

Package ‘gscreend’

May 1, 2024

Type Package

Title Analysis of pooled genetic screens

Version 1.19.0

Description Package for the analysis of pooled genetic screens (e.g. CRISPR-KO). The analysis of such screens is based on the comparison of gRNA abundances before and after a cell proliferation phase. The gscreend packages takes gRNA counts as input and allows detection of genes whose knockout decreases or increases cell proliferation.

License GPL-3

Encoding UTF-8

LazyData false

Depends R (>= 3.6)

Imports SummarizedExperiment, nloptr, fGarch, methods, BiocParallel, graphics

Suggests knitr, testthat, rmarkdown, BiocStyle

VignetteBuilder knitr

RoxygenNote 7.2.3

biocViews Software, StatisticalMethod, PooledScreens, CRISPR

URL <https://github.com/imkeller/gscreend>

BugReports <https://github.com/imkeller/gscreend/issues>

git_url <https://git.bioconductor.org/packages/gscreend>

git_branch devel

git_last_commit 1f146b3

git_last_commit_date 2024-04-30

Repository Bioconductor 3.20

Date/Publication 2024-05-01

Author Katharina Imkeller [cre, aut],
Wolfgang Huber [aut]

Maintainer Katharina Imkeller <k.imkeller@dkfz.de>

Contents

assignGeneData	2
calculateIntervalFits	3
calculateLFC	3
calculatePValues	4
createPoolScreenExp	4
createPoolScreenExpFromSE	5
defineFittingIntervals	6
fit_least_quantile	6
GeneData	7
GeneData,PoolScreenExp-method	7
normalizePoolScreenExp	8
plotModelParameters	8
plotReplicateCorrelation	9
PoolScreenExp-class	10
ResultsTable	10
RunGscreen	11
sgRNAData	12
sgRNAData,PoolScreenExp-method	13
Index	14

assignGeneData	<i>Calculate gene rank</i>
----------------	----------------------------

Description

Calculate gene rank

Usage

```
assignGeneData(object, alpha_cutoff)
```

Arguments

object	PoolScreenExp object
alpha_cutoff	alpha cutoff for alpha-RRA (default: 0.05)

Value

object

calculateIntervalFits *Calculate fit parameters for every subset of data*

Description

Calculate fit parameters for every subset of data

Usage

```
calculateIntervalFits(object, quant1, quant2)
```

Arguments

object	PoolScreenExp object
quant1	lower quantile for least squares regression (default: 0.1)
quant2	upper quantile for least squares regression (default: 0.9)

Value

object

calculateLFC *Calculate log fold changes*

Description

Calculate log fold changes

Usage

```
calculateLFC(object)
```

Arguments

object	PoolScreenExp object
--------	----------------------

Value

object

calculatePValues	<i>Calculate p-values</i>
------------------	---------------------------

Description

Calculate p-values

Usage

```
calculatePValues(object)
```

Arguments

object	PoolScreenExp object
--------	----------------------

Value

object

createPoolScreenExp	<i>Create PoolScreenExp Experiment</i>
---------------------	--

Description

Create PoolScreenExp Experiment

Usage

```
createPoolScreenExp(data)
```

Arguments

data	Input data object containing gRNA level data (SummarizedExperiment)
------	---

Value

object PoolScreenExp object

Examples

```
raw_counts <- read.table(  
  system.file('extdata', 'simulated_counts.txt',  
  package = 'gscreend'),  
  header=TRUE)  
  
counts_matrix <- cbind(raw_counts$library0, raw_counts$R0_0, raw_counts$R1_0)  
  
rowData <- data.frame(sgRNA_id = raw_counts$sgrna_id,  
  gene = raw_counts$Gene)  
  
colData <- data.frame(samplename = c('library', 'R1', 'R2'),  
  timepoint = c('T0', 'T1', 'T1'))  
  
library(SummarizedExperiment)  
se <- SummarizedExperiment(assays=list(counts=counts_matrix),  
  rowData=rowData, colData=colData)  
  
# create a PoolScreenExp experiment  
pse <- createPoolScreenExp(se)
```

```
createPoolScreenExpFromSE
```

