Package: GSABenchmark (via r-universe)

November 4, 2026

Type Package

Title Tools for benchmarking single-cell gene set analysis methods

Version 1.1.2

Description GSABenchmark is a package designed for benchmarking scRNA-seq gene set analysis (scGSA) methods. It provides both traditional and novel benchmark metrics, as well as visualization tools. Currently, GSABenchmark supports 17 scGSA methods (AddModuleScore, AUCell, CSOA, GSVA, JASMINE, MDT, MLM, ORA, Pagoda2, PLAGE, Singscore, SiPSiC, ssGSEA, UCell, UDT, VAM, and Zscore).

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Imports abdiv, CSOA, decoupleR, dplyr, escape, fabR, ggplot2, ggrepel, GSVA, hammers, henna, jaccard, lsa, Matrix, MLmetrics, methods, mltools, pagoda2, paletteer, reshape2, rlang, scLang, singscore, SiPSiC, stringr, stats, VAM, withr

Encoding UTF-8

RoxygenNote 7.3.3

Suggests AUCell, BiocStyle, knitr, qs2, ranger, rmarkdown, rpart, scater, scRNAseq, scuttle, Seurat, testthat (>= 3.0.0), UCell

biocViews Software, SingleCell, GeneSetEnrichment, GeneExpression, Visualization

VignetteBuilder knitr

URL https://github.com/andrei-stoica26/GSABenchmark

BugReports https://github.com/andrei-stoica26/GSABenchmark/issues

Config/testthat/edition 3

Config/pak/sysreqs cmake libfontconfig1-dev libfreetype6-dev git libglpk-dev make libmagick++-dev gsfonts libgit2-dev libicu-dev libpng-dev libuv1-dev libxml2-dev libssl-dev python3 libx11-dev zlib1g-dev

Repository https://bioc.r-universe.dev

Date/Publication 2026-07-26 04:32:06 UTC

RemoteUrl https://github.com/bioc/GSABenchmark

RemoteRef HEAD

RemoteSha 2e7d1881054aa925a96a28c0a95be62f864385e7

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aggregateRankPlot *Create an aggregate rank plot from a summary object*

Description

This function creates an aggregate rank plot from a summary object.

Usage

```
aggregateRankPlot(
  smr,
  title = NULL,
  xLab = "Method",
  sigDigits = 2,
  rankMethod = c("min", "average", "first", "last", "random", "max"),
  ...
)
```

Arguments

smr	Complete summary list generated with `allBenchmarkResults` or `runBenchmark`.
title	Plot title.
xLab	x axis label.
sigDigits	Number of significant digits used when displaying mean ranks. If `NULL`, the mean ranks will not be displayed.
rankMethod	Rank method. Choose between 'min', 'average', 'first', 'last', 'random' and 'max'. Default in 'min'.
...	Additional parameters passed to other functions.

Value

A ggplot object.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
p <- aggregateRankPlot(smr)
```

`allBenchmarkPlots` *Plot the complete list of benchmark summaries*

Description

This function plots the complete list of benchmark summaries.

Usage

```
allBenchmarkPlots(smr, titleSuffix = NULL, ...)
```

Arguments

`smr`	Complete summary list generated with `allBenchmarkResults` or `runBenchmark`.
`titleSuffix`	Suffix used to create plot titles If `NULL`, the plots will have no titles.
`...`	Additional parameters passed to other functions.

Value

A list of ggplot objects.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- allBenchmarkPlots(smr)
```

`allBenchmarkResults` *Generate all benchmark results with some precomputed arguments. This function generates all benchmark results by using precomputed values for* `normSilDF`, `dimMat` *and* `maxDist`.

Description

Generate all benchmark results with some precomputed arguments. This function generates all benchmark results by using precomputed values for `normSilDF`, `dimMat` and `maxDist`.

