A vector of numbers
conf.int	TRUE
level	The confidence level
joint.test	Logical value. If TRUE a 'joint' Wald test for the hypothesis $L\beta = \beta_0$ is made. Default is that the 'row-wise' tests are made, i.e. $(L\beta)_i = \beta_{0i}$. If joint.test is TRUE, then no confidence interval etc. is calculated.
...	Additional arguments; currently not used.
object	An esticon_class object.
parm	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.

Details

Let the estimated parameters of the model be

$$\beta_1, \beta_2, \dots, \beta_p$$

A linear function of the estimates is of the form

$$l = \lambda_1\beta_1 + \lambda_2\beta_2 + \dots + \lambda_p\beta_p$$

where $\lambda_1, \lambda_2, \dots, \lambda_p$ is specified by the user.

The `esticon` function calculates l , its standard error and by default also a 95 pct confidence interval. It is sometimes of interest to test the hypothesis $H_0 : l = \beta_0$ for some value β_0 given by the user. A test is provided for the hypothesis $H_0 : l = 0$ but other values of β_0 can be specified.

In general, one can specify r such linear functions at one time by specifying L to be an $r \times p$ matrix where each row consists of p numbers $\lambda_1, \lambda_2, \dots, \lambda_p$. Default is then that β_0 is a p vector of 0s but other values can be given.

It is possible to test simultaneously that all specified linear functions are equal to the corresponding values in β_0 .

For computing contrasts among levels of a single factor, `'contrast.lm'` may be more convenient.

Value

Returns a matrix with one row per linear function. Columns contain estimated coefficients, standard errors, t values, degrees of freedom, two-sided p-values, and the lower and upper endpoints of the $1-\alpha$ confidence intervals.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
data(iris)
lm1 <- lm(Sepal.Length ~ Sepal.Width + Species + Sepal.Width : Species, data=iris)
## Note that the setosa parameters are set to zero
coef(lm1)

## Estimate the intercept for versicolor
lambda1 <- c(1, 0, 1, 0, 0, 0)
esticon(lm1, L=lambda1)

## Estimate the difference between versicolor and virgica intercept
## and test if the difference is 1
lambda2 <- c(0, 1, -1, 0, 0, 0)
esticon(lm1, L=lambda2, beta0=1)

## Do both estimates at one time
esticon(lm1, L=rbind(lambda1, lambda2), beta0=c(0, 1))
```

```
## Make a combined test for that the difference between versicolor and virgica intercept
## and difference between versicolor and virginica slope is zero:
lambda3 <- c(0, 0, 0, 0, 1, -1)
esticon(lm1, L=rbind(lambda2, lambda3), joint.test=TRUE)

# Example using esticon on coxph objects (thanks to Alessandro A. Leidi).
# Using dataset 'veteran' in the survival package
# from the Veterans' Administration Lung Cancer study

if (require(survival)){
  data(veteran)
  sapply(veteran, class)
  levels(veteran$celltype)
  attach(veteran)
  veteran.s <- Surv(time, status)
  coxmod <- coxph(veteran.s ~ age + celltype + trt, method='breslow')
  summary(coxmod)

  # compare a subject 50 years old with celltype 1
  # to a subject 70 years old with celltype 2
  # both subjects on the same treatment
  AvB <- c(-20, -1, 0, 0, 0)

  # compare a subject 40 years old with celltype 2 on treat=0
  # to a subject 35 years old with celltype 3 on treat=1
  CvB <- c(5, 1, -1, 0, -1)

  est <- esticon(coxmod, L=rbind(AvB, CvB))
  est
  ##exp(est[, c(2, 7, 8)])
}
```

expr_to_fun

Convert expression into function object.

Description

Convert expression into function object.

Usage

```
expr_to_fun(expr_, order = NULL, vec_arg = FALSE)
```

Arguments

expr_	R expression.
order	desired order of function argument.
vec_arg	should the function take vector valued argument.

Examples

```

ee <- expression(b1 + (b0 - b1)*exp(-k*x) + b2*x)
ff1 <- expr_to_fun(ee)
formals(ff1)

ff2 <- expr_to_fun(ee, vec_arg=TRUE)
formals(ff2)
formals(ff2)$length_parm
formals(ff2)$names_parm |> eval()

ee <- expression(matrix(c(x1+x2, x1-x2, x1^2+x2^2, x1^3+x2^3), nrow=2))
ff1 <- expr_to_fun(ee)
ff2 <- expr_to_fun(ee, vec_arg=TRUE)

formals(ff2)
formals(ff2)$length_parm
formals(ff2)$names_parm |> eval()

```

fatacid

*Fish oil in pig food***Description**

Fish oil in pig food

Usage

fatacid

Format

A dataframe.

Details

A fish oil fatty acid X14 has been added in different concentrations to the food for pigs in a study. Interest is in studying how much of the fatty acid can be found in the tissue. The concentrations of x14 in the food are `verb+dose+={0.0, 4.4, 6.2, 9.3}`.

The pigs are fed with this food until their weight is 60 kg. From thereof and until they are slaughtered at 100kg, their food does not contain the fish oil. At 60kg (`sample=1`) and 100kg (`sample=2`) muscle biopsies are made and the concentration of x14 is determined. Measurements on the same pig are correlated, and pigs are additionally related through litters.

References

Data courtesy of Charlotte Lauridsen, Department of Animal Science, Aarhus University, Denmark.

fev	<i>Forced expiratory volume in children</i>
-----	---

Description

Dataset to examine if respiratory function in children was influenced by smoking.

Usage

```
fev
```

Format

A data frame with 654 observations on the following 5 variables.

Age Age in years.

FEV Forced expiratory volume in liters per second.

Ht Height in centimeters.

Gender Gender.

Smoke Smoking status.

References

I. Tager and S. Weiss and B. Rosner and F. Speizer (1979). Effect of Parental Cigarette Smoking on the Pulmonary Function of Children. American Journal of Epidemiology. 110:15-26

Examples

```
data(fev)
summary(fev)
```

firstlastobs	<i>Locate the index of the first/last unique value</i>
--------------	--

Description

Locate the index of the first/last unique value in i) a vector or of a variable in a data frame.

Usage

```
lastobs(x, ...)

firstobs(x, ...)