Create PoolScreenExp Experiment from summarized experiment

Description

Create PoolScreenExp Experiment from summarized experiment

Usage

```
createPoolScreenExpFromSE(data)
```

Arguments

data SummarizedExperiment object containing gRNA level data

Value

object

`defineFittingIntervals`*Calculate interval limits for splitting data into subsets*

Description

Calculate interval limits for splitting data into subsets

Usage

```
defineFittingIntervals(object)
```

Arguments

object PoolScreenExp object

Value

object

`fit_least_quantile`*Fit paramters for skew normal distribution*

Description

Fit paramters for skew normal distribution

Usage

```
fit_least_quantile(LFC, quant1, quant2)
```

Arguments

LFC logarithmic fold changes of gRNA counts
quant1 lower quantile for least quantile of squares regression (default: 0.1)
quant2 upper quantile for least quantile of squares regression (default: 0.9)

Value

fit_skewnorm

GeneData

GeneData: set and retrieve GeneData of PoolScreenExp

Description

GeneData: set and retrieve GeneData of PoolScreenExp

Usage

```
GeneData(x)
```

Arguments

x PoolScreenExp object

Value

Gene slot of the object

Examples

```
# import a PoolScreenExp object that has been generated using
# RunGscreen()
pse_an <- readRDS(
  system.file('extdata', 'gscreen_analysed_experiment.RData',
    package = 'gscreen'))

GeneData(pse_an)
```

GeneData, PoolScreenExp-method

Accessor function for the Gene slot of the PoolScreenExp class

Description

Accessor function for the Gene slot of the PoolScreenExp class

Usage

```
## S4 method for signature 'PoolScreenExp'
GeneData(x)
```

Arguments

x PoolScreenExp object

Value

Gene slot of the object

Examples

```
# import a PoolScreenExp object that has been generated using
# RunGscreen()
pse_an <- readRDS(
  system.file('extdata', 'gscreen_analysed_experiment.RData',
    package = 'gscreen'))
```

```
GeneData(pse_an)
```

normalizePoolScreenExp

Normalize raw count

Description

Normalize raw count

Usage

```
normalizePoolScreenExp(object)
```

Arguments

object PoolScreenExp object

Value

object

plotModelParameters

Plot model parameters from the fitting

Description

Plot model parameters from the fitting

Usage

```
plotModelParameters(object)
```


Arguments

object PoolScreenExp object

Value

plot

Examples

```
# import a PoolScreenExp object that has been generated using
# RunGscreen()
pse_an <- readRDS(
  system.file('extdata', 'gscreen_analysed_experiment.RData',
  package = 'gscreen'))
plotModelParameters(pse_an)
```

plotReplicateCorrelation

Plot replicate correlation

Description

Plot replicate correlation

Usage

```
plotReplicateCorrelation(object, rep1 = "R1", rep2 = "R2")
```

Arguments

object PoolScreenExp object
rep1 Name of replicate 1
rep2 Name of replicate 2

Value

replicate_plot

Examples

```
# import a PoolScreenExp object that has been generated using RunGscreen()
pse_an <- readRDS(
  system.file('extdata', 'gscreen_analysed_experiment.RData',
  package = 'gscreen'))
plotReplicateCorrelation(pse_an, rep1 = 'R1', rep2 = 'R2')
```

PoolScreenExp-class	<i>Class to store pooled CRISPR screening experiment</i>
---------------------	--

Description

The poolScreenExp class is an S4 class used to store sgRNA and gene related data as well as parameters necessary for statistical model.

Slots

sgRNAData A SummarizedExperiment containing the data related to sgRNAs.

FittingIntervals A vector defining the limits of the intervals used for fitting of null model.

LFCModelParameters A vector of parameters estimated when fitting the null model.

GeneData SummarizedExperiment containing the data related to genes.

FittingOptions A named list with options for fitting: IntervalFraction - fraction of sgRNAs used in every fitting interval (default 0.1), alphaCutoff - alpha cutoff for alpha RRA algorithm (default: 0.05).