Usage

```
allBenchmarkResults(
  scObj,
  labelCol,
  geneSets,
  gsaMethods,
  checkLabels = TRUE,
  normSilDF = NULL,
  dimMat = NULL,
  maxDist = NULL,
  efBenchmark = NULL,
  runEFBenchmark = TRUE,
  verbose = TRUE
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
labelCol	The metadata column containing the ground truth annotation.
geneSets	A list of gene sets. If not NULL while efBenchmark is NULL, the efficiency benchmark will be run.
gsaMethods	Character vector of gene set analysis methods.
checkLabels	Whether to check that geneSetNames is a subset of the values in labelCol.
normSilDF	Data frame of normalized silhouettes.
dimMat	UMAP dimensionality reduction matrix of the single-cell expression object. Unused if normSilDF is NULL.
maxDist	Maximum UMAP distance in the single-cell expression object. Unused if normSilDF or dimMat is NULL.
efBenchmark	A list of data frames generated with efficiencyBenchmark.
runEFBenchmark	Whether to run efficiency benchmark.
verbose	Whether the output of the efficiency benchmark should be verbose. Ignored if runEFBenchmark is FALSE.

Details

This function is designed to save some computational time when multiple runs are sequentially performed for the same single-cell expression object and cell identity classes, but different choices of gene sets (so long as they still describe the same classes) or methods. If a single run is planned rather than multiple ones, runBenchmark is a more straightforward choice, as it takes care of generating normSilDF and dimMat.

Value

A list of benchmark results.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- hammers::computeSilhouette(scObj, 'label')
normSilDF <- hammers::normalizeSilhouette(scObj, 'label')
dimMat <- scLang::scPCAMat(scObj)
maxDist <- max(dist(dimMat))
smr <- allBenchmarkResults(scObj, 'label', geneSets, c('CSOA', 'Zscore'),
TRUE, normSilDF, dimMat, maxDist, runEFBenchmark=FALSE)
```

---

benchmarkPlots *Plot a list of summary data frames*

Description

This function plots a list of summary data frames with methods as rows, gene sets and the average of scores across all gene sets as columns.

Usage

```
benchmarkPlots(smr, titleSuffix = NULL, lastPlotLegendLab = "Metric", ...)
```

Arguments

`smr`	List of summary data frames, whether boundary, MCC or global.
`titleSuffix`	Suffix used to create plot titles If `NULL`, the plots will have no titles.
`lastPlotLegendLab`	The legend label of the last plot.
`...`	Additional arguments passed to `scorePlot`.

Value

A list of ggplot objects.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- benchmarkPlots(smr[[1]])
```

corrPlots *Create correlation plots for method results*

Description

This function creates correlation plots for method results.

Usage

```
corrPlots(
  scObj,
  smr,
  titlePrefix = "Correlation plot",
  titleInfixes = NULL,
  titleSuffix = NULL,
  ...
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
smr	Complete summary list generated with allBenchmarkResults or runBenchmark.
titlePrefix	Prefix used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleInfixes	A character vector of title infixes used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleSuffix	Suffix used to create plot titles If NULL, the plots will have no titles.
...	Additional arguments passed to henna::correlationPlot.

Value

A named list of ggplot objects.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- corrPlots(scObj, smr)
```

corrSummary *Calculate correlation matrix for method results*

Description

This function calculates the correlation matrix for all the methods for an identity class.

Usage

```
corrSummary(scObj, smr, corMethod = "spearman")
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
smr	List containing boundary, MCC and global lists of data frames.
corMethod	Correlation method.

Value

A list of correlation matrices.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
m <- corrSummary(scObj, smr)
```

efficiencyBenchmark *Extract running times and peak memory usage for gene set analysis methods*

Description

This function extracts running times and peak memory usage for gene set analysis methods.

Usage

```
efficiencyBenchmark(
  scObj,
  labelCol,
  geneSets,
  gsaMethods,
  checkLabels = TRUE,
  verbose = TRUE
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
labelCol	The metadata column containing the ground truth annotation.
geneSets	A list of gene sets. If not NULL while efBenchmark is NULL, the efficiency benchmark will be run.
gsaMethods	Character vector of gene set analysis methods.
checkLabels	Whether to check that geneSetNames is a subset of the values in labelCol.
verbose	Whether output should be verbose.

