Package ‘gsean’

February 29, 2024

Type Package

Title Gene Set Enrichment Analysis with Networks

Description Biological molecules in a living organism seldom work individually. They usually interact each other in a cooperative way. Biological process is too complicated to understand without considering such interactions. Thus, network-based procedures can be seen as powerful methods for studying complex process. However, many methods are devised for analyzing individual genes. It is said that techniques based on biological networks such as gene co-expression are more precise ways to represent information than those using lists of genes only. This package is aimed to integrate the gene expression and biological network. A biological network is constructed from gene expression data and it is used for Gene Set Enrichment Analysis.

Version 1.22.0

Date 2023-05-24

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Depends R (>= 3.5), fgsea, PPInfer

Suggests SummarizedExperiment, pasilla, org.Dm.eg.db, AnnotationDbi, knitr, plotly, WGCNA, rmarkdown

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biocViews Software, StatisticalMethod, Network, GraphAndNetwork, GeneSetEnrichment, GeneExpression, NetworkEnrichment, Pathways, DifferentialExpression

NeedsCompilation no

VignetteBuilder knitr

git_url https://git.bioconductor.org/packages/gsean

git_branch RELEASE_3_18

git_last_commit c195ced

git_last_commit_date 2023-10-24

Repository Bioconductor 3.18

Date/Publication 2024-02-29
**Description**

Biological molecules in a living organism seldom work individually. They usually interact each other in a cooperative way. Biological process is too complicated to understand without considering such interactions. Thus, network-based procedures can be seen as powerful methods for studying complex process. However, many methods are devised for analyzing individual genes. It is said that techniques based on biological networks such as gene co-expression are more precise ways to represent information than those using lists of genes only. This package is aimed to integrate the gene expression and biological network. A biological network is constructed from gene expression data and it is used for Gene Set Enrichment Analysis.

**Details**

The DESCRIPTION file: This package was not yet installed at build time.

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**centrality_gsea**

*Gene Set Enrichment Analysis with centrality measure*

**Description**

GSEA is performed with centrality measure

**Usage**

```r
centrality_gsea(geneset, x, adjacency, pseudo = 1, nperm = 1000,
centrality = function(x) rowSums(abs(x)),
weightParam = 1, minSize = 1, maxSize = Inf,
gseaParam = 1, nproc = 0, BPPARAM = NULL)
```

**Arguments**

- `geneset` list of gene sets
- `x` Named vector of gene-level statistics. Names should be the same as in gene sets.
- `adjacency` adjacency matrix
- `pseudo` pseudo number for log2 transformation (default: 1)
- `nperm` number of permutations (default: 1000)
- `centrality` centrality measure, degree centrality or node strength is default
- `weightParam` weight parameter value for the centrality measure, equally weight if weightParam = 0 (default: 1)
- `minSize` minimal size of a gene set (default: 1)
- `maxSize` maximal size of a gene set (default: Inf)
- `gseaParam` GSEA parameter value (default: 1)
- `nproc` see fgsea::fgsea
- `BPPARAM` see fgsea::fgsea

**Value**

GSEA result

**Author(s)**

Dongmin Jung

**See Also**

fgsea::fgsea
exprs2adj

Convert gene expression data to adjacency matrix by using correlation coefficients

Description
A biological network is constructed from gene expression data and it is used for Gene Set Enrichment Analysis.

Usage
exprs2adj(x, pseudo = 1, ...)

Arguments
x  gene expression data
pseudo  pseudo number for log2 transformation (default: 1)
...  additional parameters for correlation; see WGCNA::cor

Value
adjacency matrix

Author(s)
Dongmin Jung

See Also
fgsea::fgsea, WGCNA::cor

Examples
data(exampleRanks)
Names <- names(exampleRanks)
exprs <- matrix(rnorm(10*length(exampleRanks)), ncol = 10)
adjacency <- exprs2adj(exprs)
**GO_dme**  
*Gene Ontology terms with gene ID for Drosophila melanogaster*

**Description**  
The data set contains all Gene Ontology terms for Drosophila melanogaster and genes are identified by gene ID. There are 2823 categories.