## Default S3 method:
lastobs(x, ...)

## Default S3 method:
firstobs(x, ...)

## S3 method for class 'formula'
lastobs(formula, data = parent.frame(), ...)

## S3 method for class 'formula'
firstobs(formula, data = parent.frame(), ...)
```

Arguments

x	A vector
...	Currently not used
formula	A formula (only the first term is used, see 'details').
data	A data frame

Details

If writing $\sim a + b + c$ as formula, then only a is considered.

Value

A vector.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
x <- c(rep(1, 5), rep(2, 3), rep(3, 7), rep(1, 4))
firstobs(x)
lastobs(x)
data(dietox)
firstobs(~Pig, data=dietox)
lastobs(~Pig, data=dietox)
```

formula_ops	<i>Formula operations and coercion.</i>
-------------	---

Description

Formula operations and coercion as a supplement to `update.formula()`

Usage

```
formula_add_str(frm1, terms, op = "+")

formula_add(frm1, frm2)

formula_poly(chr1, n, noint = FALSE, y = NULL)

formula_nth(frm1, n)

formula_to_interaction_matrix(frm1)

formula_chr_to_form(rhs, lhs = character(0))

to_str(chr1, collapse = "+")

terms_labels(frm1)

simplify_rhs(object)

## S3 method for class 'formula'
simplify_rhs(object)

## S3 method for class 'character'
simplify_rhs(object)

as_rhs_frm(object)

as_lhs_frm(object)

as_rhs_chr(object, string = FALSE)

as_lhs_chr(object, string = FALSE)

unique_formula(list_of_formulas)
```

Arguments

frm1, frm2	Formulas to be coerced to character vectors.
terms	Character string.

op	Either "+" (default) or "-".
chr1	Character vector to be coerced to formulas.
n	Positive integer.
noint	Boolean.
y	Response
rhs, lhs	right-hand-side and left-hand-side for formula (as characters)
collapse	Character to use as separator.
object	Character vector or formula.
string	Boolean.
list_of_formulas	list of formulas

Examples

```

formula_poly("z", 2)
formula_poly("z", 2, noint=TRUE)

as_rhs_chr(c("a", "b", "z"))
as_rhs_chr(c("a*b", "z"))

as_rhs_chr(y~a+b+z)
as_rhs_chr(y~a+b+z, string=TRUE)
as_rhs_chr(y~a+b+z)
as_rhs_chr(y~a*b+z)
as_rhs_chr(y~a*b+z, string=TRUE)

as_lhs_chr(y~a*b+z)
as_lhs_chr(log(y)~a*b+z) ## Not what one might expect
as_lhs_chr(cbind(y, u)~a*b+z) ## Not what one might expect

formula_chr_to_form(c("a*b", "z"))
formula_chr_to_form(c("a*b", "z"), "y")
formula_chr_to_form(c("a*b", "z"), "log(y)")

formula_add(y~a*b+z, ~-1)
formula_add(y~a*b+z, ~a:b)

formula_add_str(y~x1 + x2, "x3")
formula_add_str(y~x1 + x2, "x1")
formula_add_str(y~x1 + x2, "x1", op="-")

```

Description

Generate data list

Usage

```
generate_data_list(data., K, method = c("subgroups", "resample"))
```

Arguments

data.	A data frame
K	Number of folds
method	Method for generating data

get_formulas	<i>Get formulas from model_stability_glm_class object</i>
--------------	---

Description

Get formulas from model_stability_glm_class object

Usage

```
get_formulas(object, unique = TRUE, text = FALSE)
```

Arguments

object	A model_stability_glm_class object
unique	If TRUE, return unique models
text	If TRUE, return text (rather than formula).

haldCement	<i>Heat development in cement under hardening.</i>
------------	--

Description

Heat development in cement under hardening related to the chemical composition.

Usage

```
haldCement
```

Format

A data frame with 13 observations on the following 5 variables.

x1 Percentage (weight) of [3Ca0][Al2O3]

x2 Percentage (weight) of [3Ca0][SiO2]

x3 Percentage (weight) of [4Ca0][Al2O3][FeO3]

x4 Percentage (weight) of [2Ca0][SiO2]

y Heat development measured in calories per gram cement after 180 days

References

Anders Hald (1949); Statistiske Metoder; Akademisk Forlag (in Danish), page 509.

Examples

```
data(haldCement)

if( interactive() ){
  pairs( haldCement )
}
m <- lm(y ~ x1 + x2 + x3 + x4, data=haldCement)
summary(m)

# Notice: The model explains practically all variation in data;
# yet none of the explanatory variables appear to be statistically
# significant.
```

head_matrix

head and tail for matrices

Description

head and tail for matrices

Usage

```
head2(x, n = 6, m = n)
```

```
tail2(x, n = 6, m = n)
```

Arguments

x	matrix
n, m	number of rows and columns

Examples

```
M <- matrix(1:20, nrow=4)
head2(M)
head2(M, 2)
```

income	<i>income data</i>
--------	--------------------

Description

Data on income, years of educations and ethnicity for a samle of adult Americans aged over 25. The year of sampling is not available in the source.

Usage

```
income
```

Format

This data frame contains:

inc: Income: Yearly income (thousands of dollars).

educ: Education: Number of years of education (12=high school graduate, 16=college graduate).

race: Racial-Ethnic group: "b" (black), "h" (hispanic) and "w" (white).

Details

Variable names are as in the reference.

References

Agresti, A. (2024) Statistical Methods for the Social Sciences, Global Edition (6th edition). ISBN-13: 9781292449197. Table 13.1

interaction-plot	<i>Two-way interaction plot</i>
------------------	---------------------------------

Description

Plots the mean of the response for two-way combinations of factors, thereby illustrating possible interactions.

Usage

```
interaction_plot(.data, .formula, interval = "conf.int")
```

Arguments

.data	A data frame
.formula	A formula of the form $y \sim x_1 + x_2$
interval	Either conf.int, boxplot or none

Note

This is a recent addition to the package and is subject to change.

Examples

```
income$educf <- cut(income$educ, breaks=3)
income |> interaction_plot(inc ~ race + educf)
income |> interaction_plot(inc ~ race + educf, interval="conf.int")
income |> interaction_plot(inc ~ race + educf, interval="boxplot")
income |> interaction_plot(inc ~ race + educf, interval="none")
```

is_estimable	<i>Determines if contrasts are estimable.</i>
--------------	---

Description

Determines if contrasts are estimable, that is, if the contrasts can be written as a linear function of the data.

Usage

```
is_estimable(K, null.basis)
```

Arguments

K	A matrix.
null.basis	A basis for a null space (can be found with null_basis()).

Details

Consider the setting $E(Y) = Xb$. A linear function of b , say $l'b$ is estimable if and only if there exists an r such that $r'X = l'$ or equivalently $l = X'r$. Hence l must be in the column space of X' , i.e. in the orthogonal complement of the null space of X . Hence, with a basis B for the null space, `is_estimable()` checks if each row l of the matrix K is perpendicular to each column basis vector in B .

