Package 'sechm'

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Type Package

Title sechm: Complex Heatmaps from a SummarizedExperiment

Version 1.12.0

Description sechm provides a simple interface between SummarizedExperiment objects and the ComplexHeatmap package.
It enables plotting annotated heatmaps from SE objects, with easy access to rowData and colData columns,
and implements a number of features to make the generation of heatmaps easier and more flexible.
These functionalities used to be part of the SEtools package.

Depends R (>= 4.0), SummarizedExperiment, ComplexHeatmap

Imports S4Vectors, seriation, circlize, methods, randomcoloR, stats, grid, grDevices, matrixStats

Suggests BiocStyle, knitr, rmarkdown

biocViews GeneExpression, Visualization

VignetteBuilder knitr

License GPL-3

Encoding UTF-8

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Contents

`crossHm` *crossHm*

Description

Plot a multi-panel heatmap from a list of `SummarizedExperiment-class`.

Usage

```
crossHm(
  ses,
  features,
  do.scale = TRUE,
  uniqueScale = FALSE,
  assayName = .getDef("assayName"),
  sortBy = seq_along(ses),
  only.common = TRUE,
  cluster_cols = FALSE,
  cluster_rows = is.null(sortBy),
  toporder = NULL,
  hmcols = NULL,
  breaks = .getDef("breaks"),
  gaps_at = .getDef("gaps_at"),
  gaps_row = NULL,
  name = NULL,
  top_annotation = .getDef("anno_columns"),
  left_annotation = .getDef("anno_rows"),
  anno_colors = list(),
```

```
  show_rownames = NULL,
  merge_legends = FALSE,
  show_colnames = FALSE,
  rel.width = NULL,
  ...
)
```

Arguments

ses	A (named) list of SummarizedExperiment-class objects, with some matching row.names between them.
features	A vector of features (i.e. row.names) to plot.
do.scale	Logical; whether to scale rows in each SE (default TRUE).
uniqueScale	Logical; whether to force the same colorscale for each heatmap.
assayName	The name of the assay to use; if multiple names are given, the first available will be used. Defaults to "logcpm", "lognorm".
sortBy	Names or indexes of 'ses' to use for sorting rows (default all)
only.common	Logical; whether to plot only rows common to all SEs (default TRUE).
cluster_cols	Logical; whether to cluster columns (default FALSE).
cluster_rows	Logical; whether to cluster rows (default TRUE if 'do.sortRows=FALSE', FALSE otherwise).
toporder	Optional verctor of categories on which to supra-order when sorting rows, or name of a 'rowData' column to use for this purpose.
hmcols	Colors for the heatmap.
breaks	Breaks for the heatmap colors. Alternatively, symmetrical breaks can be generated automatically by setting 'breaks' to a numerical value between 0 and 1. The value is passed as the 'split.prop' argument to the getBreaks function, and indicates the proportion of the points to map to a linear scale, while the more extreme values will be plotted on a quantile scale. 'breaks=FALSE' will disable symmetrical scale and quantile capping, while retaining automatic breaks. 'breaks=1' will produce a symmetrical scale without quantile capping.
gaps_at	Columns of 'colData' to use to establish gaps between columns.
gaps_row	A named vector according to which rows will be split.
name	The title of the heatmap key.
top_annotation	Columns of 'colData' to use for top annotation.
left_annotation	Columns of 'rowData' to use for left annotation.
anno_colors	List of colors to use for annotation.
show_rownames	Whether to show row names (default TRUE if 50 rows or less).
merge_legends	Logical; passed to draw-HeatmapList-method
show_colnames	Whether to show column names (default FALSE).
rel.width	Relative width of the heatmaps
...	Any other parameter passed to each call of Heatmap.

Value

A Heatmap list.

Examples

```
data("Chen2017", package="sechm")
se1 <- Chen2017[,1:6]
se2 <- Chen2017[,7:15]
se3 <- crossHm(list(se1=se1, se2=se2), row.names(se1)[1:10] )
```

---

data *Example dataset*

Description

A SummarizedExperiment-class containing (a subset of) hippocampus RNAseq of mice treated with Forskolin.