Value

A list of two data frames, the first comprising running times in seconds, the second comprising peak memory usage in mebibytes.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
ef <- efficiencyBenchmark(scObj, 'label', geneSets[1], 'CSOA',
verbose=FALSE)
```

---

geneSetRankPlots *Create gene set rank plots for the method results*

Description

This function creates gene set rank plots for method results.

Usage

```
geneSetRankPlots(
  smr,
  rankMethod = "min",
  titlePrefix = "Distribution of ranks",
  titleInfixes = NULL,
  titleSuffix = NULL,
  xLab = "Method",
  ...
)
```

Arguments

smr	Complete summary list generated with allBenchmarkResults or runBenchmark.
rankMethod	Rank method. Choose between 'min', 'average', 'first', 'last', 'random' and 'max'. Default in 'min'.
titlePrefix	Prefix used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleInfixes	A character vector of title infixes used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleSuffix	Suffix used to create plot titles If NULL, the plots will have no titles.
xLab	x axis label.
...	Additional arguments passed to henna::rankPlot.

Value

A named list of ggplot objects.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- geneSetRankPlots(smr)
```

---

mdsPlots *Create MDS plots for method results*

Description

This function creates MDS plots for method results.

Usage

```
mdsPlots(
  scObj,
  smr,
  titlePrefix = "MDS plot",
  titleInfixes = NULL,
  titleSuffix = NULL,
  drawScores = TRUE,
  ...
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
smr	Complete summary list generated with allBenchmarkResults or runBenchmark.
titlePrefix	Prefix used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleInfixes	A character vector of title infixes used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleSuffix	Suffix used to create plot titles If NULL, the plots will have no titles.
drawScores	Whether to render scores on the plot. If set to TRUE, the third column of the input data frame will be numeric and scores will be taken from there.
...	Additional arguments passed to henna::densityPlot.

Value

A named list of ggplot objects.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- mdsPlots(scObj, smr)
```

---

memoryPlot *Plot a data frame consisting of gene set analysis method peak memory usage This function plots data frame consisting of method peak memory usages with methods as rows, gene sets and the gene set average as columns.*

Description

Plot a data frame consisting of gene set analysis method peak memory usage This function plots data frame consisting of method peak memory usages with methods as rows, gene sets and the gene set average as columns.

Usage

```
memoryPlot(
  efBenchmark,
  title = NULL,
  xLab = "Peak memory usage (MiB)",
  pointShape = 17,
  ...
)
```

Arguments

efBenchmark	A list of dataframes generated with efficiencyBenchmark.
title	Plot title.
xLab	x axis label.
pointShape	Point shape.
...	Additional parameters to be passed to scorePlot.

Value

A ggplot object.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
memoryPlot(smr[[5]])
```

---

metricRankPlots *Create metric rank plots for the method results*

Description

This function creates metric rank plots for method results.

Usage

```
metricRankPlots(
  smr,
  titlePrefix = "Distribution of ranks",
  titleInfixes = metricNames(),
  titleSuffix = NULL,
  rankMethod = "min",
  xLab = "Method",
  ...
)
```

Arguments

smr	Complete summary list generated with allBenchmarkResults or runBenchmark.
titlePrefix	Prefix used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleInfixes	A character vector of title infixes used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleSuffix	Suffix used to create plot titles If NULL, the plots will have no titles.

rankMethod	Rank method. Choose between 'min', 'average', 'first', 'last', 'random' and 'max'. Default in 'min'.
xLab	x axis label.
...	Additional arguments passed to henna::rankPlot.

Value

A named list of ggplot objects.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- metricRankPlots(smr)
```

---

predJaccardPlots *Create Jaccard tile plots for method binary predictions*

Description

This function creates Jaccard tile plots for method binary predictions.

Usage

```
predJaccardPlots(
  predictionsSmr,
  titlePrefix = "Binary prediction Jaccard plot",
  titleInfixes = NULL,
  titleSuffix = NULL,
  ...
)
```

Arguments

predictionsSmr	Binary predictions summary.
titlePrefix	Prefix used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleInfixes	A character vector of title infixes used to create a title with subplotTitle. Ignored if titleSuffix is NULL.
titleSuffix	Suffix used to create plot titles If NULL, the plots will have no titles.
...	Additional arguments passed to henna::tilePlot.