Value

A logical vector.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

References

http://web.mit.edu/18.06/www/Essays/newpaper_ver3.pdf

linest

Compute linear estimates

Description

Compute linear estimates, i.e. $L\beta$ for a range of models. One example of linear estimates is population means (also known as LSMEANS).

Usage

```
linest(object, L = NULL, level = 0.95, ...)
```

```
## S3 method for class 'linest_class'
confint(object, parm, level = 0.95, ...)
```

```
## S3 method for class 'linest_class'
coef(object, ...)
```

```
## S3 method for class 'linest_class'
summary(object, ...)
```

Arguments

object	Model object
L	Either NULL or a matrix with p columns where p is the number of parameters in the systematic effects in the model. If NULL then L is taken to be the p times p identity matrix
level	The level of the (asymptotic) confidence interval.
...	Additional arguments; currently not used.
parm	Specification of the parameters estimates for which confidence intervals are to be calculated.
confint	Should confidence interval appear in output.

Value

A dataframe with results from computing the contrasts.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[LSmeans](#), [LE_matrix](#)

Examples

```
## Make balanced dataset
dat.bal <- expand.grid(list(AA=factor(1:2), BB=factor(1:3), CC=factor(1:3)))
dat.bal$y <- rnorm(nrow(dat.bal))

## Make unbalanced dataset
# 'BB' is nested within 'CC' so BB=1 is only found when CC=1
# and BB=2,3 are found in each CC=2,3,4
dat.nst <- dat.bal
dat.nst$CC <- factor(c(1,1,2,2,2,2,1,1,3,3,3,3,1,1,4,4,4,4))

mod.bal <- lm(y ~ AA + BB * CC, data=dat.bal)
mod.nst <- lm(y ~ AA + BB : CC, data=dat.nst)

L <- LE_matrix(mod.nst, effect=c("BB", "CC"))
linest( mod.nst, L )
```

linest-get

Auxillary functions for computing lsmeans, contrasts etc

Description

Auxillary functions for computing lsmeans, contrasts etc.

Usage

```
get_xlevels(obj)

## Default S3 method:
get_xlevels(obj)

## S3 method for class 'mer'
get_xlevels(obj)

## S3 method for class 'merMod'
get_xlevels(obj)

get_contrasts(obj)
```

```

## Default S3 method:
get_contrasts(obj)

## S3 method for class 'merMod'
get_contrasts(obj)

set_xlevels(xlev, at)

get_vartypes(obj)

set_covariate_val(xlev, covariateVal)

get_X(obj, newdata, at = NULL)

## Default S3 method:
get_X(obj, newdata, at = NULL)

## S3 method for class 'merMod'
get_X(obj, newdata, at = NULL)

```

Arguments

obj	An R object
xlev	FIXME: to be described
at	FIXME: to be described
covariateVal	FIXME: to be described
newdata	FIXME: to be described

linest-matrix	<i>Linear estimates matrix</i>
---------------	--------------------------------

Description

Generate matrix specifying linear estimate.

Usage

```

LE_matrix(object, effect = NULL, at = NULL)

## Default S3 method:
LE_matrix(object, effect = NULL, at = NULL)

aggregate_linest_list(linest_list)

get_linest_list(object, effect = NULL, at = NULL)

```


Arguments

object	Model object
effect	A vector of variables. For each configuration of these the estimate will be calculated.
at	Either NULL, a list or a dataframe. 1) If a list, then the list must consist of covariates (including levels of some factors) to be used in the calculations. 2) If a dataframe, the dataframe is split rowwise and the function is invoked on each row.
linest_list	Linear estimate list (as generated by <code>get_linest_list</code>).

Details

Check this

See Also

[LSmeans](#), [linest](#)

Examples

```
## Two way anova:

data(warpbreaks)

## An additive model
m0 <- lm(breaks ~ wool + tension, data=warpbreaks)

## Estimate mean for each wool type, for tension="M":
K <- LE_matrix(m0, at=list(wool=c("A", "B"), tension="M"))
K

## Vanilla computation:
K %*% coef(m0)

## Alternative; also providing standard errors etc:
linest(m0, K)
esticon(m0, K)

## Estimate mean for each wool type when averaging over tension;
# two ways of doing this
K <- LE_matrix(m0, at=list(wool=c("A", "B")))
K
K <- LE_matrix(m0, effect="wool")
K
linest(m0, K)

## The linear estimate is sometimes called to "least squares mean"
# (LSmeans) or population means.
# Same as
LSmeans(m0, effect="wool")
```

```
## Without mentioning 'effect' or 'at' an average across all
#predictors are calculated:
K <- LE_matrix(m0)
K
linest(m0, K)

## Because the design is balanced (9 observations per combination
#of wool and tension) this is the same as computing the average. If
#the design is not balanced, the two quantities are in general not
#the same.
mean(warbreaks$breaks)

## Same as
LSmeans(m0)

## An interaction model
m1 <- lm(breaks ~ wool * tension, data=warbreaks)

K <- LE_matrix(m1, at=list(wool=c("A", "B"), tension="M"))
K
linest(m1, K)
K <- LE_matrix(m1, at=list(wool=c("A", "B")))
K
linest(m1, K)
K <- LE_matrix(m1, effect="wool")
K
linest(m1, K)
LSmeans(m1, effect="wool")

K <- LE_matrix(m1)
K
linest(m1, K)
LSmeans(m1)
```

ls-means

Compute LS-means (aka population means or marginal means)

Description

LS-means (least squares means, also known as population means and as marginal means) for a range of model types.

Usage

```
LSmeans(object, effect = NULL, at = NULL, level = 0.95, ...)
```

```
## Default S3 method:
```

```
LSmeans(object, effect = NULL, at = NULL, level = 0.95, ...)
```

```
## S3 method for class 'lmerMod'
LSmeans(object, effect = NULL, at = NULL, level = 0.95, adjust.df = TRUE, ...)

popMeans(object, effect = NULL, at = NULL, level = 0.95, ...)

## Default S3 method:
popMeans(object, effect = NULL, at = NULL, level = 0.95, ...)

## S3 method for class 'lmerMod'
popMeans(object, effect = NULL, at = NULL, level = 0.95, adjust.df = TRUE, ...)
```

Arguments

<code>object</code>	Model object
<code>effect</code>	A vector of variables. For each configuration of these the estimate will be calculated.
<code>at</code>	A list of values of covariates (including levels of some factors) to be used in the calculations
<code>level</code>	The level of the (asymptotic) confidence interval.
<code>...</code>	Additional arguments; currently not used.
<code>adjust.df</code>	Should denominator degrees of freedom be adjusted?

