Package ‘SISPA’
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Title SISPA: Method for Sample Integrated Set Profile Analysis
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Description Sample Integrated Set Profile Analysis (SISPA) is a method designed to define sample groups with similar gene set enrichment profiles.
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Collate 'SISPA.R' 'callZSCORE.R' 'callGSVA.R' 'cptSamples.R'
  'waterfallplot.R' 'freqplot.R' 'sortData.R' 'filterVars.R'
  'expression_data.R' 'variant_data.R'
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callGSVA

GSVA enrichment analysis

Description

Estimates GSVA enrichment zscores.

Usage

callGSVA(x, y)

Arguments

x
A data frame or matrix of gene or probe expression values where rows correspond to genes and columns correspond to samples

y
A list of genes as data frame or vector

Details

This function uses "zscore" gene-set enrichment method in the estimation of gene-set enrichment scores per sample.

Value

A gene-set by sample matrix of GSVA enrichment zscores.

See Also

GSVA

Examples

g <- 10 ## number of genes
s <- 30 ## number of samples
## sample data matrix with values ranging from 1 to 10
rnames <- paste("g", 1:g, sep="")
cnames <- paste("s", 1:s, sep="")
expr <- matrix(sample.int(10, size = g*s, replace = TRUE), nrow=g, ncol=s, dimnames=list(rnames, cnames))
## genes of interest
genesis <- paste("g", 1:g, sep="")
## Estimates GSVA enrichment zscores.
callGSVA(expr, genes)
**callZSCORE**

**Row ZSCORES**

**Description**

Estimates the zscores for each row in the data matrix.

**Usage**

`callZSCORE(x)`

**Arguments**

- `x`: A data frame or matrix of gene or probe expression values where rows correspond to genes and columns correspond to samples.

**Details**

This function computes row zscores per sample when the number of genes is less than 3.

**Value**

A gene-set by sample matrix of zscores.

**Examples**

```r
g <- 2  ## number of genes
s <- 60  ## number of samples
## sample data matrix with values ranging from 1 to 10
rnames <- paste("g", 1:g, sep="")
cnames <- paste("s", 1:s, sep="")
eexpr <- matrix(sample.int(10, size = g*s, replace = TRUE), nrow=g, ncol=s, dimnames=list(rnames, cnames))
## Estimates zscores
callZSCORE(eexpr)
```

---

**cptSamples**

**Sample profile identifier analysis**

**Description**

Generate sample profile identifiers from sample zscores using a change point model.

**Usage**

`cptSamples(x, cpt_data, cpt_method, cpt_max)`
**expression_data**

**Arguments**

- **x**
  A matrix or data frame of sample GSVA enrichment z-scores within which you wish to find a changepoint.

- **cpt_data**
  Identify changepoints for data using variance (cpt.var), mean (cpt.mean) or both (cpt.meanvar). Default is cpt.var.

- **cpt_method**
  Choice of single or multiple changepoint model. Default is "BinSeg".

- **cpt_max**
  The maximum number of changepoints to search for using "BinSeg" method. Default is 60.

**Details**

This function assigns samples identified in the first changepoint with the active profile ("1") while the remaining samples are grouped under inactive profile ("0").

**Value**

The input data frame with added sample identifiers and estimated changepoints. A plot showing the changepoint locations estimated on the data.

**See Also**

changepoint

**Examples**

```r
g <- 10  ## number of genes
s <- 60  ## number of samples
## sample data matrix with values ranging from 1 to 10
rnames <- paste("g", 1:g, sep="")
cnames <- paste("s", 1:s, sep="")
expr <- matrix(sample.int(10, size = g*s, replace = TRUE), nrow=g, ncol=s, dimnames=list(rnames, cnames))
## genes of interest
genes <- paste("g", 1:g, sep="")
## Estimates GSVA enrichment z-scores.
gsva_results <- callGSVA(expr,genes)
cptSamples(gsva_results,cpt_data="var",cpt_method="BinSeg",cpt_max=60)
```

---

**expression_data**

An example of RNAseq derived gene expression data

**Description**

This dataset contains the expression values of 8 probes (rows) in 125 samples (columns), as compiled by the CoMMpass study.

**Usage**

data(expression_data)

**Details**

This is data to be included in my package.
filterVars

**Value**

numeric expression dataset of 8 probes (rows) on 125 samples (column)

---

**Description**

Filter rows with zero values

**Usage**

`filterVars(x, y)`

**Arguments**

- `x`: A data frame or matrix where rows represent gene and columns represent samples
- `y`: A vector of a sample column values to apply the filtering on.

**Details**

This function filter out rows with zero data value for a given sample. Both input arguments (`x` and `y`) must be of the same length

**Value**

The returned value is a list containing an entry for each row filtered out by zero data value

**Examples**

```r
x = matrix(runif(3*10, 0, 1), ncol=3)
y <- x[,1]
filterVars(x,y)
```

---

freqplot

**Description**

Given a sample changepoint data frame, will plot number of samples with and without profile activity

**Usage**

`freqplot(x)`

**Arguments**

- `x`: A data frame containing samples as rows followed by zscores and estimated changepoints to be plotted.
Details

This function expects the output from cptSamples function of SISPA package, and shows the number of samples with (orange filled bars) and without profile activity (grey filled bars).