Value

A named list of ggplot objects.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
plots <- predJaccardPlots(smr$predictions)
```

`ratioPlot` *Create a ratio rank plot for the method results*

Description

This function creates a ratio rank plot for the method results.

Usage

```
ratioPlot(
  smr,
  title = NULL,
  nItems = 25,
  xLab = "Maximum over mean ratio",
  yLab = "Metric",
  legendLab = "Method",
  ...
)
```

Arguments

`smr`	Complete summary list generated with `allBenchmarkResults` or `runBenchmark`.
`title`	Plot title.
`nItems`	Number of retained iterms.
`xLab`	x axis label.
`yLab`	y axis label.
`legendLab`	Legend label.
`...`	Additional arguments passed to `henna::classRank`.

Value

A ggplot object.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
p <- ratioPlot(smr)
```

runAddModuleScore *Run AddModuleScore*

Description

This function runs AddModuleScore.

Usage

```
runAddModuleScore(
  scObj,
  geneSets,
  slot = "data",
  pool = rownames(scObj),
  nbin = 24,
  ctrl = 100,
  seed = 1
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
pool	The set from which features to be compared with signature genes are selected. Defaults to all features.
nbin	Number of bins of aggregate expression levels for pool features.
ctrl	Number of control features chosen from the same bin for each feature.
seed	Random seed.

Details

Reimplemented from https://github.com/satijalab.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runAddModuleScore(scObj, geneSets)
```

runAUCell *Run AUCell*

Description

This function runs AUCell using escape.

Usage

```
runAUCell(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runEscapeMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
if (requireNamespace("AUCell", quietly=TRUE)){
    scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
    scObj <- qs2::qs_read(scoPath)
    gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
    geneSets <- qs2::qs_read(gsPath)
    scObj <- runAUCell(scObj, geneSets)
    }
```

runBenchmark *Generate all benchmark results This function performs the entire* GSABenchmark *pipeline.*

Description

Generate all benchmark results This function performs the entire GSABenchmark pipeline.

Usage

```
runBenchmark(
  scObj,
  labelCol,
  geneSets,
  gsaMethods,
  runEFBenchmark = TRUE,
  verbose = TRUE
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
labelCol	The metadata column containing the ground truth annotation.
geneSets	A list of gene sets. If not NULL while efBenchmark is NULL, the efficiency benchmark will be run.
gsaMethods	Character vector of gene set analysis methods.
runEFBenchmark	Whether to run efficiency benchmark.
verbose	Whether the output of the efficiency benchmark should be verbose. Ignored if runEFBenchmark is FALSE.

Details

A wrapper around allBenchmarkResults. Slower for repeated runs, but it does not require users to manually generate normSilDF and dimMat.

Value

A list of benchmark results.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
smr <- runBenchmark(scObj, 'label', geneSets, c('CSOA', 'Zscore'), FALSE)
```

---

runBenchmarkShuffle *Generate all benchmark results for shuffled gene sets This function generates all benchmark results for shuffled gene sets.*

Description

Generate all benchmark results for shuffled gene sets This function generates all benchmark results for shuffled gene sets.

Usage

```
runBenchmarkShuffle(
  scObj,
  labelCol,
  geneSets,
  gsaMethod,
  runEFBenchmark = TRUE
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
labelCol	The metadata column containing the ground truth annotation.
geneSets	A list of gene sets. If not NULL while efBenchmark is NULL, the efficiency benchmark will be run.
gsaMethod	Name of the gene set analysis method.
runEFBenchmark	Whether to run efficiency benchmark.

Value

A list of benchmark results.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runMethodShuffle(scObj, 'label', geneSets, 'CSOA', 0.2, 0.2)
smr <- runBenchmarkShuffle(scObj, 'label', geneSets, 'CSOA', FALSE)
```

---

runGSAMethods *Run gene set analysis methods*

Description

This function runs the gene set analysis methods.

Usage

```
runGSAMethods(
  scObj,
  labelCol,
  geneSets,
  gsaMethods,
```

```
  infix = NULL,
  outputFun = silently_run
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
labelCol	The metadata column containing the ground truth annotation.
geneSets	A named list of gene sets.
gsaMethods	Character vector of gene set analysis methods.
infix	Infix to add between method name and gene set name in single-cell expression object. The string consisting of the method name and the infix is separated by the gene set name with a '_' character.
outputFun	Choose between silently_run (suppress all warnings and messages) or identity (do not suppress them). Default is silently_run.

Value

A Seurat or SingleCellExpression object with the results of the runs stored as metadata columns.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runGSAMethods(scObj, 'label', geneSets, c('CSOA', 'Zscore'))
```

---

runGSVA *Run GSVA*

Description

This function runs GSVA using GSVA.