Details

There are restrictions on the formulas allowed in the model object. For example having $y \sim \log(x)$ will cause an error. Instead one must define the variable $\log x = \log(x)$ and do $y \sim \log x$.

Value

A dataframe with results from computing the contrasts.

Warning

Notice that `LSmeans` and `LE_matrix` fails if the model formula contains an offset (as one would have in connection with e.g. Poisson regression).

Note

`LSmeans` and `popMeans` are synonymous.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[LE_matrix](#), [linest](#)

Examples

```
## Two way anova:

data(warpbreaks)

m0 <- lm(breaks ~ wool + tension, data=warpbreaks)
m1 <- lm(breaks ~ wool * tension, data=warpbreaks)
LSmeans(m0)
LSmeans(m1)

## same as:
K <- LE_matrix(m0);K
linest(m0, K)
K <- LE_matrix(m1);K
linest(m1, K)

LE_matrix(m0, effect="wool")
LSmeans(m0, effect="wool")

LE_matrix(m1, effect="wool")
LSmeans(m1, effect="wool")

LE_matrix(m0, effect=c("wool", "tension"))
LSmeans(m0, effect=c("wool", "tension"))

LE_matrix(m1, effect=c("wool", "tension"))
LSmeans(m1, effect=c("wool", "tension"))

## Regression; two parallel regression lines:

data(Puromycin)

m0 <- lm(rate ~ state + log(conc), data=Puromycin)
## Can not use LSmeans / LE_matrix here because of
## the log-transformation. Instead we must do:
Puromycin$lconc <- log( Puromycin$conc )
m1 <- lm(rate ~ state + lconc, data=Puromycin)

LE_matrix(m1)
LSmeans(m1)

LE_matrix(m1, effect="state")
LSmeans(m1, effect="state")

LE_matrix(m1, effect="state", at=list(lconc=3))
LSmeans(m1, effect="state", at=list(lconc=3))

## Non estimable contrasts

## ## Make balanced dataset
dat.bal <- expand.grid(list(AA=factor(1:2), BB=factor(1:3),
```

```

                                CC=factor(1:3)))
dat.bal$y <- rnorm(nrow(dat.bal))

## ## Make unbalanced dataset
#      'BB' is nested within 'CC' so BB=1 is only found when CC=1
#      and BB=2,3 are found in each CC=2,3,4
dat.nst <- dat.bal
dat.nst$CC <- factor(c(1, 1, 2, 2, 2, 2, 1, 1, 3, 3,
                      3, 3, 1, 1, 4, 4, 4, 4))

mod.bal <- lm(y ~ AA + BB * CC, data=dat.bal)
mod.nst <- lm(y ~ AA + BB : CC, data=dat.nst)

LSmeans(mod.bal, effect=c("BB", "CC"))
LSmeans(mod.nst, effect=c("BB", "CC"))
LSmeans(mod.nst, at=list(BB=1, CC=1))

LSmeans(mod.nst, at=list(BB=1, CC=2))
## Above: NA's are correct; not an estimable function

if( require( lme4 )){
  warp.mm <- lmer(breaks ~ -1 + tension + (1|wool), data=warpbreaks)
  LSmeans(warp.mm, effect="tension")
  class(warp.mm)
  fixef(warp.mm)
  coef(summary(warp.mm))
  vcov(warp.mm)
  if (require(pbkrttest))
    vcovAdj(warp.mm)
}

LSmeans(warp.mm, effect="tension")

```

math_teachers

Height of math teachers

Description

Height of a sample of math teachers in Danish high schools collected at a continued education day at Mariager Fjord Gymnasium in 2019.

Format: height: Height in centimeters sex: male or female

Usage

```
math_teachers
```

Format

An object of class `tbl_df` (inherits from `tbl`, `data.frame`) with 30 rows and 2 columns.

Examples

```
aggregate(height ~ sex, data=math_teachers, FUN=mean)
aggregate(height ~ sex, data=math_teachers, FUN=function(x) {c(mean=mean(x), sd=sd(x))})
```

mb_summary	<i>Fast summary of microbenchmark object</i>
------------	--

Description

Fast summary of microbenchmark object. The default summary method from the microbenchmark package is fairly slow in producing a summary (due to a call to a function from the multcomp package.)

Usage

```
mb_summary(object, unit, add.unit = TRUE, ...)
```

```
summary_mb(object, unit, add.unit = TRUE, ...)
```

Arguments

object	A microbenchmark object
unit	The time unit to be used
add.unit	Should time unit be added as column to resulting dataframe.
...	Additional arguments; currently not used.

milkman	<i>Milk yield data for manually milked cows.</i>
---------	--

Description

Milk yield data for cows milked manually twice a day (morning and evening).

Usage

```
milkman
```

Format

A data frame with 161836 observations on the following 12 variables.

cowno a numeric vector; cow identification

lactno a numeric vector; lactation number

ampm a numeric vector; milking time: 1: morning; 2: evening

dfc a numeric vector; days from calving

my a numeric vector; milk yield (kg)

fatpct a numeric vector; fat percentage

protpct a numeric vector; protein percentage

lactpct a numeric vector; lactose percentage

scc a numeric vector; somatic cell counts

race a factor with levels RDM Holstein Jersey

ecmy a numeric vector; energy corrected milk

cowlact Combination of cowno and lactno; necessary because the same cow may appear more than once in the dataset (in different lactations)

Details

There are data for 222 cows. Some cows appear more than once in the dataset (in different lactations) and there are 288 different lactations.

References

Friggens, N. C.; Ridder, C. and Løvendahl, P. (2007). On the Use of Milk Composition Measures to Predict the Energy Balance of Dairy Cows. *J. Dairy Sci.* 90:5453–5467 doi:10.3168/jds.2006-821.

This study was part of the Biosens project used data from the “Malkekoens energibalance og mobilisering” project; both were funded by the Danish Ministry of Food, Agriculture and Fisheries and the Danish Cattle Association.

Examples

```
data(milkman)
```

model_stability_glm	<i>Model stability for glm objects</i>
---------------------	--

Description

Model stability for glm objects

Usage

```
model_stability_glm(  
  data.,  
  model,  
  n.searches = 10,  
  method = c("subgroups", "resample"),  
  ...  
)
```

Arguments

data.	A data frame
model	A glm object
n.searches	Number of searches
method	Method for generating data
...	Additional arguments to be passed to step

NIRmilk	<i>NIRmilk</i>
---------	----------------

Description

Near infra red light (NIR) measurements are made at 152 wavelengths on 17 milk samples. While milk runs through a glass tube, infra red light is sent through the tube and the amount of light passing though the tube is measured at different wavelengths. Each milk sample was additionally analysed for fat, lactose, protein and dry matter.