Value

Bar plot pdf illustrating distribution of samples

Examples

```r
samples <- c("s1","s2","s3","s4","s5","s6","s7","s8","s9","s10")
zscores <- c(3.83,2.70,2.67,2.31,1.70,1.25,-0.42,-1.01,-2.43,-3.37)
changepoints <- c(1,1,1,2,2,3,3,NA,NA,NA)
sample_groups <- c(1,1,1,0,0,0,0,0,0,0)
my.data = data.frame(samples,zscores,changepoints,sample_groups)
freqplot(my.data)
```

Description

SISPA: Method for Sample Integrated Gene Set Analysis

Usage

```r
SISPA(feature=1,f1.df,f1.profile,f2.df,f2.profile,cpt_data="var",cpt_method="BinSeg",cpt_max=60)
```

Arguments

- **feature**: Number of input feature or data types
- **f1.df**: A data matrix of first feature (e.g., gene or probe expression values) where rows correspond to genes and columns correspond to samples
- **f1.profile**: A flag to specify gene profile. If gene.profile="up" then samples with increased zscores are identified. If gene.profile="down" then samples with decreased zscores are identified. Default is "up".
- **f2.df**: A data matrix of second feature (e.g., gene variant change) where rows correspond to genes and columns correspond to samples
- **f2.profile**: A flag to specify gene profile. If gene.profile="up" then samples with increased zscores are identified. If gene.profile="down" then samples with decreased zscores are identified. Default is "up".
- **cpt_data**: Identify changepoints for data using variance (cpt.var), mean (cpt.mean), or both (cpt.meanvar). Default is cpt.var.
- **cpt_method**: Choice of single or multiple changepoint model. Default is "BinSeg". See changepoint R package for details
- **cpt_max**: The maximum number of changepoints to search for using "BinSeg" method. Default is 60.
Sample Integrated Gene Set Analysis (SISPA) is a method designed to define sample groups with similar gene set enrichment profiles. The user specifies a gene list of interest and sample by gene molecular data (expression, methylation, variant, or copy change data) to obtain gene set enrichment scores by each sample. The score statistics is rank ordered by the desired profile (e.g., upregulated or downregulated) for samples. A change point model is then applied to the sample scores to identify groups of samples that show similar gene set profile patterns. Samples are ranked by desired profile activity score and grouped by samples with and without profile activity. Figure 1 shows the schematic representation of the SISPA method overview.

**Value**

The input molecular data frame with added sample identifiers and estimated changepoints. A plot showing the changepoint locations estimated on the data. Bar plots pdf illustrating distinct distribution of samples with and without profile activity.

**Examples**

```r
g <- 10  # number of genes
s <- 60  # number of samples
rnames <- paste("g", 1:g, sep=")
cnames <- paste("s", 1:s, sep=")
expr <- matrix(sample.int(10, size = g*s, replace = TRUE), nrow=g, ncol=s, dimnames=list(rnames, cnames))
SISPA(feature=1,f1.df=expr,f1.profile="up")
```

---

**sortData**

*Sorts the data by a column*

**Description**

Sorts the data frame by a column index in the given order

**Usage**

`sortData(x, i, b)`

**Arguments**

- `x` A data frame
- `i` A numeric column index of the data frame to sort it by
- `b` User specified sorting order, ascending (FALSE) or descending (TRUE)

**Details**

defaults are used: `i = 1, b = FALSE`, if not specified

**Value**

sorted data by the input column index
Author(s)

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Examples

```r
samples <- c("s1", "s2", "s3", "s4", "s5", "s6", "s7", "s8", "s9", "s10")
zscores <- c(3.83, 2.70, 2.67, 2.31, 1.70, 1.25, -0.42, -1.01, -2.43, -3.37)
my.data = data.frame(samples, zscores)
sortData(my.data, 2, TRUE)
```

variant_data

An example of RNAseq derived gene variant change data

Description

This dataset contains the variant proportion values of variants (n=380) associated with 8 genes (rows) in 125 samples (columns), as compiled by the CoMMpass study.

Usage

data(variant_data)

Details

This is data to be included in my package

Value

numeric variant dataset of 380 variants (rows) on 125 samples (column)

waterfallplot

A plotting function for SISPA sample identifiers

Description

Given a sample changepoint data frame, will plot all samples zscores from that data.

Usage

`waterfallplot(x)`

Arguments

- `x` A data frame containing samples as rows followed by zscores and estimated sample_groups to be plotted.

Details

This function expects the output from cptSamples function of SISPA package, and highlights the sample profile of interest in the changepoint 1 with orange filled bars.
Value

Bar plot pdf illustrating distinct SISPA sample profiles.

Examples

```r
samples <- c("s1","s2","s3","s4","s5","s6","s7","s8","s9","s10")
zscores <- c(3.83,2.70,2.67,2.31,1.70,1.25,-0.42,-1.01,-2.43,-3.37)
changepoints <- c(1,1,1,2,2,3,3,NA,NA,NA)
sample_groups <- c(1,1,1,0,0,0,0,0,0,0)
my.data = data.frame(samples,zscores,changepoints,sample_groups)
waterfallplot(my.data)
```
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