ResultsTable	<i>Extract a results table</i>
--------------	--------------------------------

Description

Extract a results table

Usage

```
ResultsTable(object, direction = "negative")
```

Arguments

object	PoolScreenExp object
direction	Whether the table should contain information on positive or negative fold changes ['negative' 'positive']

Value

plot

Examples

```
# import a PoolScreenExp object that has been generated using
# RunGscreen()
pse_an <- readRDS(
  system.file('extdata', 'gscreen_analysed_experiment.RData',
    package = 'gscreen'))
ResultsTable(pse_an, direction = 'negative')
```

RunGscreen	<i>run gscreen</i>
------------	--------------------

Description

run gscreen

Usage

```
RunGscreen(object, quant1 = 0.1, quant2 = 0.9, alphacutoff = 0.05)
```

Arguments

object	PoolScreenExp object
quant1	lower quantile for least quantile of squares regression (default: 0.1)
quant2	upper quantile for least quantile of squares regression (default: 0.9)
alphacutoff	alpha cutoff for alpha-RRA (default: 0.05)

Value

object

Examples

```
raw_counts <- read.table(
  system.file('extdata', 'simulated_counts.txt',
    package = 'gscreen'),
  header=TRUE)

# Create the PoolScreenExp to be analyzed
counts_matrix <- cbind(raw_counts$library0, raw_counts$R0_0, raw_counts$R1_0)

rowData <- data.frame(sgRNA_id = raw_counts$sgrna_id,
  gene = raw_counts$Gene)

colData <- data.frame(samplename = c('library', 'R1', 'R2'),
  timepoint = c('T0', 'T1', 'T1'))

library(SummarizedExperiment)
```

```
se <- SummarizedExperiment(assays=list(counts=counts_matrix),
rowData=rowData, colData=colData)

pse <- createPoolScreenExp(se)

# Run Analysis
pse_an <- RunGscreen(pse)
```

sgRNAData

sgRNAData: set and retrieve sgRNAData of PoolScreenExp

Description

sgRNAData: set and retrieve sgRNAData of PoolScreenExp

Usage

```
sgRNAData(x)
```

Arguments

x PoolScreenExp object

Value

sgRNA slot of the object

Examples

```
# import a PoolScreenExp object that has been generated using
# RunGscreen()
pse_an <- readRDS(
system.file('extdata', 'gscreen_analysed_experiment.RData',
package = 'gscreen'))

sgRNAData(pse_an)
```

`sgRNAData,PoolScreenExp-method`*Accessor function for the sgRNA slot of the PoolScreenExp class*

Description

Accessor function for the sgRNA slot of the PoolScreenExp class

Usage

```
## S4 method for signature 'PoolScreenExp'  
sgRNAData(x)
```

Arguments

x PoolScreenExp object

Value

sgRNA slot of the object

Examples

```
# import a PoolScreenExp object that has been generated using  
# RunGscreenend()  
pse_an <- readRDS(  
system.file('extdata', 'gscreenend_analysed_experiment.RData',  
package = 'gscreenend'))  
  
sgRNAData(pse_an)
```

Index

* **internal**

- assignGeneData, [2](#)
- calculateIntervalFits, [3](#)
- calculateLFC, [3](#)
- calculatePValues, [4](#)
- createPoolScreenExpFromSE, [5](#)
- defineFittingIntervals, [6](#)
- fit_least_quantile, [6](#)
- normalizePoolScreenExp, [8](#)

assignGeneData, [2](#)

calculateIntervalFits, [3](#)
calculateLFC, [3](#)
calculatePValues, [4](#)
createPoolScreenExp, [4](#)
createPoolScreenExpFromSE, [5](#)

defineFittingIntervals, [6](#)

fit_least_quantile, [6](#)

GeneData, [7](#)
GeneData, PoolScreenExp-method, [7](#)

normalizePoolScreenExp, [8](#)

plotModelParameters, [8](#)
plotReplicateCorrelation, [9](#)
PoolScreenExp-class, [10](#)

ResultsTable, [10](#)
RunGscreend, [11](#)

sgRNAData, [12](#)
sgRNAData, PoolScreenExp-method, [13](#)