Usage

```
NIRmilk
```

Format

This data frame contains 17 rows and 158 columns. The first column is the sample number. The columns Xk1m contains the transmittance (fraction of electromagnetic power) transmittance through the sample at wavelength k1m. The response variables are fat, protein, lactose and dm (dry matter).

Examples

```
data(NIRmilk)
```

nir_milk	<i>nir_milk</i>
----------	-----------------

Description

Near infra red light (NIR) measurements are made at 152 wavelengths on 17 milk samples. While milk runs through a glass tube, infra red light is sent through the tube and the amount of light passing through the tube is measured at different wavelengths. Each milk sample was additionally analysed for fat, lactose, protein and dry matter.

Usage

```
nir_milk
```

Format

A list with two components x Dataframe with infra red light amount at different wavelengths (column names are the wavelengths; just remove the leading X). y Dataframe with response variables fat, protein, lactose and dm (drymatter)

See Also

[NIRmilk](#)

Examples

```
data(nir_milk)
```

parseGroupFormula	<i>Extract components from a formula with "conditioning bar"</i>
-------------------	--

Description

Extract components from a formula with the form $y \sim x_1 + \dots + x_n \mid g_1 + \dots + g_m$

Usage

```
parseGroupFormula(form)
```

Arguments

form A formula of the form $y \sim x_1 + \dots + x_n \mid g_1 + \dots + g_m$

Value

If the formula is $y \sim x1 + x2 \mid g1 + g2$ the result is

```
model      y ~ x1 + x2
groups     g1 + g2
groupFormula ~ g1 + g2
```

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
gf1 <- parseGroupFormula(y ~ x1 + x2 | g1 + g2)
gf1

gf2 <- parseGroupFormula(~ x1 + x2 | g1 + g2)
gf2
```

pick_elements	<i>Extract (pick) elements without using brackets</i>
---------------	---

Description

Extract (pick) elements without using brackets so that elements can be picked out as part of a pipe workflow.

Usage

```
pick1(x, which)

pick2(x, which)
```

Arguments

```
x          A list, data frame, or vector.
which      The index or name of the element(s) to extract.
```

Details

These two helper functions extract elements from lists, data frames, or vectors. They are simple wrappers for the standard bracket operators in R:

- `pick1()` uses single brackets (`[]`) and returns a **subset**.
- `pick2()` uses double brackets (`[[`) and returns the **element itself**.

These are safer and more flexible than `$`, especially when used with the base R pipe (`|>`) or in functional programming.

Value

- pick1() returns a subset of x.
- pick2() returns a single element from x.

Examples

```
lst <- list(a = 1:3, b = 4:6)

# Without pipe
pick1(lst, "a")      # List with one element
pick2(lst, "a")      # Just the vector 1:3

# With base R pipe
lst |> pick1("a")
lst |> pick2("a")

df <- data.frame(x = 1:5, y = letters[1:5])

df |> pick1("y")      # Returns a data frame with column 'y'
df |> pick2("y")      # Returns column 'y' as a character vector
```

plot_lm

*Plot linear model object***Description**

Plot linear model object

Usage

```
plot_lm(lm_fit, format = "2x2", global_aes = NULL)
```

Arguments

lm_fit	An object of class 'lm'
format	The format of the plot (or a list of plots if format is "list")
global_aes	Currently no effect.

Examples

```
data(income)
m1 <- lm(inc ~ race + educ, data=income)
plot_lm(m1)
plot_lm(m1, "2x2")
plot_lm(m1, "1x4")
plot_lm(m1, "4x1")
plot_lm(m1, "list")
```

potatoes	<i>Weight and size of 20 potatoes</i>
----------	---------------------------------------

Description

Weight and size of 20 potatoes. Weight in grams; size in millimeter. There are two sizes: length is the longest length and width is the shortest length across a potato.

Usage

```
potatoes
```

Format

A data frame with 20 observations on the following 3 variables.

weight a numeric vector

length a numeric vector

width a numeric vector

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Source

My own garden; autumn 2015.

Examples

```
data(potatoes)
plot(potatoes)
```

pow	<i>Power function</i>
-----	-----------------------

Description

A function returning x raised to the power p.

Usage

```
pow(x, p)
```

Arguments

x	An object for which x^p makes sense
p	A power

Author(s)

Søren Højsgaard

prostate

Prostate Tumor Gene Expression Dataset

Description

This is the Prostate Tumor Gene Expression dataset used in Chung and Keles (2010).

Usage

```
data(prostate)
```

Format

A list with two components:

- x** Gene expression data. A matrix with 102 rows and 6033 columns.
- y** Class index. A vector with 102 elements.

Details

The prostate dataset consists of 52 prostate tumor and 50 normal samples. Normal and tumor classes are coded in 0 and 1, respectively, in **y** vector. Matrix **x** is gene expression data and arrays were normalized, log transformed, and standardized to zero mean and unit variance across genes as described in Dettling (2004) and Dettling and Beuhlmann (2002). See Chung and Keles (2010) for more details.

Source

Singh D, Febbo P, Ross K, Jackson D, Manola J, Ladd C, Tamayo P, Renshaw A, D'Amico A, Richie J, Lander E, Loda M, Kantoff P, Golub T, and Sellers W (2002), "Gene expression correlates of clinical prostate cancer behavior", *Cancer Cell*, Vol. 1, pp. 203–209.

References

- Chung D and Keles S (2010), "Sparse partial least squares classification for high dimensional data", *Statistical Applications in Genetics and Molecular Biology*, Vol. 9, Article 17.
- Dettling M (2004), "BagBoosting for tumor classification with gene expression data", *Bioinformatics*, Vol. 20, pp. 3583–3593.
- Dettling M and Beuhlmann P (2002), "Supervised clustering of genes", *Genome Biology*, Vol. 3, pp. research0069.1–0069.15.

Examples

```
data(prostate)
prostate$x[1:5,1:5]
prostate$y
```

rbind_list*Bind list of data frames and add list names as a column*

Description

Binds a named list of data frames (or tibbles) into a single data frame. Adds the list name as a new column (first column).

Usage

```
rbind_list(lst, name = "name")
```

Arguments

lst	A named list of data frames or tibbles.
name	A character scalar: name of the column to hold the list names (default "name").

Value

A data frame or tibble, depending on the class of the input.

Examples

