Package ‘maftools’

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Type Package

Title Summarize, Analyze and Visualize MAF Files

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Description Analyze and visualize Mutation Annotation Format (MAF) files from large scale sequencing studies. This package provides various functions to perform most commonly used analyses in cancer genomics and to create feature rich customizable visualzations with minimal effort.

URL https://github.com/PoisonAlien/maftools

BugReports https://github.com/PoisonAlien/maftools/issues

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`annovarToMaf` *Converts annovar annotations into MAF.*

Description

Converts variant annotations from Annovar into a basic MAF.

Usage

```
annovarToMaf(
  annovar,
  Center = NULL,
  refBuild = "hg19",
  tsbCol = NULL,
  table = "refGene",
  ens2hugo = TRUE,
  basename = NULL,
  sep = "\t",
  MAFobj = FALSE,
  sampleAnno = NULL
)
```

Arguments

`annovar`	input annovar annotation file. Can be vector of multiple files.
`Center`	Center field in MAF file will be filled with this value. Default NA.
`refBuild`	NCBI_Build field in MAF file will be filled with this value. Default hg19.
`tsbCol`	column name containing Tumor_Sample_Barcode or sample names in input file.
`table`	reference table used for gene-based annotations. Can be 'ensGene' or 'refGene'. Default 'refGene'
`ens2hugo`	If ‘table‘ is ‘ensGene‘, setting this argument to ‘TRUE‘ converts all ensemble IDs to hugo symbols.

`basename` If provided writes resulting MAF file to an output file.

`sep` field seperator for input file. Default tab seperated.

`MAFobj` If TRUE, returns results as an `MAF` object.

`sampleAnno` annotations associated with each sample/Tumor_Sample_Barcode in input annovar file. If provided it will be included in MAF object. Could be a text file or a data.frame. Ideally annotation would contain clinical data, survival information and other necessary features associated with samples. Default NULL.

Details

Annovar is one of the most widely used Variant Annotation tools in Genomics. Annovar output is generally in a tabular format with various annotation columns. This function converts such annovar output files into MAF. This function requires that annovar was run with gene based annotation as a first operation, before including any filter or region based annotations. Please be aware that this function performs no transcript prioritization.

e.g, table_annovar.pl example/ex1.avinput humandb/ -buildver hg19 -out myanno -remove -protocol (`refGene`),cytoBand,dbnsfp30a -operation (g),r,f -nastring NA

This function mainly uses gene based annotations for processing, rest of the annotation columns from input file will be attached to the end of the resulting MAF.

Value

MAF table.

References

Wang, K., Li, M. & Hakonarson, H. ANNOVAR: functional annotation of genetic variants from high-throughput sequencing data. Nucleic Acids Res 38, e164 (2010).

Examples

```
var.annovar <- system.file("extdata", "variants.hg19_multianno.txt", package = "maftools")
var.annovar.maf <- annovarToMaf(annovar = var.annovar, Center = 'CSI-NUS', refBuild = 'hg19',
tsbCol = 'Tumor_Sample_Barcode', table = 'ensGene')
```

`clinicalEnrichment` *Performs mutational enrichment analysis for a given clinical feature.*

Description

Performs paiwise and groupwise fisher exact tests to find differentially enriched genes for every factor within a clinical feature.

Usage

```
clinicalEnrichment(
  maf,
  clinicalFeature = NULL,
  annotationDat = NULL,
  minMut = 5,
  useCNV = TRUE
)
```

Arguments

maf — MAF object

clinicalFeature — columns names from ‘clinical.data‘ slot of MAF to be analysed for.

annotationDat — If MAF file was read without clinical data, provide a custom data.frame or a tsv file with a column containing Tumor_Sample_Barcodes along with clinical features. Default NULL.

minMut — Consider only genes with minimum this number of samples mutated. Default 5.

useCNV — whether to include copy number events. Only applicable when MAF is read along with copy number data. Default TRUE if available.

Value

result list containing p-values

See Also

plotEnrichmentResults

Examples

```
## Not run:
laml.maf = system.file('extdata', 'tcga_laml.maf.gz', package = 'maftools')
laml.clin = system.file('extdata', 'tcga_laml_annot.tsv', package = 'maftools')
laml = read.maf(maf = laml.maf, clinicalData = laml.clin)
clinicalEnrichment(laml, 'FAB_classification')

## End(Not run)
```

coBarplot *Draw two barplots side by side for cohort comparision.*

Description

Draw two barplots side by side for cohort comparision.

Usage

```
coBarplot(
  m1,
  m2,
  genes = NULL,
  orderBy = NULL,
  m1Name = NULL,
  m2Name = NULL,
  colors = NULL,
  normalize = TRUE,
  yLims = NULL,
  borderCol = "gray",
  titleSize = 1,
  geneSize = 0.8,
  showPct = TRUE,
  pctSize = 0.7,
  axisSize = 0.8,
  legendTxtSize = 1
)
```

Arguments

m1	first MAF object
m2	second MAF object
genes	genes to be drawn. Default takes top 5 mutated genes.
orderBy	Order genes by mutation rate in ‘m1‘ or ‘m2‘. Default ‘NULL‘, keeps the same order of ‘genes‘
m1Name	optional name for first cohort
m2Name	optional name for second cohort
colors	named vector of colors for each Variant_Classification.
normalize	Default TRUE.
yLims	Default NULL. Auto estimates. Maximum values for ‘m1‘ and ‘m2‘ respectively
borderCol	Default gray
titleSize	Default 1
geneSize	Default 0.8
showPct	Default TRUE
pctSize	Default 0.7
axisSize	Default 0.8
legendTxtSize	Default 0.8

Details

Draws two barplots side by side to display difference between two cohorts.

Value

Returns nothing. Just draws plot.

Examples

```
#' ##Primary and Relapse APL
primary.apl <- system.file("extdata", "APL_primary.maf.gz", package = "maftools")
relapse.apl <- system.file("extdata", "APL_relapse.maf.gz", package = "maftools")
##Read mafs
primary.apl <- read.maf(maf = primary.apl)
relapse.apl <- read.maf(maf = relapse.apl)
##Plot
coBarplot(m1 = primary.apl, m2 = relapse.apl, m1Name = 'Primary APL', m2Name = 'Relapse APL')
dev.off()
```

compareSignatures — *Compares identified denovo mutational signatures to known COSMIC signatures*

Description

Takes results from extractSignatures and compares them known COSMIC signatures. Two COSMIC databases are used for comparisons - "legacy" which includes 30 signaures, and "SBS" - which includes updated/refined 65 signatures

Usage

```
compareSignatures(nmfRes, sig_db = "legacy", verbose = TRUE)
```

Arguments

nmfRes	results from extractSignatures
sig_db	can be legacy or SBS. Default legacy
verbose	Default TRUE

Details

SBS signature database was obtained from https://www.synapse.org/#!Synapse:syn11738319.7

Value

list containing cosine smilarities, aetiologies if available, and best match.

See Also

trinucleotideMatrix extractSignatures plotSignatures

coOncoplot — *Draw two oncoplots side by side for cohort comparision.*

Description

Draw two oncoplots side by side for cohort comparision.

Usage

```
coOncoplot(
  m1,
  m2,
  genes = NULL,
  m1Name = NULL,
  m2Name = NULL,
  clinicalFeatures1 = NULL,
  clinicalFeatures2 = NULL,
  annotationColor1 = NULL,
  annotationColor2 = NULL,
  annotationFontSize = 1.2,
  sortByAnnotation1 = FALSE,
  sortByAnnotation2 = FALSE,
  sampleOrder1 = NULL,
  sampleOrder2 = NULL,
  additionalFeature1 = NULL,
  additionalFeaturePch1 = 20,
  additionalFeatureCol1 = "white",
  additionalFeatureCex1 = 0.9,
  additionalFeature2 = NULL,
  additionalFeaturePch2 = 20,
  additionalFeatureCol2 = "white",
  additionalFeatureCex2 = 0.9,
  sepwd_genes1 = 0.5,
  sepwd_samples1 = 0.5,
  sepwd_genes2 = 0.5,
  sepwd_samples2 = 0.5,
  colors = NULL,
  removeNonMutated = TRUE,
  anno_height = 2,
  legend_height = 4,
  geneNamefont = 0.8,
  showSampleNames = FALSE,
  SampleNamefont = 0.5,
  barcode_mar = 4,
  legendFontSize = 1.2,
  titleFontSize = 1.5,
  keepGeneOrder = FALSE,
  bgCol = "#CCCCCC",
  borderCol = "white"
)
```

Arguments

`m1` first `MAF` object

`m2` second `MAF` object

`genes` draw these genes. Default plots top 5 mutated genes from two cohorts.

`m1Name` optional name for first cohort

`m2Name` optional name for second cohort

`clinicalFeatures1`
columns names from ‘clinical.data‘ slot of m1 `MAF` to be drawn in the plot. Dafault NULL.

`clinicalFeatures2`
columns names from ‘clinical.data‘ slot of m2 `MAF` to be drawn in the plot. Dafault NULL.

`annotationColor1`
list of colors to use for ‘clinicalFeatures1‘ Default NULL.

`annotationColor2`
list of colors to use for ‘clinicalFeatures2‘ Default NULL.

`annotationFontSize`
font size for annotations Default 1.2

`sortByAnnotation1`
logical sort oncomatrix (samples) by provided ‘clinicalFeatures1‘. Sorts based on first ‘clinicalFeatures1‘. Defaults to FALSE. column-sort

`sortByAnnotation2`
same as above but for m2

`sampleOrder1` Manually speify sample names in m1 for oncolplot ordering. Default NULL.

`sampleOrder2` Manually speify sample names in m2 for oncolplot ordering. Default NULL.

`additionalFeature1`
a vector of length two indicating column name in the MAF and the factor level to be highlighted.

`additionalFeaturePch1`
Default 20

`additionalFeatureCol1`
Default "white"

`additionalFeatureCex1`
Default 0.9

`additionalFeature2`
a vector of length two indicating column name in the MAF and the factor level to be highlighted.

`additionalFeaturePch2`
Default 20

`additionalFeatureCol2`
Default "white"

`additionalFeatureCex2`
Default 0.9

`sepwd_genes1` Default 0.5

`sepwd_samples1` Default 0.5

`sepwd_genes2` Default 0.5

`sepwd_samples2` Default 0.5

`colors` named vector of colors for each Variant_Classification.

`removeNonMutated`
Logical. If `TRUE` removes samples with no mutations in the oncoplot for better visualization. Default `TRUE`.

`anno_height` Height of clinical margin. Default 2

`legend_height` Height of legend margin. Default 4

`geneNamefont` font size for gene names. Default 1

`showSampleNames`
whether to show sample names. Defult FALSE.

`SampleNamefont` font size for sample names. Default 0.5

`barcode_mar` Margin width for sample names. Default 4

`legendFontSize` font size for legend. Default 1.2

`titleFontSize` font size for title. Default 1.5

`keepGeneOrder` force the resulting plot to use the order of the genes as specified. Default FALSE

`bgCol` Background grid color for wild-type (not-mutated) samples. Default gray - "#CCCCCC"

`borderCol` border grid color for wild-type (not-mutated) samples. Default ’white’

Details

Draws two oncoplots side by side to display difference between two cohorts.

Value

Returns nothing. Just draws plot.