**Usage**  
```
GO_dme
```

**Format**  
a list of gene sets

**Value**  
GO gene sets

**Author(s)**  
Dongmin Jung

**Source**  
http://www.go2msig.org/cgi-bin/prebuilt.cgi?taxid=7227

**Examples**  
```
load(system.file("data", "GO_dme.rda", package = "gsean"))
```

---

**gsean**  
*Gene Set Enrichment Analysis with Networks*

**Description**  
GSEA or ORA is performed with networks from gene expression data

**Usage**  
```
gsean(geneset, x, exprs, pseudo = 1, threshold = 0.99, nperm = 1000,  
centrality = function(x) rowSums(abs(x)), weightParam = 1,  
minSize = 1, maxSize = Inf, gseaParam = 1, nproc = 0,  
BPPARAM = NULL, corParam = list(), tmax = 10, ...)
```
Arguments

- **geneset**: list of gene sets
- **x**: Named vector of gene-level statistics for GSEA or set of genes for ORA. Names should be the same as in gene sets.
- **exprs**: gene expression data
- **pseudo**: pseudo number for log2 transformation (default: 1)
- **threshold**: threshold of correlation for nodes to be considered neighbors for ORA (default: 0.99)
- **nperm**: number of permutations (default: 1000)
- **centrality**: centrality measure, degree centrality or node strength is default
- **weightParam**: weight parameter value for the centrality measure, equally weight if weightParam = 0 (default: 1)
- **minSize**: minimal size of a gene set (default: 1)
- **maxSize**: maximal size of a gene set (default: Inf)
- **gseaParam**: GSEA parameter value (default: 1)
- **nproc**: see fgsea::fgsea
- **BPPARAM**: see fgsea::fgsea
- **corParam**: additional parameters for correlation; see WGCNA::cor
- **tmax**: maximum number of iterations for label propagation (default: 10)
- **...**: additional parameters for label propagation; see RANKS::label.prop

Value

GSEA result

Author(s)

Dongmin Jung

See Also

- exprs2adj, label_prop_gsea, centrality_gsea

Examples

data(examplePathways)
data(exampleRanks)
exampleRanks <- exampleRanks[1:100]
Names <- names(exampleRanks)
exprs <- matrix(rnorm(10*length(exampleRanks)), ncol = 10)ownames(exprs) <- names(exampleRanks)
set.seed(1)
result.GSEA <- gsean(examplePathways, exampleRanks, exprs)
**Description**

The data set contains 186 KEGG pathways for Drosophila melanogaster and genes are identified by gene symbol.

**Usage**

```r
KEGG_hsa
```

**Format**

a list of gene sets

**Value**

KEGG gene sets

**Author(s)**

Dongmin Jung

**Source**

http://software.broadinstitute.org/gsea/msigdb/collections.jsp

**Examples**

```r
load(system.file("data", "KEGG_hsa.rda", package = "gsean"))
```

---

**label_prop_gsea**

*Over-representation analysis with the label propagation algorithm*

**Description**

ORA is performed by GSEA with the label propagation algorithm

**Usage**

```r
label_prop_gsea(geneset, x, adjacency, threshold = 0.99, nperm = 1000, minSize = 1, maxSize = Inf, gseaParam = 1, nproc = 0, BPPARAM = NULL, ...)
```
label_prop_gsea

Arguments

- **geneset** list of gene sets
- **x** set of genes
- **adjacency** adjacency matrix
- **threshold** threshold of correlation for nodes to be considered neighbors (default: 0.99)
- **nperm** number of permutations (default: 1000)
- **minSize** minimal size of a gene set (default: 1)
- **maxSize** maximal size of a gene set (default: Inf)
- **gseaParam** GSEA parameter value (default: 1)
- **nproc** see fgsea::fgsea
- **BPPARAM** see fgsea::fgsea
- ... additional parameters for label propagation; see RANKS::label.prop

Value

GSEA result

Author(s)

Dongmin Jung

See Also

fgsea::fgsea

Examples

data(examplePathways)
data(exampleRanks)
exampleRanks <- exampleRanks[1:100]
geneNames <- names(exampleRanks)
set.seed(1)
x <- sample(geneNames, 10)
adjacency <- diag(length(exampleRanks))
rownames(adjacency) <- geneNames
result.GSEA <- label_prop_gsea(examplePathways, x, adjacency)
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