```
lst <- list(a = data.frame(x = 1:2), b = data.frame(x = 3:4))
rbind_list(lst)

lst <- split(iris, iris$Species)
rbind_list(lst)
```

reciprocal	<i>Reciprocal function</i>
------------	----------------------------

Description

A function returning the reciprocal of its argument

Usage

```
reciprocal(x)
```

Arguments

x	An R object for which 1/x makes sense
---	---------------------------------------

Author(s)

Søren Højsgaard

recodeVar	<i>Recode values of a vector</i>
-----------	----------------------------------

Description

Recodes a vector with values, say 1,2 to a variable with values, say 'a', 'b'

Usage

```
recodeVar(x, src, tgt, default = NULL, keep.na = TRUE)
```

```
recode_var(x, src, tgt, default = NULL, keep.na = TRUE)
```

Arguments

x	A vector; the variable to be recoded.
src	The source values: a subset of the present values of x
tgt	The target values: the corresponding new values of x
default	Default target value for those values of x not listed in src. When default=NULL, values of x which are not given in src will be kept in the output.
keep.na	If TRUE then NA's in x will be retained in the output

Value

A vector

Warning

Care should be taken if `x` is a factor. A safe approach may be to convert `x` to a character vector using `as.character`.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[cut](#), [factor](#), [recodeVar](#)

Examples

```
x <- c("dec", "jan", "feb", "mar", "apr", "may")
src1 <- list(c("dec", "jan", "feb"), c("mar", "apr", "may"))
tgt1 <- list("winter", "spring")
recodeVar(x, src=src1, tgt=tgt1)
#[1] "winter" "winter" "winter" "spring" "spring" "spring"

x <- c(rep(1:3, 3))
#[1] 1 2 3 1 2 3 1 2 3

## Simple usage:
recodeVar(x, src=c(1, 2), tgt=c("A", "B"))
#[1] "A" "B" NA "A" "B" NA "A" "B" NA

## Here we need to use lists
recodeVar(x, src=list(c(1, 2)), tgt=list("A"))
#[1] "A" "A" NA "A" "A" NA "A" "A" NA
recodeVar(x, src=list(c(1, 2)), tgt=list("A"), default="L")
#[1] "A" "A" "L" "A" "A" "L" "A" "A" "L"
recodeVar(x, src=list(c(1, 2), 3), tgt=list("A", "B"), default="L")
#[1] "A" "A" "B" "A" "A" "B" "A" "A" "B"

## Dealing with NA's in x
x<-c(NA,rep(1:3, 3),NA)
#[1] NA 1 2 3 1 2 3 1 2 3 NA
recodeVar(x, src=list(c(1, 2)), tgt=list("A"))
#[1] NA "A" "A" NA "A" "A" NA "A" "A" NA NA
recodeVar(x, src=list(c(1, 2)), tgt=list("A"), default="L")
#[1] NA "A" "A" "L" "A" "A" "L" "A" "A" "L" NA
recodeVar(x, src=list(c(1, 2)), tgt=list("A"), default="L", keep.na=FALSE)
#[1] "L" "A" "A" "L" "A" "A" "L" "A" "A" "L" "L"

x <- c("no", "yes", "not registered", "no", "yes", "no answer")
recodeVar(x, src = c("no", "yes"), tgt = c("0", "1"), default = NA)
```

recover_pca_data	<i>Recover data from principal component analysis</i>
------------------	---

Description

Recover data from principal component analysis based on the first (typically few) components.

Usage

```
recover_pca_data(object, comp = 1)
```

Arguments

object	An object of class prcomp.
comp	The number of components to be used. Must be smaller than the number of variables.

Value

A dataframe

Examples

```
crime <- doBy::crimeRate
rownames(crime) <- crime$state
crime$state <- NULL

o <- order(apply(scale(crime), 1, sum))
dat <- crime[o,]
head(dat)
tail(dat)
matplot(scale(dat), type="l")

pc1 <- prcomp(dat, scale. = TRUE)
summary(pc1)
rec2 <- recover_pca_data(pc1, 2)

pairs(rec2)

par(mfrow=c(1,2))
matplot(scale(dat), type="l")
matplot(scale(rec2), type="l")

j <- merge(dat, rec2, by=0)
pairs(j[, -1])
```

renameCol	<i>Rename columns in a matrix or a dataframe.</i>
-----------	---

Description

Rename columns in a matrix or a dataframe.

Usage

```
renameCol(indata, src, tgt)
```

Arguments

indata	A dataframe or a matrix
src	Source: Vector of names of columns in indata to be renamed. Can also be a vector of column numbers.
tgt	Target: Vector with corresponding new names in the output.

Value

A dataframe if indata is a dataframe; a matrix in indata is a matrix.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
renameCol(CO2, 1:2, c("kk", "ll"))
renameCol(CO2, c("Plant", "Type"), c("kk", "ll"))

# These fail - as they should:
# renameCol(CO2, c("Plant", "Type", "conc"), c("kk", "ll"))
# renameCol(CO2, c("Plant", "Type", "Plant"), c("kk", "ll"))
```

response	<i>Get response variable from model</i>
----------	---

Description

Get response variable from model

Usage

```
response(object)
```

Arguments

object lm or glm object

Examples

```
data(cars)
lm1 <- lm(dist ~ speed + I(speed^2), data=cars)
lm1 |> response() |> head()
cars <- cars |> add_pred(lm1)
cars |> head()
cars <- cars |> add_resid(lm1)
cars
```

response_plot	<i>Plot the response variable against the predictor variables.</i>
---------------	--

Description

Plot the response variable against the predictor variables.

Usage

```
response_plot(
  data.,
  formula.,
  geoms = NULL,
  global_aes = NULL,
  plot = TRUE,
  nrow = NULL,
  ncol = NULL
)
```

Arguments

data.	A data frame containing the variables in the formula.
formula.	A formula of the form $y \sim x_1 + x_2 + \dots + x_n$, where y is the response variable and $x_1, x_2, \dots, x_n$ are the predictor variables. A dot as right hand side is allowed.
geoms	A list of ggplot2 geoms to be added to the plot.
global_aes	A list of global aesthetics to be added to the plot.
plot	A logical value indicating whether the plot should be displayed.
nrow, ncol	Number of rows / columns in plot.

Value

A list of ggplot2 plots.

Examples

```
library(ggplot2)
response_plot(iris, Sepal.Width ~ ., geoms=geom_point())
response_plot(iris, Sepal.Width ~ ., geoms=geom_point(), global_aes=list(color="Species"))
personality |> response_plot(easygon~, geoms=geom_point(), global_aes=NULL)
```

scaleBy

Group-wise scaling of data

Description

Splits a data frame or matrix by grouping variables and scales numeric variables within each group.