Examples

```
#' ##Primary and Relapse APL
primary.apl <- system.file("extdata", "APL_primary.maf.gz", package = "maftools")
relapse.apl <- system.file("extdata", "APL_relapse.maf.gz", package = "maftools")
##Read mafs
primary.apl <- read.maf(maf = primary.apl)
relapse.apl <- read.maf(maf = relapse.apl)
##Plot
coOncoplot(m1 = primary.apl, m2 = relapse.apl, m1Name = 'Primary APL', m2Name = 'Relapse APL')
dev.off()
```

drugInteractions *Drug-Gene Interactions*

Description

Checks for drug-gene interactions and druggable categories

Usage

```
drugInteractions(
  maf,
  top = 20,
  genes = NULL,
  plotType = "bar",
  drugs = FALSE,
  fontSize = 0.8
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`top`	Top number genes to check for. Default 20
`genes`	Manually specify gene list
`plotType`	Can be bar, pie Default bar plot.
`drugs`	Check for known/reported drugs. Default FALSE
`fontSize`	Default 0.8

Details

This function takes a list of genes and checks for known/reported drug-gene interactions or Druggable categories. All gene-drug interactions and drug claims are compiled from Drug Gene Interaction Databse. See reference for details and cite it if you use this function.

References

Griffith, M., Griffith, O. L., Coffman, A. C., Weible, J. V., McMichael, J. F., Spies, N. C., et. al,. 2013. DGIdb - Mining the druggable genome. Nature Methods.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
drugInteractions(maf = laml)
```

`estimateSignatures` *Estimate number of signatures based on cophenetic correlation metric*

Description

Estimate number of signatures based on cophenetic correlation metric

Usage

```
estimateSignatures(
  mat,
  nMin = 2,
  nTry = 6,
  nrun = 10,
  parallel = 4,
  pConstant = NULL,
  verbose = TRUE,
  plotBestFitRes = FALSE
)
```

Arguments

`mat` Input matrix of diemnsion nx96 generated by `trinucleotideMatrix`

`nMin` Minimum number of signatures to try. Default 2.

`nTry` Maximum number of signatures to try. Default 6.

`nrun` numeric giving the number of run to perform for each value in range. Default 5

`parallel` Default 4. Number of cores to use.

`pConstant` A small positive value to add to the matrix. Use it ONLY if the functions throws an `non-conformable arrays` error

`verbose` Default TRUE

`plotBestFitRes` plots consensus heatmap for range of values tried. Default FALSE

Details

This function decomposes a non-negative matrix into n signatures. Extracted signatures are compared against 30 experimentally validated signatures by calculating cosine similarity. See http://cancer.sanger.ac.uk/cosm for details.

Value

a list with NMF.rank object and summary stats.

See Also

plotCophenetic extractSignatures trinucleotideMatrix

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.tnm <- trinucleotideMatrix(maf = laml, ref_genome = 'BSgenome.Hsapiens.UCSC.hg19', prefix = 'chr',
add = TRUE, useSyn = TRUE)
library("NMF")
laml.sign <- estimateSignatures(mat = laml.tnm, plotBestFitRes = FALSE, nMin = 2, nTry = 3, nrun = 2, pConstant =

## End(Not run)
```

extractSignatures *Extract mutational signatures from trinucleotide context.*

Description

Decompose a matrix of 96 substitution classes into n signatures.

Usage

```
extractSignatures(
  mat,
  n = NULL,
  plotBestFitRes = FALSE,
  parallel = 4,
  pConstant = NULL
)
```

Arguments

mat	Input matrix of diemnsion nx96 generated by trinucleotideMatrix
n	decompose matrix into n signatures. Default NULL. Tries to predict best value for n by running NMF on a range of values and chooses based on cophenetic correlation coefficient.
plotBestFitRes	plots consensus heatmap for range of values tried. Default FALSE
parallel	Default 4. Number of cores to use.
pConstant	A small positive value to add to the matrix. Use it ONLY if the functions throws an non-conformable arrays error

Details

This function decomposes a non-negative matrix into n signatures.

Value

a list with decomposed scaled signatures, signature contributions in each sample and NMF object.

See Also

trinucleotideMatrix plotSignatures compareSignatures

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.tnm <- trinucleotideMatrix(maf = laml, ref_genome = 'BSgenome.Hsapiens.UCSC.hg19', prefix = 'chr',
add = TRUE, useSyn = TRUE)
library("NMF")
laml.sign <- extractSignatures(mat = laml.tnm, plotBestFitRes = FALSE, n = 2, pConstant = 0.01)

## End(Not run)
```

forestPlot *Draw forest plot for differences betweeen cohorts.*

Description

Draw forest plot for differences betweeen cohorts.

Usage

```
forestPlot(
  mafCompareRes,
  pVal = 0.05,
  fdr = NULL,
  color = NULL,
  geneFontSize = 1.2,
  titleSize = 1.2,
  lineWidth = 2.2
)
```

Arguments

mafCompareRes	results from mafCompare
pVal	p-value threshold. Default 0.05.
fdr	fdr threshold. Default NULL. If provided uses adjusted pvalues (fdr).
color	vector of colors for cohorts. Default NULL.
geneFontSize	Font size for gene symbols. Default 1.2
titleSize	font size for titles. Default 1.2
lineWidth	line width for CI bars. Default 2.2

Details

Plots results from `link{mafCompare}` as a forest plot with x-axis as log10 converted odds ratio and differentially mutated genes on y-axis.

Value

Nothing

See Also

`mafCompare`

Examples

```
##Primary and Relapse APL
primary.apl <- system.file("extdata", "APL_primary.maf.gz", package = "maftools")
relapse.apl <- system.file("extdata", "APL_relapse.maf.gz", package = "maftools")
##Read mafs
primary.apl <- read.maf(maf = primary.apl)
relapse.apl <- read.maf(maf = relapse.apl)
##Perform analysis and draw forest plot.
pt.vs.rt <- mafCompare(m1 = primary.apl, m2 = relapse.apl, m1Name = 'Primary',
m2Name = 'Relapse', minMut = 5)
forestPlot(mafCompareRes = pt.vs.rt)
```

`genesToBarcodes` *Extracts Tumor Sample Barcodes where the given genes are mutated.*

Description

Extracts Tumor Sample Barcodes where the given genes are mutated.

Usage

```
genesToBarcodes(maf, genes = NULL, justNames = FALSE, verbose = TRUE)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`genes`	Hogo_Symbol for which sample names to be extracted.
`justNames`	if TRUE, just returns samples names instead of summarized tables.
`verbose`	Default TRUE

Value

list of `data.tables` with samples in which given genes are mutated.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
genesToBarcodes(maf = laml, genes = 'DNMT3A')
```

genotypeMatrix *Creates a Genotype Matrix for every variant*

Description

Creates a Genotype matrix using allele frequcies or by muatation status.

Usage

```
genotypeMatrix(
  maf,
  genes = NULL,
  tsb = NULL,
  includeSyn = FALSE,
  vafCol = NULL,
  vafCutoff = c(0.1, 0.75)
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`genes`	create matrix for only these genes. Define NULL
`tsb`	create matrix for only these tumor sample barcodes/samples. Define NULL
`includeSyn`	whether to include silent mutations. Default FALSE
`vafCol`	specify column name for vaf's. Default NULL. If not provided simply assumes all mutations are heterozygous.
`vafCutoff`	specify minimum and maximum vaf to define mutations as heterozygous. Default range 0.1 to 0.75. Mutations above maximum vafs are defined as homozygous.

Value

matrix

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
genotypeMatrix(maf = laml, genes = "RUNX1")
```

getClinicalData *extract annotations from MAF object*

Description

extract annotations from MAF object

Usage

```
getClinicalData(x)

## S4 method for signature 'MAF'
getClinicalData(x)
```

Arguments

x	An object of class MAF

Value

annotations associated with samples in MAF

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
getClinicalData(x = laml)
```

getCytobandSummary *extract cytoband summary from GISTIC object*

Description

extract cytoband summary from GISTIC object

Usage

```
getCytobandSummary(x)

## S4 method for signature 'GISTIC'
getCytobandSummary(x)
```

Arguments

x	An object of class GISTIC

Value

summarizied gistic results by altered cytobands.

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
getCytobandSummary(laml.gistic)
```

getFields *extract available fields from MAF object*

Description

extract available fields from MAF object

Usage

```
getFields(x)

## S4 method for signature 'MAF'
getFields(x)
```

Arguments

x	An object of class MAF

Value

Field names in MAF file

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
getFields(x = laml)
```

getGeneSummary *extract gene summary from MAF or GISTIC object*

Description

extract gene summary from MAF or GISTIC object

Usage

```
getGeneSummary(x)

## S4 method for signature 'MAF'
getGeneSummary(x)

## S4 method for signature 'GISTIC'
getGeneSummary(x)
```

Arguments

x An object of class MAF or GISTIC

Value

gene summary table

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
getGeneSummary(laml)
```

getSampleSummary *extract sample summary from MAF or GISTIC object*

Description

extract sample summary from MAF or GISTIC object

Usage

```
getSampleSummary(x)

## S4 method for signature 'MAF'
getSampleSummary(x)

## S4 method for signature 'GISTIC'
getSampleSummary(x)
```

Arguments

x An object of class MAF or GISTIC

Value

sample summary table

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
getSampleSummary(x = laml)
```

GISTIC-class *Class GISTIC*

Description

S4 class for storing summarized MAF.

Slots

- `data` data.table of summarized GISTIC file.
- `cnv.summary` table containing alterations per sample
- `cytoband.summary` table containing alterations per cytoband
- `gene.summary` table containing alterations per gene
- `cnMatrix` character matrix of dimension n*m where n is number of genes and m is number of samples
- `numericMatrix` numeric matrix of dimension n*m where n is number of genes and m is number of samples
- `gis.scores` gistic.scores
- `summary` table with basic GISTIC summary stats
- `classCode` mapping between numeric values in numericMatrix and copy number events.

See Also

`getGeneSummary` `getSampleSummary` `getCytobandSummary`

gisticBubblePlot *Plot gistic results as a bubble plot*

Description

Plots significantly altered cytobands as a function of number samples in which it is altered and number genes it contains. Size of each bubble is according to -log10 transformed q values.

Usage

```
gisticBubblePlot(
  gistic = NULL,
  color = NULL,
  markBands = NULL,
  fdrCutOff = 0.1,
  log_y = TRUE,
  txtSize = 3
)
```

Arguments

`gistic` an object of class `GISTIC` generated by `readGistic`

`color` colors for Amp and Del events.

`markBands` any cytobands to label. Can be cytoband labels, or number of top bands to highlight. Default top 5 lowest q values.

`fdrCutOff` fdr cutoff to use. Default 0.1

`log_y` log10 scale y-axis (# genes affected). Default TRUE

`txtSize` label size for bubbles.

Value

Nothing

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
gisticBubblePlot(gistic = laml.gistic, markBands = "")
```

gisticChromPlot *Plot gistic results along linearized chromosome*

Description

A genomic plot with segments highlighting signififcant Amplifications and Deletion regions.

Usage

```
gisticChromPlot(
  gistic = NULL,
  fdrCutOff = 0.1,
  markBands = NULL,
  color = NULL,
  ref.build = "hg19",
  cytobandOffset = 0.01,
  txtSize = 0.8,
  cytobandTxtSize = 0.6,
  maf = NULL,
  mutGenes = NULL,
  y_lims = NULL,
  mutGenesTxtSize = 0.6
)
```

Arguments

gistic	an object of class GISTIC generated by readGistic
fdrCutOff	fdr cutoff to use. Default 0.1
markBands	any cytobands to label. Default top 5 lowest q values.
color	colors for Amp and Del events.
ref.build	reference build. Could be hg18, hg19 or hg38.
cytobandOffset	if scores.gistic file is given use this to adjust cytoband size.
txtSize	label size for lables
cytobandTxtSize	label size for cytoband
maf	an optional maf object
mutGenes	mutated genes from maf object to be highlighted
y_lims	Deafult NULL. A vector upper and lower y-axis limits
mutGenesTxtSize	Default 0.6

Value

nothing

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
gisticChromPlot(laml.gistic)
```

---

gisticOncoPlot *Plot gistic results.*

Description

takes output generated by readGistic and draws a plot similar to oncoplot.

Usage