Usage

```
runGSVA(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runGSVAMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runGSVA(scObj, geneSets)
```

---

runJASMINE *Run JASMINE*

Description

This function runs JASMINE.

Usage

```
runJASMINE(
  scObj,
  geneSets,
  slot = "data",
  method = c("oddsratio", "likelihood")
)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
method	One of 'oddsratio' and 'likelihood'.

Details

Reimplemented from https://github.com/NNoureen/JASMINE. The method's paper can be found at https://doi.org/10.7554/eLife.71994.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runJASMINE(scObj, geneSets)
```

`runMDT` *Run MDT using decoupleR*

Description

This function runs `MDT` using `decoupleR`.

Usage

```
runMDT(scObj, geneSets, slot = "data", ...)
```

Arguments

`scObj`	A `Seurat` or `SingleCellExperiment` object.
`geneSets`	A named list of gene sets.
`slot`	Gene expression slot.
`...`	Additional parameters passed to `runDecoupleRMethod`.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
if (requireNamespace("ranger", quietly=TRUE)){
    scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
    scObj <- qs2::qs_read(scoPath)
    gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
    geneSets <- qs2::qs_read(gsPath)
    scObj <- runMDT(scObj, geneSets)
}
```

`runMethodShuffle` *Run gene set analysis method on shuffled gene sets*

Description

This function runs a gene set analysis method on shuffled gene sets.

Usage

```
runMethodShuffle(
  scObj,
  labelCol,
  geneSets,
  gsaMethod,
  loss = c(0, 0.2),
  noise = c(0, 0.2),
  doGrid = TRUE,
  averageReplicates = TRUE,
  seeds = c(1, 2, 3),
  outputFun = identity
)
```

Arguments

`scObj`	A `Seurat` or `SingleCellExperiment` object.
`labelCol`	The metadata column containing the ground truth annotation.
`geneSets`	A named list of gene sets.
`gsaMethod`	Name of the gene set analysis method.
`loss`	A numeric vector of gene loss values. Must be in [0, 1).
`noise`	A numeric vector of noise values. Must be in [0, 1).
`doGrid`	Whether to run the methods for each loss-noise combination.
`averageReplicates`	Whether to average replicates. If `TRUE`, a single set of scores will be returned for each loss-noise combination for which the method is run. If `FALSE`, distinct sets of scores will be returned for each replicate.
`seeds`	A numeric vector of random seeds passed to `hammers::shuffleGenes`. Its length determines the number of replicates.
`outputFun`	Choose between silently_run (suppress all warnings and messages) or identity (do not suppress them). Default is silently_run.

Value

A `Seurat` or `SingleCellExpression` object with the results of the runs stored as metadata columns.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runMethodShuffle(scObj, 'label', geneSets, 'CSOA', 0.2, 0.2)
```

---

runMLM *Run MLM using decoupleR*

Description

This function runs MLM using decoupleR.

Usage

```
runMLM(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runDecoupleRMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runMLM(scObj, geneSets)
```

runORA *Run ORA using decoupleR*

Description

This function runs ORA using decoupleR.

Usage

```
runORA(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runDecoupleRMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runORA(scObj, geneSets)
```

runPagoda2 *Run pagoda2*

Description

This function runs pagoda2.

Usage

```
runPagoda2(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional arguments passed to pagoda2::score.cells.puram.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runPagoda2(scObj, geneSets)
```

---

runPLAGE *Run PLAGE*

Description

This function runs PLAGE using GSVA.

Usage

```
runPLAGE(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runGSVAMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runPLAGE(scObj, geneSets)
```

runSingscore *Run Singscore*

Description

This function runs Singscore.

Usage

```
runSingscore(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional arguments passed to singscore::simpleScore.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runSingscore(scObj, geneSets)
```

runSiPSiC *Run SiPSiC*

Description

This function runs SiPSiC.

Usage

```
runSiPSiC(scObj, geneSets, slot = "counts", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional arguments passed to SiPSiC::getPathwayScores.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runSiPSiC(scObj, geneSets)
```

---

runssGSEA *Run ssGSEA*

Description

This function runs ssGSEA using escape.