Usage

```
scaleBy(formula, data = parent.frame(), center = TRUE, scale = TRUE)
```

```
scale_by(data, formula, center = TRUE, scale = TRUE)
```

Arguments

formula	Grouping structure: a formula, character vector, or variables as as.quoted.
data	A data frame or matrix.
center	Logical; if TRUE, center the variables.
scale	Logical; if TRUE, scale the variables.

Value

A list of data frames or matrices (same class as input), one per group.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[summaryBy](#), [transformBy](#), [orderBy](#)

Examples

```
scale_by(iris, ~Species)
scale_by(iris, ~1)

## Combine result into one data frame:
a <- scale_by(iris, ~Species)
d <- do.call(rbind, a)
```

```
## Old interface
scaleBy(~Species, data = iris, center = TRUE, scale = FALSE)
scaleBy(~1, data = iris)
```

scale_df

Scale numeric variables in a data frame

Description

Applies `base::scale()` to numeric, integer, or logical columns in a data frame. Non-numeric columns are left unchanged.

Usage

```
scale_df(x, center = TRUE, scale = TRUE)
```

Arguments

x	A data frame or matrix.
center	Logical; if TRUE, center the variables.
scale	Logical; if TRUE, scale the variables.

Details

If x is not a data frame, `base::scale()` is applied directly.

Value

An object of the same class as x.

Examples

```
scale_df(iris)
```

section_fun

Section a function and set default values in function

Description

Section a functions domain by fixing certain arguments of a function call.

Usage

```
set_default(fun, nms, vls = NULL)

section_fun(fun, nms, vls = NULL, method = "args")

section_fun_sub(fun, nms, vls = NULL, envir = parent.frame())

section_fun_env(fun, nms, vls = NULL)

get_section(object)

get_fun(object)
```

Arguments

fun	Function to be sectioned
nms	Either a named list of the form name=value where each name is the name of an argument of the function (in which case vls is ignored) or a character vector of names of arguments.
vls	A vector or list of values of the arguments
method	One of the following: 1) "args" (default); based on substituting fixed values into the function argument list as default values). For backward compatibility can also be "def". 2) "body" for substituting fixed values into the function body. For backward compatibility can also be "sub". 3) "env": (for environment); using an auxillary argument for storing sectioned values.
envir	Environment
object	An object from section_fun (a scaffold object).

Details

Let E be a subset of the cartesian product $X \times Y$ where X and Y are some sets. Consider a function $f(x,y)$ defined on E . Then for any x in X , the section of E defined by x (denoted E_x) is the set of y 's in Y such that (x, y) is in E . Correspondingly, the section of $f(x,y)$ defined by x is the function f_x defined on E_x given by $f_x(y)=f(x,y)$.

section_fun is a wrapper for calling set_default (default method), section_fun_env or section_fun_sub. Notice that creating a sectioned function with section_fun_sub can be time consuming.

Value

A new function: The input function fun but with certain arguments fixed at specific values.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk> based on code adapted from the curry package.

See Also

[bquote_fun_list\(\)](#)

Examples

```
f <- function(x, y){x + y}

f_ <- section_fun(f, list(y = 10), method="args") ## "def" is default
f_ <- section_fun(f, nms="y", vls=10, method="args") ## SAME AS ABOVE
f_
f_(x=1)

f_ <- section_fun(f, list(y = 10), method="body") ##
f_ <- section_fun(f, nms="y", vls=10, method="body") ## SAME AS ABOVE
f_
f_(x=1)

f_ <- section_fun(f, list(y = 10), method="env")
f_ <- section_fun(f, nms="y", vls=10, method="env") ## SAME AS ABOVE
f_
f_(x=1)
get_section(f_)
get_fun(f_)

## With more complicated values:
g <- function(A, B) {
  A + B
}
g_ <- section_fun(g, list(A = matrix(1:4, nrow=2)))
g_ <- section_fun(g, "A", list(matrix(1:4, nrow=2)))
g_(diag(1, 2))

g_ <- section_fun(g, list(A = matrix(1:4, nrow=2)))

## Using built in function
set.seed(123)
rnorm5 <- section_fun(rnorm, list(n=5))
rnorm5(0, 1)

set.seed(123)
rnorm(5)
```

set_list_set_matrix	<i>Matrix representation of list of vectors and vice versa</i>
---------------------	--

Description

Matrix representation of list of vectors and vice versa

Usage

```
set_list2matrix(set_list, aggregate = FALSE)

matrix2set_list(set_matrix)
```

Arguments

set_list	list of vectors
aggregate	should the vectors be aggregated
set_matrix	matrix representation

Examples

```
l <- list(c(1,2,3), c(3,2,4), c(3,2,4))
m1 <- set_list2matrix(l)
m1
matrix2set_list(m1)

m2 <- set_list2matrix(l, aggregate=TRUE)
m2
matrix2set_list(m2)
```

shoes	<i>shoes</i>
-------	--------------

Description

Wear of soles of shoes of materials A and B for one foot each for of ten boys.

Usage

```
shoes
```


Format

This data frame contains:

A: Wear, material A

B: Wear, material B

boy: Id of boy

footA: The foot with material A

Details

The shoes data are measurements of the amount wear of the soles of shoes worn by 10 boys. The soles were made to two different synthetic materials, a standard material A and a cheaper material B.

References

Box, Hunter, Hunter (2005) Statistics for Experimenters, 2nd edition Wiley, p. 81.

split_byrow_bycol	<i>Split matrix or dataframe into list</i>
-------------------	--

Description

Split matrix or dataframe into list by columns or by rows

Usage

```
split_bycol(x, idx = NULL, as.list = FALSE)
```

```
split_byrow(x, idx = NULL)
```

Arguments

x	Matrix or dataframe.
idx	Index to split by. If NULL, split by columns or rows.
as.list	If TRUE, return list of dataframes. If FALSE, return list of matrices.

Examples

```
x <- mtcars[1:3, 1:6]
x |> split_bycol()
x |> split_bycol(as.list=TRUE)
x |> split_bycol(as.list=FALSE)
x |> split_bycol(idx=c(1,1,1,2,2,3,3,3))
## x |> split_bycol(idx=c(1,1,7,2,2,3,3,3)) ## Gives error

x <- mtcars[1:6, 1:6]
```

```
x |> split_byrow()
x |> split_byrow(idx=c(1,1,2,2))

m <- as.matrix(x)
u <- x |> split_byrow(idx=c(1,1,2,2))
y <- m |> split_byrow(idx=c(1,1,2,2))
```

sub_seq*Find sub-sequences of identical elements in a vector.*

Description

Find sub-sequences of identical elements in a vector.