```
gisticOncoPlot(
  gistic = NULL,
  top = NULL,
  bands = NULL,
  showTumorSampleBarcodes = FALSE,
  gene_mar = 5,
  barcode_mar = 6,
  sepwd_genes = 0.5,
  sepwd_samples = 0.25,
  clinicalData = NULL,
  clinicalFeatures = NULL,
  sortByAnnotation = FALSE,
  sampleOrder = NULL,
  annotationColor = NULL,
  bandsToIgnore = NULL,
  removeNonAltered = TRUE,
  colors = NULL,
  SampleNamefontSize = 0.6,
  fontSize = 0.8,
  legendFontSize = 1.2,
  annotationFontSize = 1.2,
  borderCol = "white",
  bgCol = "#CCCCCC"
)
```

Arguments

`gistic` an `GISTIC` object generated by `readGistic`

`top` how many top cytobands to be drawn. defaults to all.

`bands` draw oncoplot for these bands. Default NULL.

`showTumorSampleBarcodes` logical to include sample names.

`gene_mar` Default 5

`barcode_mar` Default 6

`sepwd_genes` Default 0.5

`sepwd_samples` Default 0.25

`clinicalData` data.frame with columns containing Tumor_Sample_Barcodes and rest of columns with annotations.

`clinicalFeatures` columns names from ‘clinicalData‘ to be drawn in the plot. Dafault NULL.

`sortByAnnotation` logical sort oncomatrix (samples) by provided ‘clinicalFeatures‘. Defaults to FALSE. column-sort

`sampleOrder` Manually speify sample names for oncolplot ordering. Default NULL.

`annotationColor` list of colors to use for clinicalFeatures. Default NULL.

`bandsToIgnore` do not show these bands in the plot Default NULL.

`removeNonAltered` Logical. If `TRUE` removes samples with no mutations in the oncoplot for better visualization. Default `FALSE`.

`colors` named vector of colors Amp and Del events.

`SampleNamefontSize` font size for sample names. Default 0.6

`fontSize` font size for cytoband names. Default 0.8

`legendFontSize` font size for legend. Default 1.2

`annotationFontSize` font size for annotations. Default 1.2

`borderCol` Default "white"

`bgCol` Default "#CCCCCC"

Details

Takes gistic file as input and plots it as a matrix. Any desired annotations can be added at the bottom of the oncoplot by providing `annotation`

Value

None.

See Also

oncostrip

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
gisticOncoPlot(laml.gistic)
```

---

icgcSimpleMutationToMAF

Converts ICGC Simple Somatic Mutation format file to MAF

Description

Converts ICGC Simple Somatic Mutation format file to Mutation Annotation Format. Basic fields are converted as per MAF specififcations, rest of the fields are retained as in the input file. Ensemble gene IDs are converted to HGNC Symbols. Note that by default Simple Somatic Mutation format contains all affected transcripts of a variant resuting in multiple entries of the same variant in same sample. It is hard to choose a single affected transcript based on annotations alone and by default this program removes repeated variants as duplicated entries. If you wish to keep all of them, set removeDuplicatedVariants to FALSE.

Usage

```
icgcSimpleMutationToMAF(
  icgc,
  basename = NA,
  MAFobj = FALSE,
  clinicalData = NULL,
  removeDuplicatedVariants = TRUE,
  addHugoSymbol = FALSE
)
```

Arguments

`icgc` Input data in ICGC Simple Somatic Mutation format. Can be gz compressed.

`basename` If given writes to output file with basename.

`MAFobj` If TRUE returns results as an `MAF` object.

`clinicalData` Clinical data associated with each sample/Tumor_Sample_Barcode in MAF. Could be a text file or a data.frame. Default NULL.

`removeDuplicatedVariants`
removes repeated variants in a particuar sample, mapped to multiple transcripts of same Gene. See Description. Default TRUE.

`addHugoSymbol` If TRUE replaces ensemble gene IDs with Hugo_Symbols. Default FALSE.

Details

ICGC Simple Somatic Mutattion format specififcation can be found here: http://docs.icgc.org/submission/guide/icgc-simple-somatic-mutation-format/

Value

tab delimited MAF file.

Examples

```
esca.icgc <- system.file("extdata", "simple_somatic_mutation.open.ESCA-CN.sample.tsv.gz", package = "maftools
esca.maf <- icgcSimpleMutationToMAF(icgc = esca.icgc)
```

`inferHeterogeneity` *Clusters variants based on Variant Allele Frequencies (VAF).*

Description

takes output generated by read.maf and clusters variants to infer tumor heterogeneity. This function requires VAF for clustering and density estimation. VAF can be on the scale 0-1 or 0-100. Optionally if copy number information is available, it can be provided as a segmented file (e.g, from Circular Binary Segmentation). Those variants in copy number altered regions will be ignored.

Usage

```
inferHeterogeneity(
  maf,
  tsb = NULL,
  top = 5,
  vafCol = NULL,
  segFile = NULL,
  ignChr = NULL,
  minVaf = 0,
  maxVaf = 1,
  useSyn = FALSE,
  dirichlet = FALSE
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`tsb`	specify sample names (Tumor_Sample_Barcodes) for which clustering has to be done.
`top`	if `tsb` is NULL, uses top n number of most mutated samples. Defaults to 5.
`vafCol`	manually specify column name for vafs. Default looks for column 't_vaf'
`segFile`	path to CBS segmented copy number file. Column names should be Sample, Chromosome, Start, End, Num_Probes and Segment_Mean (log2 scale).
`ignChr`	ignore these chromosomes from analysis. e.g, sex chromsomes chrX, chrY. Default NULL.
`minVaf`	filter low frequency variants. Low vaf variants maybe due to sequencing error. Default 0. (on the scale of 0 to 1)
`maxVaf`	filter high frequency variants. High vaf variants maybe due to copy number alterations or impure tumor. Default 1. (on the scale of 0 to 1)
`useSyn`	Use synonymous variants. Default FALSE.
`dirichlet`	Deprecated! No longer supported. uses nonparametric dirichlet process for clustering. Default FALSE - uses finite mixture models.

Details

This function clusters variants based on VAF to estimate univariate density and cluster classification. There are two methods available for clustering. Default using parametric finite mixture models and another method using nonparametric inifinite mixture models (Dirichlet process).

Value

list of clustering tables.

References

Chris Fraley and Adrian E. Raftery (2002) Model-based Clustering, Discriminant Analysis and Density Estimation Journal of the American Statistical Association 97:611-631

Jara A, Hanson TE, Quintana FA, Muller P, Rosner GL. DPpackage: Bayesian Semi- and Nonparametric Modeling in R. Journal of statistical software. 2011;40(5):1-30.

Olshen AB, Venkatraman ES, Lucito R, Wigler M. Circular binary segmentation for the analysis of array-based DNA copy number data. Biostatistics. 2004;5(4):557-72.

See Also

`plotClusters`

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
TCGA.AB.2972.clust <- inferHeterogeneity(maf = laml, tsb = 'TCGA-AB-2972', vafCol = 'i_TumorVAF_WU')

## End(Not run)
```

lollipopPlot *Draws lollipop plot of amino acid changes on to Protein structure.*

Description

Draws lollipop plot of amino acid changes. Protein domains are derived from PFAM database.

Usage

```
lollipopPlot(
  maf,
  gene = NULL,
  AACol = NULL,
  labelPos = NULL,
  labPosSize = 0.9,
  showMutationRate = TRUE,
  showDomainLabel = TRUE,
  cBioPortal = FALSE,
  refSeqID = NULL,
  proteinID = NULL,
  roundedRect = TRUE,
  repel = FALSE,
  collapsePosLabel = TRUE,
  showLegend = TRUE,
  legendTxtSize = 0.8,
  labPosAngle = 0,
  domainLabelSize = 0.8,
  axisTextSize = c(1, 1),
  printCount = FALSE,
  colors = NULL,
  domainAlpha = 1,
  domainBorderCol = "black",
  bgBorderCol = "black",
  labelOnlyUniqueDoamins = TRUE,
  defaultYaxis = FALSE,
  titleSize = c(1.2, 1),
  pointSize = 1.5
)
```

Arguments

maf	an MAF object generated by read.maf
gene	HGNC symbol for which protein structure to be drawn.
AACol	manually specify column name for amino acid changes. Default looks for fields 'HGVSp_Short', 'AAChange' or 'Protein_Change'. Changes can be of any format i.e, can be a numeric value or HGVSp annotations (e.g; p.P459L, p.L2195Pfs*30 or p.Leu2195ProfsTer30)
labelPos	Amino acid positions to label. If 'all', labels all variants.
labPosSize	Text size for labels. Default 0.9

`showMutationRate`
: Whether to show the somatic mutation rate on the title. Default TRUE

`showDomainLabel`
: Label domains within the plot. Default TRUE. If 'FALSE" domains are annotated in legend.

`cBioPortal`
: Adds annotations similar to cBioPortals MutationMapper and collapse Variants into Truncating and rest.

`refSeqID`
: RefSeq transcript identifier for gene if known.

`proteinID`
: RefSeq protein identifier for gene if known.

`roundedRect`
: Default TRUE. If 'TRUE' domains are drawn with rounded corners. Requires `berryFunctions`

`repel`
: If points are too close to each other, use this option to repel them. Default FALSE. Warning: naive method, might make plot ugly in case of too many variants!

`collapsePosLabel`
: Collapses overlapping labels at same position. Default TRUE

`showLegend`
: Default TRUE

`legendTxtSize`
: Text size for legend. Default 0.8

`labPosAngle`
: angle for labels. Defaults to horizonal 0 degree labels. Set to 90 for vertical; 45 for diagonal labels.

`domainLabelSize`
: text size for domain labels. Default 0.8

`axisTextSize`
: text size x and y tick labels. Default c(1,1).

`printCount`
: If TRUE, prints number of summarized variants for the given protein.

`colors`
: named vector of colors for each Variant_Classification. Default NULL.

`domainAlpha`
: Default 1

`domainBorderCol`
: Default "black". Set to NA to remove.

`bgBorderCol`
: Default "black". Set to NA to remove.

`labelOnlyUniqueDoamins`
: Default TRUE only labels unique doamins.

`defaultYaxis`
: If FALSE, just labels min and maximum y values on y axis.

`titleSize`
: font size for title and subtitle. Default c(1.2, 1)

`pointSize`
: size of lollipop heads. Default 1.5

Details

This function by default looks for fields 'HGVSp_Short', 'AAChange' or 'Protein_Change' in maf file. One can also manually specify field name containing amino acid changes.

Value

Nothing

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
lollipopPlot(maf = laml, gene = 'KIT', AACol = 'Protein_Change')
```

lollipopPlot2 *Compare two lollipop plots*

Description

Compare two lollipop plots

Usage

```
lollipopPlot2(
  m1,
  m2,
  gene = NULL,
  AACol1 = NULL,
  AACol2 = NULL,
  m1_name = NULL,
  m2_name = NULL,
  m1_label = NULL,
  m2_label = NULL,
  refSeqID = NULL,
  proteinID = NULL,
  labPosAngle = 0,
  labPosSize = 0.9,
  colors = NULL,
  alpha = 1,
  axisTextSize = c(1, 1),
  pointSize = 1.2,
  roundedRect = TRUE,
  showDomainLabel = TRUE,
  domainBorderCol = "black",
  domainLabelSize = 1,
  legendTxtSize = 1,
  verbose = TRUE
)
```

Arguments

`m1`	first `MAF` object
`m2`	second `MAF` object
`gene`	HGNC symbol for which protein structure to be drawn.
`AACol1`	manually specify column name for amino acid changes in m1. Default looks for fields 'HGVSp_Short', 'AAChange' or 'Protein_Change'.
`AACol2`	manually specify column name for amino acid changes in m2. Default looks for fields 'HGVSp_Short', 'AAChange' or 'Protein_Change'.
`m1_name`	name for `m1` cohort. optional.
`m2_name`	name for `m2` cohort. optional.
`m1_label`	Amino acid positions to label for `m1` cohort. If 'all', labels all variants.
`m2_label`	Amino acid positions to label for `m2` cohort. If 'all', labels all variants.

`refSeqID` RefSeq transcript identifier for gene if known.

`proteinID` RefSeq protein identifier for gene if known.

`labPosAngle` angle for labels. Defaults to horizonal 0 degree labels. Set to 90 for vertical; 45 for diagonal labels.

`labPosSize` Text size for labels. Default 3

`colors` named vector of colors for each Variant_Classification. Default NULL.

`alpha` color adjustment. Default 1

`axisTextSize` text size for axis labels. Default 1.

`pointSize` size of lollipop heads. Default 1.2

`roundedRect` Default FALSE. If ‘TRUE‘ domains are drawn with rounded corners. Requires `berryFunctions`

`showDomainLabel` Label domains within the plot. Default TRUE. If FALSE domains are annotated in legend.

`domainBorderCol` Default "black". Set to NA to remove.

`domainLabelSize` text size for domain labels. Default 1.

`legendTxtSize` Default 1.

`verbose` Default TRUE

Details

Draws lollipop plot for a gene from two cohorts

See Also

`lollipopPlot`

`mafCompare`

Examples