Value

a SummarizedExperiment-class.

References

Chen et al. 2017. Mapping Gene Expression in Excitatory Neurons during Hippocampal Late-Phase Long-Term Potentiation *Frontiers in Molecular Neuroscience*. DOI: 10.3389/fnmol.2017.00039

---

getBreaks *getBreaks*

Description

Produces symmetrical breaks for a color scale, with the scale steps increasing for large values, which is useful to avoid outliers influencing too much the color scale.

Usage

```
getBreaks(x, n, split.prop = 0.98, symmetric = TRUE)
```

Arguments

x	A matrix of log2FC (or any numerical values centered around 0)
n	The desired number of breaks.
split.prop	The proportion of the data points to plot on a linear scale; the remaining will be plotted on a scale with regular frequency per step (quantile).
symmetric	Logical; whether breaks should be symmetric around 0 (default TRUE)

Value

A vector of breaks of length = ‘n‘

Examples

```
dat <- rnorm(100,sd = 10)
getBreaks(dat, 10)
```

`getDEA` *getDEA*

Description

Extracts (standardized) DEA results from the rowData of an SE object.

Usage

```
getDEA(se, dea = NULL, homogenize = FALSE)
```

Arguments

`se`	A `SummarizedExperiment-class`, with DEAs each saved as a rowData column of ‘se‘, with the column name prefixed with "DEA."
`dea`	The optional name of the DEA to extract
`homogenize`	Logical; whether to homogenize the DEA

Value

The DEA data.frame if ‘dea‘ is given, otherwise a named list of data.frames.

Examples

```
# loading example SE
data("Chen2017", package="sechm")
# this ones doesn't have saved DEAs in the standard format:
getDEA(Chen2017)
```

getDEGs *Get DEGs from a SE or list of DEA results*

Description

Get DEGs from a SE or list of DEA results

Usage

```
getDEGs(
  x,
  dea = NULL,
  lfc.th = log2(1.3),
  fdr.th = 0.05,
  direction = 0,
  merge = TRUE
)
```

Arguments

x	A 'SummarizedExperiment' object with DEA results in rowData, or a list of DEA result data.frames.
dea	Which DEA(s) to use (default all). Used only if 'x' is a 'SummarizedExperiment'.
lfc.th	Absolute log-foldchange threshold.
fdr.th	FDR threshold.
direction	If !=0, specifies whether to fetch only upregulated or downregulated features
merge	Logical; whether to take the union of DEGs from the different DEAs (when more than one).

Value

A character vector with the significant features, or a list of such vectors.

Examples

```
# loading example SE
data("Chen2017", package="sechm")
# this ones doesn't have saved DEAs in the standard format:
getDEGs(Chen2017)
```

homogenizeDEA *homogenizeDEA*

Description

Standardizes the outputs of differential expression methods (to an edgeR-like style)

Usage

```
homogenizeDEA(x)
```

Arguments

x	A data.frame containing the results of a differential expression analysis

Value

A standardized data.frame.

log2FC *log2FC*

Description

Generates log2(foldchange) matrix/assay, eventually on a per-batch fashion.

Usage

```
log2FC(
  x,
  fromAssay = NULL,
  controls,
  by = NULL,
  isLog = NULL,
  agFun = rowMeans,
  toAssay = "log2FC",
  pseudocount = 1L,
  ndigits = 2
)
```

Arguments

x	A numeric matrix, or a 'SummarizedExperiment' object
fromAssay	The assay to use if 'x' is a 'SummarizedExperiment'
controls	A vector of which samples should be used as controls for foldchange calculations.
by	An optional vector indicating groups/batches by which the controls will be averaged to calculate per-group foldchanges.
isLog	Logical; whether the data is log-transformed. If NULL, will attempt to figure it out from the data and/or assay name
agFun	Aggregation function for the baseline (default rowMeans)
toAssay	The name of the assay in which to save the output. If left to the default value, both a log2FC assay as well as a scaled log2FC assay (scaled by unit-variance, but not centered) will be saved in the object.
pseudocount	If the origin assay is not log-transformed, 'pseudocount' will be added to the values before calculating a log-transformation. This prevents infinite fold-changes and moderates them.
ndigits	Number of digits after the decimal of the log2FC (and scaledLFC).