Usage

```
runssGSEA(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runEscapeMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runssGSEA(scObj, geneSets)
```

runUCell *Run UCell*

Description

This function runs UCell using escape.

Usage

```
runUCell(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runEscapeMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
if (requireNamespace("UCell", quietly=TRUE)){
    scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
    scObj <- qs2::qs_read(scoPath)
    gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
    geneSets <- qs2::qs_read(gsPath)
    scObj <- runUCell(scObj, geneSets)
    }
```

runUDT *Run UDT using decoupleR*

Description

This function runs UDT using decoupleR.

Usage

```
runUDT(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional parameters passed to runDecoupleRMethod.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
if (requireNamespace("rpart", quietly=TRUE)){
    scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
    scObj <- qs2::qs_read(scoPath)
    gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
    geneSets <- qs2::qs_read(gsPath)
    scObj <- runUDT(scObj, geneSets)
    }
```

---

runVAM *Run VAM*

Description

This function runs VAM.

Usage

```
runVAM(scObj, geneSets, slot = "data", ...)
```

Arguments

scObj	A Seurat or SingleCellExperiment object.
geneSets	A named list of gene sets.
slot	Gene expression slot.
...	Additional arguments passed to VAM::vam.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runVAM(scObj, geneSets)
```

`runZscore` *Run Zscore*

Description

This function runs `Zscore` using `GSVA`.

Usage

```
runZscore(scObj, geneSets, slot = "data", ...)
```

Arguments

`scObj`	A `Seurat` or `SingleCellExperiment` object.
`geneSets`	A named list of gene sets.
`slot`	Gene expression slot.
`...`	Additional parameters passed to `runGSVAMethod`.

Value

A single-cell expression object with the results saved as a metadata column.

Examples

```
scoPath <- system.file('extdata', 'scObj.qs2', package='GSABenchmark')
scObj <- qs2::qs_read(scoPath)
gsPath <- system.file('extdata', 'geneSets.qs2', package='GSABenchmark')
geneSets <- qs2::qs_read(gsPath)
scObj <- runZscore(scObj, geneSets)
```

scorePlot *Plot a data frame consisting of gene set analysis method scores This function plots a data frame consisting of method scores with methods as rows, gene sets and the gene set average as columns.*

Description

Plot a data frame consisting of gene set analysis method scores This function plots a data frame consisting of method scores with methods as rows, gene sets and the gene set average as columns.

Usage

```
scorePlot(
  scoreDF,
  title = NULL,
  xLab = "Score",
  yLab = "Method",
  isDecreasing = FALSE,
  palette = "grDevices::Dark 3",
  legendLab = "Gene set",
  pointSize = 1.5,
  pointShape = 19
)
```

Arguments

scoreDF	A summary data frame.
title	Plot title.
xLab	x axis label.
yLab	y axis label.
isDecreasing	Logical; whether the methods should be displayed on the plot in decreasing order of the obtained average scores. If FALSE (as default), the methods will be displayed in increasing order of the average scores.
palette	Color palette.
legendLab	Legend label.
pointSize	Point size.
pointShape	Point shape.

Value

A ggplot object.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
scorePlot(smr[[1]][[1]])
```

`supportedMethods` *Show supported methods*

Description

This function shows the methods currently supported by GSABenchmark.

Usage

```
supportedMethods()
```

Value

A character vector of supported methods.

Examples

```
supportedMethods()
```

`timePlot` *Plot a data frame consisting of gene set analysis method running times This function plots data frame consisting of method running times with methods as rows, gene sets and the gene set average as columns.*

Description

Plot a data frame consisting of gene set analysis method running times This function plots data frame consisting of method running times with methods as rows, gene sets and the gene set average as columns.

Usage

```
timePlot(
  efBenchmark,
  title = NULL,
  xLab = "Running time (s)",
  pointShape = 17,
  ...
)
```

Arguments

efBenchmark	A list of dataframes generated with efficiencyBenchmark.
title	Plot title.
xLab	x axis label.
pointShape	Point shape.
...	Additional parameters to be passed to scorePlot.

Value

A ggplot object.

Examples

```
sPath <- system.file('extdata', 'smr.qs2', package='GSABenchmark')
smr <- qs2::qs_read(sPath)
timePlot(smr[[5]])
```

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