```
primary.apl <- system.file("extdata", "APL_primary.maf.gz", package = "maftools")
relapse.apl <- system.file("extdata", "APL_relapse.maf.gz", package = "maftools")
primary.apl <- read.maf(maf = primary.apl)
relapse.apl <- read.maf(maf = relapse.apl)
lollipopPlot2(m1 = primary.apl, m2 = relapse.apl, gene = "FLT3",AACol1 = "amino_acid_change", AACol2 = "amino_a
```

`MAF-class` *Class MAF*

Description

S4 class for storing summarized MAF.

Slots

`data` data.table of MAF file containing all non-synonymous variants.

`variants.per.sample` table containing variants per sample

`variant.type.summary` table containing variant types per sample

`variant.classification.summary` table containing variant classification per sample

`gene.summary` table containing variant classification per gene

`summary` table with basic MAF summary stats

`maf.silent` subset of main MAF containing only silent variants

`clinical.data` clinical data associated with each sample/Tumor_Sample_Barcode in MAF.

See Also

`getGeneSummary` `getSampleSummary` `getFields`

`mafCompare` *compare two cohorts (MAF).*

Description

compare two cohorts (MAF).

Usage

```
mafCompare(m1, m2, m1Name = NULL, m2Name = NULL, minMut = 5, useCNV = TRUE)
```

Arguments

`m1`	first `MAF` object
`m2`	second `MAF` object
`m1Name`	optional name for first cohort
`m2Name`	optional name for second cohort
`minMut`	Consider only genes with minimum this number of samples mutated in atleast one of the cohort for analysis. Helful to ignore single mutated genes. Default 5.
`useCNV`	whether to include copy number events to compare MAFs. Only applicable when MAF is read along with copy number data. Default TRUE if available.

Details

Performs fisher test on 2x2 contigency table generated from two cohorts to find differentially mutated genes.

Value

result list

See Also

`forestPlot`

`lollipopPlot2`

Examples

```
primary.apl <- system.file("extdata", "APL_primary.maf.gz", package = "maftools")
relapse.apl <- system.file("extdata", "APL_relapse.maf.gz", package = "maftools")
primary.apl <- read.maf(maf = primary.apl)
relapse.apl <- read.maf(maf = relapse.apl)
pt.vs.rt <- mafCompare(m1 = primary.apl, m2 = relapse.apl, m1Name = 'Primary',
m2Name = 'Relapse', minMut = 5)
```

mafSummary *Summary statistics of MAF*

Description

Summarizes genes and samples irrespective of the type of alteration. This is different from getSampleSummary and getGeneSummary which returns summaries of only non-synonymous variants.

Usage

```
mafSummary(maf)
```

Arguments

maf	an MAF object generated by read.maf

Details

This function takes MAF object as input and returns summary table.

Value

Returns a list of summarized tables

See Also

getGeneSummary getSampleSummary

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
mafSummary(maf = laml)
```

mafSurvGroup *Performs survival analysis for a geneset*

Description

Similar to mafSurvival but for a geneset

Usage

```
mafSurvGroup(
  maf,
  geneSet = NULL,
  clinicalData = NULL,
  time = "Time",
  Status = "Status"
)
```

Arguments

maf an MAF object generated by read.maf

geneSet gene names for which survival analysis needs to be performed. Samples with mutations in ALL of the genes provided are used as genes-set mutants.

clinicalData dataframe containing events and time to events. Default looks for clinical data in annotation slot of MAF.

time column name contining time in clinicalData

Status column name containing status of patients in clinicalData. must be logical or numeric. e.g, TRUE or FALSE, 1 or 0.

Value

Survival plot

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml.clin <- system.file("extdata", "tcga_laml_annot.tsv", package = "maftools")
laml <- read.maf(maf = laml.maf,  clinicalData = laml.clin)
mafSurvGroup(maf = laml, geneSet = c('DNMT3A', 'FLT3'), time = 'days_to_last_followup', Status = 'Overall_Surv
```

mafSurvival *Performs survival analysis*

Description

Performs survival analysis by grouping samples from maf based on mutation status of given gene(s) or manual grouping of samples.

Usage

```
mafSurvival(
  maf,
  genes = NULL,
  samples = NULL,
  clinicalData = NULL,
  time = "Time",
  Status = "Status",
  groupNames = c("Mutant", "WT"),
  showConfInt = TRUE,
  addInfo = TRUE,
  col = c("maroon", "royalblue"),
  isTCGA = FALSE,
  textSize = 12,
  fn = NULL,
  width = 6,
  height = 6
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`genes`	gene names for which survival analysis needs to be performed. Samples with mutations in any one of the genes provided are used as mutants.
`samples`	samples to group by. Genes and samples are mutually exclusive.
`clinicalData`	dataframe containing events and time to events. Default looks for clinical data in annotation slot of `MAF`.
`time`	column name contining time in `clinicalData`
`Status`	column name containing status of patients in `clinicalData`. must be logical or numeric. e.g, TRUE or FALSE, 1 or 0.
`groupNames`	names for groups. Should be of length two. Default c("Mutant", "WT")
`showConfInt`	TRUE. Whether to show confidence interval in KM plot.
`addInfo`	TRUE. Whether to show survival info in the plot.
`col`	colors for plotting.
`isTCGA`	FALSE. Is data is from TCGA.
`textSize`	Text size for surv table. Default 7.
`fn`	NULL. If provided saves pdf plot with basename fn.
`width`	width of plot to be saved. Default 6
`height`	height of plot to be saved. Default 6

Details

This function takes MAF file and groups them based on mutation status associated with given gene(s) and performs survival analysis. Requires dataframe containing survival status and time to event. Make sure sample names match to Tumor Sample Barcodes from MAF file.

Value

Survival plot

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml.clin <- system.file("extdata", "tcga_laml_annot.tsv", package = "maftools")
laml <- read.maf(maf = laml.maf,  clinicalData = laml.clin)
mafSurvival(maf = laml, genes = 'DNMT3A', time = 'days_to_last_followup', Status = 'Overall_Survival_Status', 
```

---

math.score *calculates MATH (Mutant-Allele Tumor Heterogeneity) score.*

Description

calcuates MATH scores from variant allele frequencies. Mutant-Allele Tumor Heterogeneity (MATH) score is a measure of intra-tumor genetic heterogeneity. High MATH scores are related to lower survival rates. This function requies vafs.

Usage

```
math.score(maf, vafCol = NULL, sampleName = NULL, vafCutOff = 0.075)
```

Arguments

`maf` an `MAF` object generated by `read.maf`

`vafCol` manually specify column name for vafs. Default looks for column 't_vaf'

`sampleName` sample name for which MATH score to be calculated. If NULL, calculates for all samples.

`vafCutOff` minimum vaf for a variant to be considered for score calculation. Default 0.075

Value

`data.table` with MATH score for every Tumor_Sample_Barcode

References

Mroz, Edmund A. et al. Intra-Tumor Genetic Heterogeneity and Mortality in Head and Neck Cancer: Analysis of Data from The Cancer Genome Atlas. Ed. Andrew H. Beck. PLoS Medicine 12.2 (2015): e1001786.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.math <- math.score(maf = laml, vafCol = 'i_TumorVAF_WU',
sampleName = c('TCGA-AB-3009', 'TCGA-AB-2849', 'TCGA-AB-3002', 'TCGA-AB-2972'))
```

merge_mafs *Merge multiple mafs into single MAF*

Description

Merges multiple maf files/objects/data.frames into a single MAF.

Usage

```
merge_mafs(mafs, verbose = TRUE, ...)
```

Arguments

`mafs`	a list of `MAF` objects or data.frames or paths to MAF files.
`verbose`	Default TRUE
`...`	additional arguments passed `read.maf`

Value

`MAF` object

mutCountMatrix *Generates count matrix of mutations.*

Description

Generates a count matrix of mutations. i.e, number of mutations per gene per sample.

Usage

```
mutCountMatrix(
  maf,
  includeSyn = FALSE,
  countOnly = NULL,
  removeNonMutated = TRUE
)
```

Arguments

`maf`	an MAF object generated by `read.maf`
`includeSyn`	whether to include sysnonymous variants in ouput matrix. Default FALSE
`countOnly`	Default NULL - counts all variants. You can specify type of 'Variant_Classification' to count. For e.g, countOnly = 'Splice_Site' will generates matrix for only Splice_Site variants.
`removeNonMutated`	Logical Default `TRUE`, removes samples with no mutations from the matrix.

Value

Integer Matrix

See Also

getFields getGeneSummary getSampleSummary

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
##Generate matrix
mutCountMatrix(maf = laml)
##Generate count matrix of Splice_Site mutations
mutCountMatrix(maf = laml, countOnly = 'Splice_Site')
```

---

oncodrive *Detect cancer driver genes based on positional clustering of variants.*

Description

Clusters variants based on their position to detect disease causing genes.

Usage

```
oncodrive(
  maf,
  AACol = NULL,
  minMut = 5,
  pvalMethod = "zscore",
  nBgGenes = 100,
  bgEstimate = TRUE,
  ignoreGenes = NULL
)
```

Arguments

`maf` an MAF object generated by read.maf

`AACol` manually specify column name for amino acid changes. Default looks for field ’AAChange’

`minMut` minimum number of mutations required for a gene to be included in analysis. Default 5.

`pvalMethod` either zscore (default method for oncodriveCLUST), poisson or combined (uses lowest of the two pvalues).

`nBgGenes` minimum number of genes required to estimate background score. Default 100. Do not change this unless its necessary.

`bgEstimate` If FALSE skips background estimation from synonymous variants and uses predifined values estimated from COSMIC synonymous variants.

`ignoreGenes` Ignore these genes from analysis. Default NULL. Helpful in case data contains large number of variants belonging to polymorphic genes such as mucins and TTN.

Details

This is the re-implimentation of algorithm defined in OncodriveCLUST article. Concept is based on the fact that most of the variants in cancer causing genes are enriched at few specific loci (aka hotspots). This method takes advantage of such positions to identify cancer genes. Cluster score of 1 means, a single hotspot hosts all observed variants. If you use this function, please cite OncodriveCLUST article.

Value

data table of genes ordered according to p-values.

References

Tamborero D, Gonzalez-Perez A and Lopez-Bigas N. OncodriveCLUST: exploiting the positional clustering of somatic mutations to identify cancer genes. Bioinformatics. 2013; doi: 10.1093/bioinformatics/btt395s

See Also

`plotOncodrive`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.sig <- oncodrive(maf = laml, AACol = 'Protein_Change', minMut = 5)
```

`OncogenicPathways` *Enrichment of known oncogenic pathways*

Description

Checks for enrichment of known oncogenic pathways

Usage

```
OncogenicPathways(maf, pathways = NULL, fontSize = 1, panelWidths = c(2, 4, 4))
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`pathways`	Can be a two column data.frame/tsv-file with genes and correspoding pathwaymappings. Default ‘NULL‘, uses a predefined list of pathways. See reference for details.
`fontSize`	Default 1
`panelWidths`	Default c(2, 4, 4)

Details

Oncogenic signalling pathways are derived from TCGA cohorts. See reference for details.

Value

Prints fraction of altered pathway

References

Sanchez-Vega F, Mina M, Armenia J, Chatila WK, Luna A, La KC, Dimitriadoy S, Liu DL, Kantheti HS, Saghafinia S et al. 2018. Oncogenic Signaling Pathways in The Cancer Genome Atlas. Cell 173: 321-337 e310

See Also

PlotOncogenicPathways

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
OncogenicPathways(maf = laml)
```

---

oncoplot *draw an oncoplot*

Description

takes output generated by read.maf and draws an oncoplot

Usage

```
oncoplot(
  maf,
  top = 20,
  minMut = NULL,
  genes = NULL,
  altered = FALSE,
  drawRowBar = TRUE,
  drawColBar = TRUE,
  leftBarData = NULL,
  leftBarLims = NULL,
  rightBarData = NULL,
  rightBarLims = NULL,
  topBarData = NULL,
  logColBar = FALSE,
  includeColBarCN = TRUE,
  clinicalFeatures = NULL,
  annotationColor = NULL,
  annotationDat = NULL,
  pathways = NULL,
  selectedPathways = NULL,
  draw_titv = FALSE,
  showTumorSampleBarcodes = FALSE,
  barcode_mar = 4,
  barcodeSrt = 90,
  gene_mar = 5,
  anno_height = 1,
  legend_height = 4,
  sortByAnnotation = FALSE,
  groupAnnotationBySize = TRUE,
  annotationOrder = NULL,
  sortByMutation = FALSE,
  keepGeneOrder = FALSE,
  GeneOrderSort = TRUE,
  sampleOrder = NULL,
  additionalFeature = NULL,
  additionalFeaturePch = 20,
  additionalFeatureCol = "gray70",
  additionalFeatureCex = 0.9,
  genesToIgnore = NULL,
  removeNonMutated = TRUE,
  fill = TRUE,
  cohortSize = NULL,
  colors = NULL,
  bgCol = "#CCCCCC",
  borderCol = "white",
  annoBorderCol = NA,
  numericAnnoCol = NULL,
  drawBox = FALSE,
  fontSize = 0.8,
  SampleNamefontSize = 1,
  titleFontSize = 1.5,
  legendFontSize = 1.2,
  annotationFontSize = 1.2,
  sepwd_genes = 0.5,
  sepwd_samples = 0.25,
  writeMatrix = FALSE,
  colbar_pathway = FALSE,
  showTitle = TRUE,
  titleText = NULL
)
```

Arguments

`maf` an `MAF` object generated by `read.maf`

`top` how many top genes to be drawn. defaults to 20.