Value

An object of same class as 'x'; if a 'SummarizedExperiment', will have the additional assay named from 'toAssay'.

Examples

```
log2FC( matrix(rnorm(40), ncol=4), controls=1:2 )
```

---

meltSE *meltSE*

Description

Melts a SE object into a ggplot-ready long data.frame.

Usage

```
meltSE(
  x,
  features,
  assayName = NULL,
  colDat.columns = NULL,
  rowDat.columns = NULL,
  flatten = TRUE,
  baseDF = TRUE
)
```

Arguments

x	An object of class SummarizedExperiment-class
features	A vector of features (i.e. row.names) to include. Use 'features=NULL' to include all.
assayName	The name(s) of the assay(s) to use. If NULL and the assays are named, all of them will be included.
colDat.columns	The colData columns to include (defaults includes all). Use 'colDat.columns=NA' in order not to include any.
rowDat.columns	The rowData columns to include (default all). Use 'rowData=NA' to not include any.
flatten	Logical, whether to flatten nested data.frames.
baseDF	Logical, whether to return a base data.frame (removing columns containing other objects such as atomic lists). Filtering is applied after flattening.

Value

A data.frame (or a DataFrame).

Examples

```
data("Chen2017", package="sechm")
head(meltSE(Chen2017,"Fos"))
```

---

qualitativeColors *qualitativeColors*

Description

qualitativeColors

Usage

```
qualitativeColors(names, ...)
```

Arguments

names	The names to which the colors are to be assigned, or an integer indicating the desired number of colors
...	passed to 'randomcoloR::distinctColorPalette'

Value

A vector (eventually named) of colors

resetAllSechmOptions *resetAllSechmOptions*

Description

Resents all package options

Usage

```
resetAllSechmOptions()
```

Value

None

Examples

```
resetAllSechmOptions()
```

safescale *safescale*

Description

Equivalent to ‘base::scale‘, but handling missing values and null variance a bit more elegantly.

Usage

```
safescale(x, center = TRUE, byRow = FALSE)
```

Arguments

x	A matrix.
center	Logical, whether to center values.
byRow	Logical, whether to scale by rows instead of columns.

Value

A scaled matrix.

Examples

```
m <- matrix(rnorm(100), nrow=10)
m.scaled <- safescale(m)
```

sechm *sechm*

Description

ComplexHeatmap wrapper for SummarizedExperiment-class.

Usage

```
sechm(
  se,
  features,
  do.scale = FALSE,
  assayName = NULL,
  name = NULL,
  sortRowsOn = seq_len(ncol(se)),
  cluster_cols = FALSE,
  cluster_rows = is.null(sortRowsOn),
  toporder = NULL,
  hmcols = NULL,
  breaks = .getDef("breaks"),
  gaps_at = NULL,
  gaps_row = NULL,
  left_annotation = NULL,
  right_annotation = NULL,
  top_annotation = NULL,
  bottom_annotation = NULL,
  anno_colors = list(),
  show_rownames = NULL,
  show_colnames = FALSE,
  isMult = FALSE,
  show_heatmap_legend = !isMult,
  show_annotation_legend = TRUE,
  mark = NULL,
  na_col = "white",
  annorow_title_side = ifelse(show_colnames, "bottom", "top"),
  annocol_title_side = "right",
  includeMissing = FALSE,
  sort.method = "MDS_angle",
  ...
)
```

Arguments

se	A SummarizedExperiment-class.
features	A vector of features (i.e. row names of 'se'). Alternatively, can be a list of feature sets, in which case these will be plotted as different row chunks.