Usage

```
sub_seq(x, item = NULL)

subSeq(x, item = NULL)
```

Arguments

x	An atomic vector or a factor.
item	Optionally a specific value to look for in x.

Value

A dataframe.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[rle](#)

Examples

```
x <- c(1, 1, 1, 0, 0, 1, 1, 1, 2, 2, 2, 1, 2, 2, 2, 3)
sub_seq(x)
sub_seq(x, item=1)
```

taylor	<i>Taylor expansion (one dimension)</i>
--------	---

Description

Returns Taylor polynomial approximating a function `fn(x)`

Usage

```
taylor(fn, x0, ord = 1)
```

Arguments

<code>fn</code>	A function of one variable and that variable must be named 'x'.
<code>x0</code>	The point in which to to the Taylor expansion.
<code>ord</code>	The order of the Taylor expansion.

Value

function.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

Examples

```
fn <- function(x) log(x)
ord <- 2
x0 <- 2

xv <- seq(.2, 5, .1)
plot(xv, fn(xv), type="l")
lines(xv, taylor(fn, x0=x0, ord=ord)(xv), lty=2)
abline(v=x0)

fn <- function(x) sin(x)
ord <- 4
x0 <- 0
xv <- seq(-2*pi, 2*pi, 0.1)
plot(xv, fn(xv), type="l")
lines(xv, taylor(fn, x0=x0, ord=ord)(xv), lty=2)
abline(v=x0)
```

tidy-esticon	<i>Tidy an esticon object</i>
--------------	-------------------------------

Description

Tidy summarizes information about the components of the object.

Usage

```
## S3 method for class 'esticon_class'
tidy(x, conf.int = FALSE, conf.level = 0.95, ...)
```

Arguments

x	A 'esticon_class' object (produced by esticon methods).
conf.int	Should confidence intervals be added.
conf.level	Desired confidence level.
...	Additional arguments; currently not used.

tidy-linest	<i>Tidy a linest object</i>
-------------	-----------------------------

Description

Tidy summarizes information about the components of the object.

Usage

```
## S3 method for class 'linest_class'
tidy(x, conf.int = FALSE, conf.level = 0.95, ...)
```

Arguments

x	A 'linest_class' object (produced by linest methods).
conf.int	Should confidence intervals be added.
conf.level	Desired confidence level.
...	Additional arguments; currently not used.

time_since_event	Calculate "time since event" in a vector
------------------	--

Description

Calculates the time since the nearest event in a sequence, optionally using a custom time scale.

Usage

```
time_since_event(yvar, tvar = seq_along(yvar))  
  
timeSinceEvent(...)
```

Arguments

yvar	A numeric or logical vector indicating events.
tvar	An optional numeric vector specifying time values. Defaults to the index.
...	Arguments passed on to time_since_event

Details

Events are coded as 1 (or TRUE). Non-events are anything else. The result includes absolute and signed distances to events.

Value

A data frame with columns 'yvar', 'tvar', 'abs.tse' (absolute time since event), 'sign.tse' (signed time since event), and other helper columns.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also

[subSeq](#), [rle](#)

Examples

```
## Example 1: Basic usage with default time index  
y <- c(0, 0, 1, 0, 0, 1, 0)  
tse <- time_since_event(y)  
print(tse)  
  
## Example 2: Custom (non-integer) time variable  
y <- c(0, 0, 1, 0, 0, 0, 1, 0)  
t <- seq(0.5, 3.5, length.out = length(y))  
tse <- time_since_event(y, t)
```

```
print(tse)

## Example 3: Plotting the signed time since event
plot(sign.tse ~ tvar, data = tse, type = "b",
      main = "Signed time since event",
      xlab = "Time", ylab = "Signed time since event")
grid()
abline(h = 0, col = "red", lty = 2)
```

truncate0	Truncate values in a matrix / vector to zero if they are below a certain threshold.
-----------	---

Description

Truncate values in a matrix / vector to zero if they are below a certain threshold.

Usage

```
truncate0(x, tol = 0.6, sparse = TRUE)
```

Arguments

x	matrix / vector
tol	threshold
sparse	logical; if TRUE and x is a matrix, return a sparse matrix

v	Shorthand for vparse()
---	------------------------

Description

A short and convenient alias for vparse(). Accepts unquoted names, character vectors, or a formula.

Usage

```
v(...)
```

Arguments

...	Variable input in any accepted vparse() form
-----	--

Value

A character vector of variable names

vcheck	<i>Check if variables exist in a data frame</i>
--------	---

Description

Check if variables exist in a data frame

Usage

```
vcheck(df, ...)
```

Arguments

df	A data frame
...	Variables to check

Value

TRUE if all variables exist, otherwise error

vmap	<i>Apply a function to each parsed variable name</i>
------	--

Description

Apply a function to each parsed variable name

Usage

```
vmap(.vars, .f)
```

Arguments

.vars	Variables to parse
.f	Function to apply to each name

Value

A list of results

vparse	<i>Variable utilities: parse, select, check, map, rename</i>
--------	--

Description

These functions provide flexible tools for parsing and managing variable names from formulas, unquoted names, or character vectors. Demonstrated using C02 dataset.

Usage

```
vparse(...)
```

Arguments

... Variable input (unquoted, character vector, or formula)

vrename	<i>Rename columns in a data frame</i>
---------	---------------------------------------

Description

Rename columns in a data frame

Usage

```
vrename(df, rename_map)
```

Arguments

df	A data frame
rename_map	A named character vector (old_name = new_name)

Value

A data frame with renamed columns

vselect	<i>Select columns from a data frame using flexible input</i>
---------	--

Description

Select columns from a data frame using flexible input

Usage

```
vselect(df, ...)
```

Arguments

df	A data frame
...	Variable input (unquoted, character vector, or formula)

Value

A data frame with selected columns

which.maxn	<i>Where are the n largest or n smallest elements in a numeric vector ?</i>
------------	---

Description

Determines the locations, i.e., indices of the n largest or n smallest elements of a numeric vector.

Usage

```
which.maxn(x, n = 1)
```

Arguments

x	numeric vector
n	integer ≥ 1

Value

A vector of length at most n with the indices of the n largest / smaller elements. NAs are discarded and that can cause the vector to be smaller than n.

Author(s)

Søren Højsgaard, <sorenh@math.aau.dk>

See Also[which.max](#), [which.min](#)**Examples**

```
x <- c(1:4, 0:5, 11, NA, NA)
ii <- which.minn(x, 5)
```

```
x <- c(1, rep(NA,10), 2)
ii <- which.minn(x, 5)
```

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