`minMut` draw all genes with ‘min‘ number of mutations. Can be an integer or fraction (of samples mutated), Default NULL

`genes` Just draw oncoplot for these genes. Default NULL.

`altered` Default FALSE. Chooses top genes based on muatation status. If `TRUE` chooses top genes based alterations (CNV or mutation).

`drawRowBar` logical. Plots righ barplot for each gene. Default `TRUE`.

`drawColBar` logical plots top barplot for each sample. Default `TRUE`.

`leftBarData` Data for leftside barplot. Must be a data.frame with two columns containing gene names and values. Default ‘NULL‘

`leftBarLims` limits for ‘leftBarData‘. Default ‘NULL‘.

`rightBarData` Data for rightside barplot. Must be a data.frame with two columns containing to gene names and values. Default ‘NULL‘ which draws distibution by variant classification. This option is applicable when only ‘drawRowBar‘ is TRUE.

`rightBarLims` limits for ‘rightBarData‘. Default ‘NULL‘.

`topBarData` Default ‘NULL‘ which draws absolute number of mutation load for each sample. Can be overridden by choosing one clinical indicator(Numeric) or by providing a two column data.frame contaning sample names and values for each sample. This option is applicable when only ‘drawColBar‘ is TRUE.

`logColBar` Plot top bar plot on log10 scale. Default `FALSE`.

`includeColBarCN`
Whether to include CN in column bar plot. Default TRUE

`clinicalFeatures`
columns names from ‘clinical.data‘ slot of `MAF` to be drawn in the plot. Dafault NULL.

`annotationColor`
Custom colors to use for ‘clinicalFeatures‘. Must be a named list containing a named vector of colors. Default NULL. See example for more info.

`annotationDat` If MAF file was read without clinical data, provide a custom `data.frame` with a column `Tumor_Sample_Barcode` containing sample names along with rest of columns with annotations. You can specify which columns to be drawn using ‘clinicalFeatures‘ argument.

`pathways` Default ‘NULL‘. Can be ‘auto‘, or a two column data.frame/tsv-file with genes and correspoding pathway mappings.‘

`selectedPathways`
Manually provide the subset of pathway names to be seletced from ‘pathways‘. Default NULL. In case ‘pathways‘ is ‘auto‘ draws top 3 altered pathways.

`draw_titv` logical Includes TiTv plot. `FALSE`

`showTumorSampleBarcodes`
logical to include sample names.

`barcode_mar` Margin width for sample names. Default 4

`barcodeSrt` Rotate sample labels. Default 90.

`gene_mar` Margin width for gene names. Default 5

`anno_height` Height of plotting area for sample annotations. Default 1

`legend_height` Height of plotting area for legend. Default 4

`sortByAnnotation`
logical sort oncomatrix (samples) by provided ‘clinicalFeatures‘. Sorts based on first ‘clinicalFeatures‘. Defaults to FALSE. column-sort

`groupAnnotationBySize`
Further group ‘sortByAnnotation‘ orders by their size. Defaults to TRUE. Largest groups comes first.

`annotationOrder`
Manually specify order for annotations. Works only for first ‘clinicalFeatures‘. Default NULL.

`sortByMutation` Force sort matrix according mutations. Helpful in case of MAF was read along with copy number data. Default FALSE.

`keepGeneOrder` logical whether to keep order of given genes. Default FALSE, order according to mutation frequency

`GeneOrderSort` logical this is applicable when ‘keepGeneOrder‘ is TRUE. Default TRUE

`sampleOrder` Manually speify sample names for oncolplot ordering. Default NULL.

`additionalFeature` a vector of length two indicating column name in the MAF and the factor level to be highlighted. Provide a list of values for highlighting more than one features

`additionalFeaturePch` Default 20

`additionalFeatureCol` Default "gray70"

`additionalFeatureCex` Default 0.9

`genesToIgnore` do not show these genes in Oncoplot. Default NULL.

`removeNonMutated` Logical. If `TRUE` removes samples with no mutations in the oncoplot for better visualization. Default `TRUE`.

`fill` Logical. If `TRUE` draws genes and samples as blank grids even when they are not altered.

`cohortSize` Number of sequenced samples in the cohort. Default all samples from Cohort. You can manually specify the cohort size. Default `NULL`

`colors` named vector of colors for each Variant_Classification.

`bgCol` Background grid color for wild-type (not-mutated) samples. Default gray - "#CCCCCC"

`borderCol` border grid color (not-mutated) samples. Default ’white’.

`annoBorderCol` border grid color for annotations. Default NA.

`numericAnnoCol` color palette used for numeric annotations. Default ’YlOrBr’ from RColorBrewer

`drawBox` logical whether to draw a box around main matrix. Default FALSE

`fontSize` font size for gene names. Default 0.8.

`SampleNamefontSize` font size for sample names. Default 1

`titleFontSize` font size for title. Default 1.5

`legendFontSize` font size for legend. Default 1.2

`annotationFontSize` font size for annotations. Default 1.2

`sepwd_genes` size of lines seperating genes. Default 0.5

`sepwd_samples` size of lines seperating samples. Default 0.25

`writeMatrix` writes character coded matrix used to generate the plot to an output file.

`colbar_pathway` Draw top column bar with respect to diplayed pathway. Default FALSE.

`showTitle` Default TRUE

`titleText` Custom title. Default ‘NULL‘

Details

Takes maf file as input and plots it as a matrix. Any desired clincal features can be added at the bottom of the oncoplot by providing `clinicalFeatures`. Oncoplot can be sorted either by mutations or by clinicalFeatures using arguments `sortByMutation` and `sortByAnnotation` respectively.

Value

None.

See Also

`oncostrip`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml.clin = system.file('extdata', 'tcga_laml_annot.tsv', package = 'maftools')
laml <- read.maf(maf = laml.maf, clinicalData = laml.clin)
#Basic onocplot
oncoplot(maf = laml, top = 3)
#Changing colors for variant classifications (You can use any colors, here in this example we will use a color pa
col = RColorBrewer::brewer.pal(n = 8, name = 'Paired')
names(col) = c('Frame_Shift_Del','Missense_Mutation', 'Nonsense_Mutation', 'Multi_Hit', 'Frame_Shift_Ins',
               'In_Frame_Ins', 'Splice_Site', 'In_Frame_Del')
#Color coding for FAB classification; try getAnnotations(x = laml) to see available annotations.
fabcolors = RColorBrewer::brewer.pal(n = 8,name = 'Spectral')
names(fabcolors) = c("M0", "M1", "M2", "M3", "M4", "M5", "M6", "M7")
fabcolors = list(FAB_classification = fabcolors)
oncoplot(maf = laml, colors = col, clinicalFeatures = 'FAB_classification', sortByAnnotation = TRUE, annotatio
```

`oncostrip` *draw an oncostrip similar to cBioportal oncoprinter output.*

Description

draw an oncostrip similar to cBioportal oncoprinter output.

Usage

```
oncostrip(maf = NULL, ...)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`...`	arguments passed `oncoplot`

Details

This is just a wrapper around `oncoplot` with drawRowBar and drawColBar set to FALSE

Value

None.

See Also

oncoplot

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
dev.new()
oncostrip(maf = laml, genes = c('NPM1', 'RUNX1'))
```

pfamDomains *pfam domain annotation and summarization.*

Description

Summarizes amino acid positions and annotates them with pfam domain information.

Usage

```
pfamDomains(
  maf = NULL,
  AACol = NULL,
  summarizeBy = "AAPos",
  top = 5,
  domainsToLabel = NULL,
  baseName = NULL,
  varClass = "nonSyn",
  width = 5,
  height = 5,
  labelSize = 1
)
```

Arguments

maf	an MAF object generated by read.maf
AACol	manually specify column name for amino acid changes. Default looks for field 'AAChange'
summarizeBy	Summarize domains by amino acid position or conversions. Can be "AAPos" or "AAChange"
top	How many top mutated domains to label in the scatter plot. Defaults to 5.
domainsToLabel	Default NULL. Exclusive with top argument.
baseName	If given writes the results to output file. Default NULL.
varClass	which variants to consider for summarization. Can be nonSyn, Syn or all. Default nonSyn.
width	width of the file to be saved.
height	height of the file to be saved.
labelSize	font size for labels. Default 1.

Value

returns a list two tables summarized by amino acid positions and domains respectively. Also plots top 5 most mutated domains as scatter plot.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
pfamDomains(maf = laml, AACol = 'Protein_Change')
```

---

plotApobecDiff *Plot differences between APOBEC enriched and non-APOBEC enriched samples.*

Description

Plots differences between APOBEC enriched and non-APOBEC enriched samples

Usage

```
plotApobecDiff(
  tnm,
  maf,
  pVal = 0.05,
  title_size = 1,
  axis_lwd = 1,
  font_size = 1.2
)
```

Arguments

tnm	output generated by trinucleotideMatrix
maf	an MAF object used to generate the matrix
pVal	p-value threshold for fisher's test. Default 0.05.
title_size	size of title. Default 1.3
axis_lwd	axis width. Default 1
font_size	font size. Default 1.2

Details

Plots differences between APOBEC enriched and non-APOBEC enriched samples (TCW). Plot includes differences in mutations load, tCw motif distribution and top genes altered.

Value

list of table containing differenatially altered genes. This can be passed to forestPlot to plot results.