do.scale	Logical; whether to scale rows (default FALSE).
assayName	An optional vector of assayNames to use. The first available will be used, or the first assay if NULL.
name	The name of the heatmap, eventually appearing as title of the color scale.
sortRowsOn	Sort rows by MDS polar order using the specified columns (default all)
cluster_cols	Whether to cluster columns (default F)
cluster_rows	Whether to cluster rows; default FALSE if 'do.sortRows=TRUE'.
toporder	Optional vector of categories on which to supra-order when sorting rows, or name of a 'rowData' column to use for this purpose.
hmcols	Colors for the heatmap.
breaks	Breaks for the heatmap colors. Alternatively, symmetrical breaks can be generated automatically by setting 'breaks' to a numerical value between 0 and 1. The value is passed as the 'split.prop' argument to the getBreaks function, and indicates the proportion of the points to map to a linear scale, while the more extreme values will be plotted on a quantile scale. 'breaks=FALSE' will disable symmetrical scale and quantile capping, while retaining automatic breaks. 'breaks=1' will produce a symmetrical scale without quantile capping.
gaps_at	Columns of 'colData' to use to establish gaps between columns.
gaps_row	Passed to the heatmap function; if missing, will be set automatically according to toporder.
left_annotation	Columns of 'rowData' to use for left annotation. Alternatively, an 'HeatmapAnnotation' object.
right_annotation	Columns of 'rowData' to use for left annotation. Alternatively, an 'HeatmapAnnotation' object.
top_annotation	Columns of 'colData' to use for top annotation. Alternatively, an 'HeatmapAnnotation' object. To disable (overriding defaults), use 'top_annotation=character()'.
bottom_annotation	Columns of 'colData' to use for bottom annotation. Alternatively, an 'HeatmapAnnotation' object.
anno_colors	List of colors to use for annotation.
show_rownames	Whether to show row names (default TRUE if less than 50 rows to plot).
show_colnames	Whether to show column names (default FALSE).
isMult	Logical; used to silence labels when plotting multiple heatmaps
show_heatmap_legend	Logical; whether to show heatmap legend
show_annotation_legend	Logical; whether to show the annotation legend.
mark	An optional vector of gene names to highlight.
na_col	Color of NA values
annorow_title_side	Side (top or bottom) of row annotation names

annocol_title_side	Side (left or right) of column annotation names
includeMissing	Logical; whether to include missing features (default FALSE)
sort.method	Row sorting method (see sortRows)
...	Further arguments passed to 'Heatmap'

Value

A a Heatmap-class.

Examples

```
data("Chen2017", package="sechm")
sechm(Chen2017, row.names(Chen2017)[1:10], do.scale=TRUE)
```

---

setRowAttr *Set rowData attribute of given rows*

Description

Set rowData attribute of given rows

Usage

```
setRowAttr(se, values, name = "cluster", clear = TRUE, other = NA)
```

Arguments

se	A 'SummarizedExperiment' object
values	A named vector of values, where the names correspond to rows of 'se'
name	The name of the rowData column in which to store the attribute.
clear	Logical; whether to clear out any pre-existing such column.
other	The value for unspecified rows (default NA)

Value

The modified 'se' object.

Examples

```
data("Chen2017", package="sechm")
Chen2017 <- setRowAttr(Chen2017, c("Arc"=1,"Junb"=1,"Npas4"=2))
```

setSechmOption *setSechmOption*

Description

Sets a package-wide option for ‘sechm‘

Usage

```
setSechmOption(variable, value)
```

Arguments

variable	The name of the variable to set
value	The parameter value to save

Value

None

Examples

```
setSechmOption("hmcols", value=c("blue","black","yellow"))
```

sortRows *sortRows*

Description

sortRows

Usage

```
sortRows(
  x,
  z = FALSE,
  toporder = NULL,
  na.rm = FALSE,
  method = "MDS_angle",
  toporder.meth = "before"
)
```

Arguments

x	A numeric matrix or data.frame.
z	Whether to scale rows for the purpose of calculating order.
toporder	Optional verctor of categories (length=nrow(x)) on which to supra-order when sorting rows.
na.rm	Whether to remove missing values and invariant rows.
method	Seriation method; 'MDS_angle' (default) or 'R2E' recommended.
toporder.meth	Whether to perform higher-order sorting 'before' (default) or 'after' the lower-order sorting.

Value

A reordered matrix or data.frame.

Examples

```
# random data
m <- matrix( round(rnorm(100,mean=10, sd=2)), nrow=10,
             dimnames=list(LETTERS[1:10], letters[11:20]) )
m
sortRows(m)
```

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