See Also

trinucleotideMatrix plotSignatures

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.tnm <- trinucleotideMatrix(maf = laml, ref_genome = 'BSgenome.Hsapiens.UCSC.hg19', prefix = 'chr',
add = TRUE, useSyn = TRUE)
plotApobecDiff(laml.tnm)

## End(Not run)
```

plotCBSsegments *Plots segmented copy number data.*

Description

Plots segmented copy number data.

Usage

```
plotCBSsegments(
  cbsFile = NULL,
  maf = NULL,
  tsb = NULL,
  savePlot = FALSE,
  ylims = NULL,
  seg_size = 0.1,
  width = 6,
  height = 3,
  genes = NULL,
  ref.build = "hg19",
  writeTable = FALSE,
  removeXY = FALSE,
  color = NULL
)
```

Arguments

cbsFile	CBS segmented copy number file. Column names should be Sample, Chromosome, Start, End, Num_Probes and Segment_Mean (log2 scale).
maf	optional MAF
tsb	If segmentation file contains many samples (as in gistic input), specify sample name here. Defualt plots head 1 sample. Set 'ALL' for plotting all samples. If you are maping maf, make sure sample names in Sample column of segmentation file matches to those Tumor_Sample_Barcodes in MAF.
savePlot	If true plot is saved as pdf.
ylims	Default NULL
seg_size	Default 0.1
width	width of plot
height	height of plot

`genes`	If given and maf object is specified, maps all mutataions from maf onto segments. Default NULL
`ref.build`	Reference build for chromosome sizes. Can be hg18, hg19 or hg38. Default hg19.
`writeTable`	If true and if maf object is specified, writes plot data with each variant and its corresponding copynumber to an output file.
`removeXY`	don not plot sex chromosomes.
`color`	Manually specify color scheme for chromosomes. Default NULL. i.e, aletrnating Gray70 and midnightblue

Details

this function takes segmented copy number data and plots it. If MAF object is specified, all mutations are highlighted on the plot.

Value

Draws plot

Examples

```
tcga.ab.009.seg <- system.file("extdata", "TCGA.AB.3009.hg19.seg.txt", package = "maftools")
plotCBSsegments(cbsFile = tcga.ab.009.seg)
```

---

plotClusters *Plot density plots from clutering results.*

Description

Plots results from inferHeterogeneity.

Usage

```
plotClusters(
  clusters,
  tsb = NULL,
  genes = NULL,
  showCNvars = FALSE,
  colors = NULL
)
```

Arguments

`clusters`	clustering results from `inferHeterogeneity`
`tsb`	sample to plot from clustering results. Default plots all samples from results.
`genes`	genes to highlight on the plot. Can be a vector of gene names, `CN_altered` to label copy number altered varinats. or `all` to label all genes. Default NULL.
`showCNvars`	show copy numbered altered variants on the plot. Default FALSE.
`colors`	manual colors for clusters. Default NULL.

Value

returns nothing.

See Also

inferHeterogeneity

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
seg = system.file('extdata', 'TCGA.AB.3009.hg19.seg.txt', package = 'maftools')
TCGA.AB.3009.clust <- inferHeterogeneity(maf = laml, tsb = 'TCGA-AB-3009',
segFile = seg, vafCol = 'i_TumorVAF_WU')
plotClusters(TCGA.AB.3009.clust, genes = c('NF1', 'SUZ12'), showCNvars = TRUE)

## End(Not run)
```

plotCophenetic *Draw an elbow plot of cophenetic correlation metric.*

Description

Draw an elbow plot of cophenetic correlation metric.

Usage

```
plotCophenetic(res = NULL, bestFit = NULL)
```

Arguments

res	output from estimateSignatures
bestFit	rank to highlight. Default NULL

Details

This function draws an elbow plot of cophenetic correlation metric.

See Also

estimateSignatures plotCophenetic

plotEnrichmentResults *Plots results from clinicalEnrichment analysis*

Description

Plots results from clinicalEnrichment analysis

Usage

```
plotEnrichmentResults(
  enrich_res,
  pVal = 0.05,
  cols = NULL,
  annoFontSize = 0.8,
  geneFontSize = 0.8,
  legendFontSize = 0.8,
  showTitle = TRUE
)
```

Arguments

enrich_res	results from clinicalEnrichment or signatureEnrichment
pVal	Default 0.05
cols	named vector of colors for factor in a clinical feature. Default NULL
annoFontSize	cex for annotation font size. Default 0.8
geneFontSize	cex for gene font size. Default 0.8
legendFontSize	cex for legend font size. Default 0.8
showTitle	Default TRUE

Value

returns nothing.

See Also

clinicalEnrichment signatureEnrichment

plotmafSummary *Plots maf summary.*

Description

Plots maf summary.

Usage

```
plotmafSummary(
  maf,
  rmOutlier = TRUE,
  dashboard = TRUE,
  titvRaw = TRUE,
  log_scale = FALSE,
  addStat = NULL,
  showBarcodes = FALSE,
  fs = 1,
  textSize = 0.8,
  color = NULL,
  titleSize = c(1, 0.8),
  titvColor = NULL,
  top = 10
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`rmOutlier`	If TRUE removes outlier from boxplot.
`dashboard`	If FALSE plots simple summary instead of dashboard style.
`titvRaw`	TRUE. If false instead of raw counts, plots fraction.
`log_scale`	FALSE. If TRUE log10 transforms Variant Classification, Variant Type and Variants per sample sub-plots.
`addStat`	Can be either mean or median. Default NULL.
`showBarcodes`	include sample names in the top bar plot.
`fs`	base size for text. Default 1
`textSize`	font size if showBarcodes is TRUE. Default 0.8
`color`	named vector of colors for each Variant_Classification.
`titleSize`	font size for title and subtitle. Default c(10, 8)
`titvColor`	colors for SNV classifications.
`top`	include top n genes dashboard plot. Default 10.

Value

Prints plot.

See Also

`read.maf` `MAF`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf, useAll = FALSE)
plotmafSummary(maf = laml, addStat = 'median')
```

plotOncodrive *Plots results from* oncodrive

Description

Takes results from oncodrive and plots them as a scatter plot. Size of the gene shows number of clusters (hotspots), x-axis can either be an absolute number of variants accumulated in these clusters or a fraction of total variants found in these clusters. y-axis is fdr values transformed into -log10 for better representation. Labels indicate Gene name with number clusters observed.

Usage

```
plotOncodrive(
  res = NULL,
  fdrCutOff = 0.05,
  useFraction = FALSE,
  colCode = NULL,
  bubbleSize = 1,
  labelSize = 1
)
```

Arguments

res	results from oncodrive
fdrCutOff	fdr cutoff to call a gene as a driver.
useFraction	if TRUE uses a fraction of total variants as X-axis scale instead of absolute counts.
colCode	Colors to use for indicating significant and non-signififcant genes. Default NULL
bubbleSize	Size for bubbles. Default 2.
labelSize	font size for labelling genes. Default 1.

Value

Nothing

See Also

oncodrive

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.sig <- oncodrive(maf = laml, AACol = 'Protein_Change', minMut = 5)
plotOncodrive(res = laml.sig, fdrCutOff = 0.1)
```

PlotOncogenicPathways *Plot oncogenic pathways*

Description

Plot oncogenic pathways

Usage

```
PlotOncogenicPathways(
  maf,
  pathways = NULL,
  fullPathway = FALSE,
  removeNonMutated = TRUE,
  tsgCol = "red",
  ogCol = "royalblue",
  fontSize = 0.6,
  showTumorSampleBarcodes = FALSE,
  sampleOrder = NULL,
  SampleNamefontSize = 0.6
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`pathways`	Name of pathways to be drawn
`fullPathway`	Include all genes from the pathway. Defaulr FALS only plots mutated genes
`removeNonMutated`	Default TRUE
`tsgCol`	Color for tumro suppressor genes. Default red
`ogCol`	Color for onco genes. Default royalblue
`fontSize`	Default 0.6
`showTumorSampleBarcodes`	logical to include sample names.
`sampleOrder`	Manually speify sample names for oncolplot ordering. Default NULL.
`SampleNamefontSize`	font size for sample names. Default 10

Details

Draws oncoplot of oncogenic pathway.

References

Sanchez-Vega F, Mina M, Armenia J, Chatila WK, Luna A, La KC, Dimitriadoy S, Liu DL, Kantheti HS, Saghafinia S et al. 2018. Oncogenic Signaling Pathways in The Cancer Genome Atlas. Cell 173: 321-337 e310

See Also

OncogenicPathways

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
PlotOncogenicPathways(maf = laml, pathways = "RTK-RAS")
```

plotSignatures *Plots decomposed mutational signatures*

Description

Takes results from extractSignatures and plots decomposed mutational signatures as a barplot.

Usage

```
plotSignatures(
  nmfRes = NULL,
  contributions = FALSE,
  color = NULL,
  patient_order = NULL,
  font_size = 1.2,
  show_title = TRUE,
  sig_db = "legacy",
  axis_lwd = 2,
  title_size = 0.9,
  show_barcodes = FALSE,
  yaxisLim = 0.3,
  ...
)
```

Arguments

nmfRes	results from extractSignatures
contributions	If TRUE plots contribution of signatures in each sample.
color	colors for each Ti/Tv conversion class. Default NULL
patient_order	User defined ordering of samples. Default NULL.
font_size	font size. Default 1.2
show_title	If TRUE compares signatures to COSMIC signatures and prints them as title
sig_db	Only applicable if show_title is TRUE. Can be legacy or SBS. Default legacy
axis_lwd	axis width. Default 2.
title_size	size of title. Default 1.3
show_barcodes	Default FALSE
yaxisLim	Default 0.3. If NA autoscales.
...	further plot options passed to barplot

Value

Nothing

See Also

`trinucleotideMatrix` `plotSignatures`

`plotTiTv` *Plot Transition and Trasnversion ratios.*

Description

Takes results generated from `titv` and plots the Ti/Tv ratios and contributions of 6 mutational conversion classes in each sample.

Usage

```
plotTiTv(
  res = NULL,
  plotType = "both",
  sampleOrder = NULL,
  color = NULL,
  showBarcodes = FALSE,
  textSize = 0.8,
  baseFontSize = 1,
  axisTextSize = c(1, 1),
  plotNotch = FALSE
)
```

Arguments

`res`	results generated by `titv`
`plotType`	Can be 'bar', 'box' or 'both'. Defaults to 'both'
`sampleOrder`	Sample names in which the barplot should be ordered. Default NULL
`color`	named vector of colors for each coversion class.
`showBarcodes`	Whether to include sample names for barplot
`textSize`	fontsize if showBarcodes is TRUE. Deafult 2.
`baseFontSize`	font size. Deafult 1.
`axisTextSize`	text size x and y tick labels. Default c(1,1).
`plotNotch`	logical. Include notch in boxplot.

Value

None.

See Also

`titv`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.titv = titv(maf = laml, useSyn = TRUE)
plotTiTv(laml.titv)
```

---

plotVaf *Plots vaf distribution of genes*

Description

Plots vaf distribution of genes as a boxplot. Each dot in the jitter is a variant.

Usage

```
plotVaf(
  maf,
  vafCol = NULL,
  genes = NULL,
  top = 10,
  orderByMedian = TRUE,
  keepGeneOrder = FALSE,
  flip = FALSE,
  fn = NULL,
  gene_fs = 0.8,
  axis_fs = 0.8,
  height = 5,
  width = 5,
  showN = TRUE,
  color = NULL
)
```

Arguments

maf	an MAF object generated by read.maf
vafCol	manually specify column name for vafs. Default looks for column 't_vaf'
genes	specify genes for which plots has to be generated
top	if genes is NULL plots top n number of genes. Defaults to 5.
orderByMedian	Orders genes by decreasing median VAF. Default TRUE
keepGeneOrder	keep gene order. Default FALSE
flip	if TRUE, flips axes. Default FALSE
fn	Filename. If given saves plot as a output pdf. Default NULL.
gene_fs	font size for gene names. Default 0.8
axis_fs	font size for axis. Default 0.8
height	Height of plot to be saved. Default 5
width	Width of plot to be saved. Default 4
showN	if TRUE, includes number of observations
color	manual colors. Default NULL.

Value

Nothing.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
plotVaf(maf = laml, vafCol = 'i_TumorVAF_WU')
```

prepareMutSig *Prepares MAF file for MutSig analysis.*

Description

Corrects gene names for MutSig compatibility.

Usage

```
prepareMutSig(maf, fn = NULL)
```

Arguments

maf	an MAF object generated by read.maf
fn	basename for output file. If provided writes MAF to an output file with the given basename.

Details

MutSig/MutSigCV is most widely used program for detecting driver genes. However, we have observed that covariates files (gene.covariates.txt and exome_full192.coverage.txt) which are bundled with MutSig have non-standard gene names (non Hugo_Symbols). This discrepancy between Hugo_Symbols in MAF and non-Hugo_symbols in covariates file causes MutSig program to ignore such genes. For example, KMT2D - a well known driver gene in Esophageal Carcinoma is represented as MLL2 in MutSig covariates. This causes KMT2D to be ignored from analysis and is represented as an insignificant gene in MutSig results. This function attempts to correct such gene symbols with a manually curated list of gene names compatible with MutSig covariates list.

Value

returns a MAF with gene symbols corrected.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
prepareMutSig(maf = laml)
```

`rainfallPlot` *Rainfall plot to display hyper mutated genomic regions.*

Description

Plots inter variant distance as a function of genomic locus.

Usage

```
rainfallPlot(
  maf,
  tsb = NULL,
  detectChangePoints = FALSE,
  ref.build = "hg19",
  color = NULL,
  savePlot = FALSE,
  width = 6,
  height = 3,
  fontSize = 1.2,
  pointSize = 0.4
)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`. Required.
`tsb`	specify sample names (Tumor_Sample_Barcodes) for which plotting has to be done. If NULL, draws plot for most mutated sample.
`detectChangePoints`	If TRUE, detectes genomic change points where potential kataegis are formed. Results are written to an output tab delimted file.
`ref.build`	Reference build for chromosome sizes. Can be hg18, hg19 or hg38. Default hg19.
`color`	named vector of colors for each coversion class.
`savePlot`	If TRUE plot is saved to output pdf. Default FALSE.
`width`	width of plot to be saved.
`height`	height of plot to be saved.
`fontSize`	Default 12.
`pointSize`	Default 0.8.

Details

If ‘detectChangePoints“ is set to TRUE, this function will identify Kataegis loci. Kategis detection algorithm by Moritz Goretzky at WWU Munster, which exploits the definition of Kategis (six consecutive mutations with an avg. distance of 1000bp) to idetify hyper mutated genomic loci. Algorithm starts with a double-ended queue to which six consecutive mutations are added and their average intermutation distance is calculated. If the average intermutation distance is larger than 1000, one element is added at the back of the queue and one is removed from the front. If the average intermutation distance is less or equal to 1000, further mutations are added until the average intermutation distance is larger than 1000. After that all mutations in the double-ended queue are written into output as one kataegis and the double-ended queue is reinitialized with six mutations.

Value

Results are written to an output file with suffix changePoints.tsv

---

read.maf *Read MAF files.*

Description

Takes tab delimited MAF (can be plain text or gz compressed) file as an input and summarizes it in various ways. Also creates oncomatrix - helpful for visualization.

Usage

```
read.maf(
  maf,
  clinicalData = NULL,
  removeDuplicatedVariants = TRUE,
  useAll = TRUE,
  gisticAllLesionsFile = NULL,
  gisticAmpGenesFile = NULL,
  gisticDelGenesFile = NULL,
  gisticScoresFile = NULL,
  cnLevel = "all",
  cnTable = NULL,
  isTCGA = FALSE,
  vc_nonSyn = NULL,
  verbose = TRUE
)
```

Arguments

`maf` tab delimited MAF file. File can also be gz compressed. Required. Alternatively, you can also provide already read MAF file as a dataframe.

`clinicalData` Clinical data associated with each sample/Tumor_Sample_Barcode in MAF. Could be a text file or a data.frame. Default NULL.

`removeDuplicatedVariants`
removes repeated variants in a particuar sample, mapped to multiple transcripts of same Gene. See Description. Default TRUE.

`useAll` logical. Whether to use all variants irrespective of values in Mutation_Status. Defaults to TRUE. If FALSE, only uses with values Somatic.

`gisticAllLesionsFile`
All Lesions file generated by gistic. e.g; all_lesions.conf_XX.txt, where XX is the confidence level. Default NULL.

`gisticAmpGenesFile`
Amplification Genes file generated by gistic. e.g; amp_genes.conf_XX.txt, where XX is the confidence level. Default NULL.

`gisticDelGenesFile`
Deletion Genes file generated by gistic. e.g; del_genes.conf_XX.txt, where XX is the confidence level. Default NULL.

`gisticScoresFile`
scores.gistic file generated by gistic. Default NULL

`cnLevel` level of CN changes to use. Can be 'all', 'deep' or 'shallow'. Default uses all i.e, genes with both 'shallow' or 'deep' CN changes

`cnTable` Custom copynumber data if gistic results are not available. Input file or a data.frame should contain three columns in aforementioned order with gene name, Sample name and copy number status (either 'Amp' or 'Del'). Default NULL.

`isTCGA` Is input MAF file from TCGA source. If TRUE uses only first 12 characters from Tumor_Sample_Barcode.

`vc_nonSyn` NULL. Provide manual list of variant classifications to be considered as non-synonymous. Rest will be considered as silent variants. Default uses Variant Classifications with High/Moderate variant consequences. http://asia.ensembl.org/Help/Glossary?id=
"Frame_Shift_Del", "Frame_Shift_Ins", "Splice_Site", "Translation_Start_Site","Nonsense_Mutatio
"Nonstop_Mutation", "In_Frame_Del","In_Frame_Ins", "Missense_Mutation"

`verbose` TRUE logical. Default to be talkative and prints summary.

Details

This function takes MAF file as input and summarizes them. If copy number data is available, e.g from GISTIC, it can be provided too via arguments gisticAllLesionsFile, gisticAmpGenesFile, and gisticDelGenesFile. Copy number data can also be provided as a custom table containing Gene name, Sample name and Copy Number status.

Note that if input MAF file contains multiple affected transcripts of a variant, this function by default removes them as duplicates, while keeping single unique entry per variant per sample. If you wish to keep all of them, set removeDuplicatedVariants to FALSE.

FLAGS - If you get a note on possible FLAGS while reading MAF, it means some of the top mutated genes are fishy. These genes are often non-pathogenic and passengers, but are frequently mutated in most of the public exome studies. Examples of such genes include TTN, MUC16, etc. This note can be ignored without any harm, it's only generated as to make user aware of such genes. See references for details on FLAGS.

Value

An object of class MAF.

References

Shyr C, Tarailo-Graovac M, Gottlieb M, Lee JJ, van Karnebeek C, Wasserman WW. FLAGS, frequently mutated genes in public exomes. BMC Med Genomics 2014; 7: 64.

See Also

`plotmafSummary` `write.mafSummary`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
```

readGistic *Read and summarize gistic output.*

Description

A little function to summarize gistic output files. Summarized output is returned as a list of tables.

Usage

```
readGistic(
  gisticAllLesionsFile = NULL,
  gisticAmpGenesFile = NULL,
  gisticDelGenesFile = NULL,
  gisticScoresFile = NULL,
  cnLevel = "all",
  isTCGA = FALSE,
  verbose = TRUE
)
```

Arguments

`gisticAllLesionsFile`
: All Lesions file generated by gistic. e.g; all_lesions.conf_XX.txt, where XX is the confidence level. Required. Default NULL.

`gisticAmpGenesFile`
: Amplification Genes file generated by gistic. e.g; amp_genes.conf_XX.txt, where XX is the confidence level. Default NULL.

`gisticDelGenesFile`
: Deletion Genes file generated by gistic. e.g; del_genes.conf_XX.txt, where XX is the confidence level. Default NULL.

`gisticScoresFile`
: scores.gistic file generated by gistic.

`cnLevel`
: level of CN changes to use. Can be 'all', 'deep' or 'shallow'. Default uses all i.e, genes with both 'shallow' or 'deep' CN changes

`isTCGA`
: Is the data from TCGA. Default FALSE.

`verbose`
: Default TRUE

Details

Requires output files generated from GISTIC. Gistic documentation can be found here ftp://ftp.broadinstitute.org/pub/GIS

Value

A list of summarized data.

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
```

setdiffMAF *Set Operations for MAF objects*

Description

Set Operations for MAF objects

Usage

```
setdiffMAF(x, y, mafObj = TRUE, refAltMatch = TRUE, ...)

intersectMAF(x, y, refAltMatch = TRUE, mafObj = TRUE, ...)
```

Arguments

`x`	the first ‘MAF‘ object.
`y`	the second ‘MAF‘ object.
`mafObj`	Return output as an ‘MAF‘ object. Default ‘TRUE‘
`refAltMatch`	Set operations are done by matching ref and alt alleles in addition to loci (Default). Id FALSE only loci (chr, start, end positions) are matched.
`...`	other parameters passing to ‘subsetMaf‘ for subsetting operations.

Value

subset table or an object of class `MAF-class`. If no overlaps found returns ‘NULL‘

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
x <- subsetMaf(maf = laml, tsb = c('TCGA-AB-3009'))
y <- subsetMaf(maf = laml, tsb = c('TCGA-AB-2933'))
setdiffMAF(x, y)
intersectMAF(x, y) #Should return NULL due to no common variants
```

signatureEnrichment *Performs sample stratification based on signature contribution and enrichment analysis.*

Description

Performs k-means clustering to assign signature to samples and performs enrichment analysis.

Usage

```
signatureEnrichment(maf, sig_res, minMut = 5, useCNV = FALSE, fn = NULL)
```

Arguments

maf	an MAF object used for signature analysis.
sig_res	Signature results from extractSignatures
minMut	Consider only genes with minimum this number of samples mutated. Default 5.
useCNV	whether to include copy number events. Only applicable when MAF is read along with copy number data. Default TRUE if available.
fn	basename for output file. Default NULL.

Value

result list containing p-values

See Also

plotEnrichmentResults

---

somaticInteractions *Exact tests to detect mutually exclusive, co-occuring and altered genesets.*

Description

Performs Pair-wise Fisher's Exact test to detect mutually exclusive or co-occuring events.

Usage

```
somaticInteractions(
  maf,
  top = 25,
  genes = NULL,
  pvalue = c(0.05, 0.01),
  returnAll = TRUE,
  geneOrder = NULL,
  fontSize = 0.8,
  showSigSymbols = TRUE,
  showCounts = FALSE,
  countStats = "all",
  countType = "all",
  countsFontSize = 0.8,
  countsFontColor = "black",
  colPal = "BrBG",
  showSum = TRUE,
  colNC = 9,
  nShiftSymbols = 5,
  sigSymbolsSize = 2,
  sigSymbolsFontSize = 0.9,
  pvSymbols = c(46, 42),
  limitColorBreaks = TRUE
)
```

Arguments

maf an MAF object generated by read.maf

top check for interactions among top 'n' number of genes. Defaults to top 25. genes

genes List of genes among which interactions should be tested. If not provided, test will be performed between top 25 genes.

pvalue Default c(0.05, 0.01) p-value threshold. You can provide two values for upper and lower threshold.

returnAll If TRUE returns test statistics for all pair of tested genes. Default FALSE, returns for only genes below pvalue threshold.

geneOrder Plot the results in given order. Default NULL.

fontSize cex for gene names. Default 0.8

showSigSymbols Default TRUE. Heighlight significant pairs

showCounts Default TRUE. Include number of events in the plot

countStats Default 'all'. Can be 'all' or 'sig'

countType Default 'cooccur'. Can be 'all', 'cooccur', 'mutexcl'

countsFontSize Default 0.8

countsFontColor
Default 'black'

colPal colPalBrewer palettes. See RColorBrewer::display.brewer.all() for details

showSum show [sum] with gene names in plot, Default TRUE

colNC Number of different colors in the palette, minimum 3, default 9

nShiftSymbols shift if positive shift SigSymbols by n to the left, default = 5

sigSymbolsSize size of symbols in the matrix and in legend

sigSymbolsFontSize
size of font in legends

pvSymbols vector of pch numbers for symbols of p-value for upper and lower thresholds c(upper, lower)

limitColorBreaks
limit color to extreme values. Default TRUE

Details

This function and plotting is inspired from genetic interaction analysis performed in the published study combining gene expression and mutation data in MDS. See reference for details.

Value

list of data.tables

References

Gerstung M, Pellagatti A, Malcovati L, et al. Combining gene mutation with gene expression data improves outcome prediction in myelodysplastic syndromes. Nature Communications. 2015;6:5901. doi:10.1038/ncomms6901.

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
somaticInteractions(maf = laml, top = 5)
```

subsetMaf *Subset MAF objects*

Description

Subsets MAF based on given conditions.

Usage

```
subsetMaf(
  maf,
  tsb = NULL,
  genes = NULL,
  query = NULL,
  clinQuery = NULL,
  ranges = NULL,
  mult = "first",
  fields = NULL,
  mafObj = TRUE,
  includeSyn = TRUE,
  isTCGA = FALSE,
  dropLevels = TRUE,
  restrictTo = "all"
)
```

Arguments

maf	an MAF object generated by `read.maf`
tsb	subset by these samples (Tumor Sample Barcodes)
genes	subset by these genes
query	query string. e.g, "Variant_Classification == 'Missense_Mutation'" returns only Missense variants.
clinQuery	query by clinical variable.
ranges	subset by ranges. data.frame with 3 column (chr, start, end). Overlaps are identified by `foverlaps` function with arguments 'type = within', 'mult = all', 'nomatch = NULL'
mult	When multiple loci in 'ranges' match to the variants maf, mult=. controls which values are returned - "all" , "first" (default) or "last". This value is passed to 'mult' argument of `foverlaps`
fields	include only these fields along with necessary fields in the output
mafObj	returns output as MAF class `MAF-class`. Default TRUE
includeSyn	Default TRUE, only applicable when mafObj = FALSE. If mafObj = TRUE, synonymous variants will be stored in a seperate slot of MAF object.
isTCGA	Is input MAF file from TCGA source.
dropLevels	Default TRUE.
restrictTo	restrict subset operations to these. Can be 'all', 'cnv', or 'mutations'. Default 'all'. If 'cnv' or 'mutations', subset operations will only be applied on copy-number or mutation data respectively, while retaining other parts as is.

Value

subset table or an object of class MAF-class

See Also

getFields

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
##Select all Splice_Site mutations from DNMT3A and NPM1
subsetMaf(maf = laml, genes = c('DNMT3A', 'NPM1'),
query = "Variant_Classification == 'Splice_Site'")
##Select all variants with VAF above 30%
subsetMaf(maf = laml, query = "i_TumorVAF_WU > 30")
##Extract data for samples 'TCGA.AB.3009' and 'TCGA.AB.2933' but only include vaf filed.
subsetMaf(maf = laml, tsb = c('TCGA-AB-3009', 'TCGA-AB-2933'), fields = 'i_TumorVAF_WU')
##Subset by ranges
ranges = data.frame(chr = c("2", "17"), start = c(25457000, 7571720), end = c(25458000, 7590868))
subsetMaf(laml, ranges = ranges)
```

survGroup *Predict genesets associated with survival*

Description

Predict genesets associated with survival

Usage

```
survGroup(
  maf,
  top = 20,
  genes = NULL,
  geneSetSize = 2,
  minSamples = 5,
  clinicalData = NULL,
  time = "Time",
  Status = "Status",
  verbose = TRUE
)
```

Arguments

maf	an MAF object generated by read.maf
top	If genes is NULL by default used top 20 genes
genes	Manual set of genes
geneSetSize	Default 2

`minSamples` minimum number of samples to be mutated to be considered for analysis. Default 5

`clinicalData` dataframe containing events and time to events. Default looks for clinical data in annotation slot of `MAF`.

`time` column name contining time in `clinicalData`

`Status` column name containing status of patients in `clinicalData`. must be logical or numeric. e.g, TRUE or FALSE, 1 or 0.

`verbose` Default TRUE

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml.clin <- system.file("extdata", "tcga_laml_annot.tsv", package = "maftools")
laml <- read.maf(maf = laml.maf,  clinicalData = laml.clin)
survGroup(maf = laml, top = 20, geneSetSize = 1, time = "days_to_last_followup", Status = "Overall_Survival_Sta
```

`tcgaCompare` *Compare mutation load against TCGA cohorts*

Description

Compares mutation load in input MAF against all of 33 TCGA cohorts derived from MC3 project.

Usage

```
tcgaCompare(
  maf,
  capture_size = NULL,
  tcga_capture_size = 50,
  cohortName = NULL,
  tcga_cohorts = NULL,
  primarySite = FALSE,
  col = c("gray70", "black"),
  bg_col = c("#EDF8B1", "#2C7FB8"),
  medianCol = "red",
  decreasing = FALSE,
  logscale = TRUE,
  rm_hyper = FALSE,
  rm_zero = TRUE
)
```

Arguments

`maf` `MAF` object(s) generated by `read.maf`

`capture_size` capture size for input MAF in MBs. Default NULL. If provided plot will be scaled to mutations per mb. TCGA capture size is assumed to be 50mb.

`tcga_capture_size`
capture size for TCGA cohort in MB. Default 50

`cohortName` name for the input MAF cohort. Default "Input"

`tcga_cohorts`	restrict tcga data to these cohorts.
`primarySite`	If TRUE uses primary site of cancer as labels instead of TCGA project IDs. Default FALSE.
`col`	color vector for length 2 TCGA cohorts and input MAF cohort. Default gray70 and black.
`bg_col`	background color. Default'#EDF8B1', '#2C7FB8'
`medianCol`	color for median line. Default red.
`decreasing`	Default FALSE. Cohorts are arranged in increasing mutation burden.
`logscale`	Default TRUE
`rm_hyper`	Remove hyper mutated samples (outliers)? Default FALSE
`rm_zero`	Remove samples with zero mutations? Default TRUE

Value

data.table with median mutations per cohort

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
tcgaCompare(maf = laml, cohortName = "AML")
```

`tcgaDriverBP` *Compare genes to known TCGA drivers and their biological pathways*

Description

A small function which uses known cancer driver genes and their associatd pathways from TCGA cohorts. See reference for details

Usage

```
tcgaDriverBP(m, genes = NULL, top = 20, fontSize = 0.7)
```

Arguments

`m`	an `MAF` object
`genes`	genes to compare. Default 'NULL'.
`top`	Top number of genes to use. Mutually exclusive with 'genes' argument. Default 20
`fontSize`	Default 0.7

References

Bailey MH, Tokheim C, Porta-Pardo E, et al. Comprehensive Characterization of Cancer Driver Genes and Mutations . Cell. 2018;173(2):371–385.e18. doi:10.1016/j.cell.2018.02.060

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
tcgaDriverBP(m = laml)
```

titv *Classifies SNPs into transitions and transversions*

Description

takes output generated by read.maf and classifies Single Nucleotide Variants into Transitions and Transversions.

Usage

```
titv(maf, useSyn = FALSE, plot = TRUE, file = NULL)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`useSyn`	Logical. Whether to include synonymous variants in analysis. Defaults to FALSE.
`plot`	plots a titv fractions. default TRUE.
`file`	basename for output file name. If given writes summaries to output file. Default NULL.

Value

list of `data.frames` with Transitions and Transversions summary.

See Also

`plotTiTv`

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.titv = titv(maf = laml, useSyn = TRUE)
```

tmb *Estimate Tumor Mutation Burden*

Description

Estimates Tumor Mutation Burden in terms of per megabases

Usage

```
tmb(maf, captureSize = 50, logScale = TRUE)
```

Arguments

`maf` maf `MAF` object

`captureSize` capture size for input MAF in MBs. Default 50MB.

`logScale` Default TRUE. For plotting purpose only.

Value

data.table with TMB for every sample

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
tmb(maf = laml)
```

`trinucleotideMatrix` *Extract single 5' and 3' bases flanking the mutated site for de-novo signature analysis. Also estimates APOBEC enrichment scores.*

Description

Extract single 5' and 3' bases flanking the mutated site for de-novo signature analysis. Also estimates APOBEC enrichment scores.

Usage

```
trinucleotideMatrix(
  maf,
  ref_genome = NULL,
  prefix = NULL,
  add = TRUE,
  ignoreChr = NULL,
  useSyn = TRUE,
  fn = NULL
)
```

Arguments

`maf` an `MAF` object generated by `read.maf`

`ref_genome` BSgenome object or name of the installed BSgenome package. Example: BSgenome.Hsapiens.UCSC
Default NULL, tries to auto-detect from installed genomes.

`prefix` Prefix to add or remove from contig names in MAF file.

`add` If prefix is used, default is to add prefix to contig names in MAF file. If false prefix will be removed from contig names.

`ignoreChr` Chromsomes to ignore from analysis. e.g. chrM

`useSyn` Logical. Whether to include synonymous variants in analysis. Defaults to TRUE

`fn` If given writes APOBEC results to an output file with basename fn. Default NULL.

Details

Extracts immediate 5' and 3' bases flanking the mutated site and classifies them into 96 substitution classes. Requires BSgenome data packages for sequence extraction.

APOBEC Enrichment: Enrichment score is calculated using the same method described by Roberts et al.

E = (n_tcw * background_c) / (n_C * background_tcw)

where, n_tcw = number of mutations within T[C>T]W and T[C>G]W context. (W -> A or T)

n_C = number of mutated C and G

background_C and background_tcw motifs are number of C and TCW motifs occuring around +/- 20bp of each mutation.

One-sided Fisher's Exact test is performed to determine the enrichment of APOBEC tcw mutations over background.

Value

list of 2. A matrix of dimension nx96, where n is the number of samples in the MAF and a table describing APOBEC enrichment per sample.

References

Roberts SA, Lawrence MS, Klimczak LJ, et al. An APOBEC Cytidine Deaminase Mutagenesis Pattern is Widespread in Human Cancers. Nature genetics. 2013;45(9):970-976. doi:10.1038/ng.2702.

See Also

extractSignatures plotApobecDiff

Examples

```
## Not run:
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
laml.tnm <- trinucleotideMatrix(maf = laml, ref_genome = 'BSgenome.Hsapiens.UCSC.hg19',
prefix = 'chr', add = TRUE, useSyn = TRUE)

## End(Not run)
```

vafCompare *compare VAF across two cohorts*

Description

Draw boxplot distibution of VAFs across two cohorts

Usage

```
vafCompare(
  m1,
  m2,
  genes = NULL,
  top = 5,
  vafCol1 = NULL,
  vafCol2 = NULL,
  m1Name = "M1",
  m2Name = "M2",
  cols = c("#2196F3", "#4CAF50"),
  sigvals = TRUE,
  nrows = NULL,
  ncols = NULL
)
```

Arguments

`m1`	first `MAF` object. Required.
`m2`	second `MAF` object. Required.
`genes`	specify genes for which plot has to be generated. Default NULL.
`top`	if genes is NULL plots top n number of genes. Defaults to 5.
`vafCol1`	manually specify column name for vafs in `m1`. Default looks for column 't_vaf'
`vafCol2`	manually specify column name for vafs in `m2`. Default looks for column 't_vaf'
`m1Name`	optional name for first cohort
`m2Name`	optional name for second cohort
`cols`	vector of colors corresponding to `m1` and `m2` respectivelly.
`sigvals`	Estimate and add significance stars. Default TRUE.
`nrows`	Number of rows in the layout. Default NULL - estimated automatically
`ncols`	Number of genes drawn per row. Default 4

`write.GisticSummary` *Writes GISTIC summaries to output tab-delimited text files.*

Description

Writes GISTIC summaries to output tab-delimited text files.

Usage

```
write.GisticSummary(gistic, basename = NULL)
```

Arguments

`gistic`	an object of class `GISTIC` generated by `readGistic`
`basename`	basename for output file to be written.

Value

None. Writes output as tab delimited text files.

See Also

readGistic

Examples

```
all.lesions <- system.file("extdata", "all_lesions.conf_99.txt", package = "maftools")
amp.genes <- system.file("extdata", "amp_genes.conf_99.txt", package = "maftools")
del.genes <- system.file("extdata", "del_genes.conf_99.txt", package = "maftools")
scores.gistic <- system.file("extdata", "scores.gistic", package = "maftools")
laml.gistic = readGistic(gisticAllLesionsFile = all.lesions, gisticAmpGenesFile = amp.genes, gisticDelGenesFi
write.GisticSummary(gistic = laml.gistic, basename = 'laml')
```

`write.mafSummary` *Writes maf summaries to output tab-delimited text files.*

Description

Writes maf summaries to output tab-delimited text files.

Usage

```
write.mafSummary(maf, basename = NULL)
```

Arguments

`maf`	an `MAF` object generated by `read.maf`
`basename`	basename for output file to be written.

Details

Writes MAF and related summaries to output files.

Value

None. Writes output as text files.

See Also

read.maf

Examples

```
laml.maf <- system.file("extdata", "tcga_laml.maf.gz", package = "maftools")
laml <- read.maf(maf = laml.maf)
write.mafSummary(maf = laml, basename = 'laml')
```

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