

# Package ‘DOSE’

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**Type** Package

**Title** Disease Ontology Semantic and Enrichment analysis

**Version** 4.7.0

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**Description** This package implements five methods proposed by Resnik, Schlicker, Jiang, Lin and Wang respectively for measuring semantic similarities among DO terms and gene products. Enrichment analyses including hypergeometric model and gene set enrichment analysis are also implemented for discovering disease associations of high-throughput biological data.

**Depends** R (>= 3.5.0)

**Imports** AnnotationDbi, enrichit (>= 0.0.4), ggplot2, GOSemSim (>= 2.37.1), methods, reshape2, utils, yulab.utils (> 0.2.2)

**Suggests** prettydoc, clusterProfiler, gson (>= 0.0.5), knitr, memoise, org.Hs.eg.db, rmarkdown, testthat

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**Encoding** UTF-8

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**BugReports** <https://github.com/GuangchuangYu/DOSE/issues>

**biocViews** Annotation, Visualization, MultipleComparison, GeneSetEnrichment, Pathways, Software

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 DOSE-package

*DOSE: Disease Ontology Semantic and Enrichment analysis*


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### Description

This package implements five methods proposed by Resnik, Schlicker, Jiang, Lin and Wang respectively for measuring semantic similarities among DO terms and gene products. Enrichment analyses including hypergeometric model and gene set enrichment analysis are also implemented for discovering disease associations of high-throughput biological data.

### Author(s)

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### See Also

Useful links:

- <https://yulab-smu.top/contribution-knowledge-mining/>
- Report bugs at <https://github.com/GuangchuangYu/DOSE/issues>

---

clusterSim	<i>clusterSim</i>
------------	-------------------

---

## Description

semantic similarity between two gene clusters

## Usage

```
clusterSim(  
  cluster1,  
  cluster2,  
  ont = "HDO",  
  organism = "hsa",  
  measure = "Wang",  
  combine = "BMA"  
)
```

## Arguments

cluster1	a vector of gene IDs
cluster2	another vector of gene IDs
ont	one of "HDO", "HPO" and "MPO"
organism	one of "hsa" and "mmu"
measure	One of "Resnik", "Lin", "Rel", "Jiang" and "Wang" methods.
combine	One of "max", "avg", "rcmax", "BMA" methods, for combining

## Details

given two gene clusters, this function calculates semantic similarity between them.

## Value

similarity

## Author(s)

Yu Guangchuang

## Examples

```
## Not run:  
cluster1 <- c("835", "5261", "241", "994")  
cluster2 <- c("307", "308", "317", "321", "506", "540", "378", "388", "396")  
clusterSim(cluster1, cluster2)  
  
## End(Not run)
```

---

computeIC	<i>compute information content</i>
-----------	------------------------------------

---

**Description**

compute information content

**Usage**

```
computeIC(ont = "HDO")
```

**Arguments**

ont                    one of "DO", "HPO" and "MPO"

**Author(s)**

Guangchuan Yu <https://yulab-smu.top>

---

DataSet	<i>Datasets</i>
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---

**Description**

Information content and DO term to entrez gene IDs mapping

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doseSim	<i>doseSim</i>
---------	----------------

---

**Description**

measuring similarities between two DO term vectors.

**Usage**

```
doseSim(DO1, DO2, measure = "Wang", ont = "HDO")
```

```
doSim(DO1, DO2, measure = "Wang", ont = "HDO")
```

**Arguments**

DO1                    DO term, MPO term or HPO term vector  
 DO2                    DO term, MPO term or HPO term vector  
 measure                one of "Wang", "Resnik", "Rel", "Jiang", "Lin", and "TCSS".  
 ont                     one of "HDO", "HPO" and "MPO"

**Details**

provide two term vectors, this function will calculate their similarities.

**Value**

score matrix

**Author(s)**

Guangchuang Yu <https://yulab-smu.top>

---

dose\_params

*Shared parameters for DOSE functions*

---

**Description**

Shared parameters for DOSE functions

**Arguments**

gene	a vector of entrez gene id
organism	one of "hsa" and "mmu"
ont	one of "HDO", "HPO" or "MPO"
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
universe	background genes
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
qvalueCutoff	qvalue cutoff
readable	whether mapping gene ID to gene Name
geneList	order ranked geneList
exponent	weight of each step
nPerm	permutation numbers
verbose	print message or not
adaptive	logical, use adaptive permutation or not (default: FALSE)
minPerm	minimum number of permutations for adaptive mode (default: 1000)
maxPerm	maximum number of permutations for adaptive mode (default: 10000)
method	method of GSEA, one of "multilevel", "permute", "sample"

---

enrichDGN                      *Enrichment analysis based on the DisGeNET* (<http://www.disgenet.org/>)

---

### Description

given a vector of genes, this function will return the enrichment NCG categories with FDR control

### Usage

```
enrichDGN(
  gene,
  pvalueCutoff = 0.05,
  pAdjustMethod = "BH",
  universe,
  minGSSize = 10,
  maxGSSize = 500,
  qvalueCutoff = 0.2,
  readable = FALSE
)
```

### Arguments

gene	a vector of entrez gene id
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
universe	background genes
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
qvalueCutoff	qvalue cutoff
readable	whether mapping gene ID to gene Name

### Value

A enrichResult instance

### Author(s)

Guangchuang Yu

### References

Janet et al. (2015) DisGeNET: a discovery platform for the dynamical exploration of human diseases and their genes. *Database* bav028 <http://database.oxfordjournals.org/content/2015/bav028.long>

---

`enrichDGNv`*enrichDGN*

---

## Description

Enrichment analysis based on the DisGeNET (<http://www.disgenet.org/>)

## Usage

```
enrichDGNv(  
  snp,  
  pvalueCutoff = 0.05,  
  pAdjustMethod = "BH",  
  universe,  
  minGSSize = 10,  
  maxGSSize = 500,  
  qvalueCutoff = 0.2,  
  readable = FALSE  
)
```

## Arguments

<code>snp</code>	a vector of SNP
<code>pvalueCutoff</code>	pvalue cutoff
<code>pAdjustMethod</code>	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
<code>universe</code>	background genes
<code>minGSSize</code>	minimal size of genes annotated by ontology term for testing
<code>maxGSSize</code>	maximal size of each geneSet for analyzing
<code>qvalueCutoff</code>	qvalue cutoff
<code>readable</code>	whether mapping gene ID to gene Name

## Details

given a vector of genes, this function will return the enrichment NCG categories with FDR control

## Value

A `enrichResult` instance

## Author(s)

Guangchuang Yu

## References

Janet et al. (2015) DisGeNET: a discovery platform for the dynamical exploration of human diseases and their genes. *Database* bav028 <http://database.oxfordjournals.org/content/2015/bav028.long>

---

`enrichDO`*DO Enrichment Analysis*

---

**Description**

Given a vector of genes, this function will return the enrichment DO categories with FDR control.

**Usage**

```
enrichDO(  
  gene,  
  ont = "HDO",  
  organism = "hsa",  
  pvalueCutoff = 0.05,  
  pAdjustMethod = "BH",  
  universe,  
  minGSSize = 10,  
  maxGSSize = 500,  
  qvalueCutoff = 0.2,  
  readable = FALSE  
)
```

**Arguments**

<code>gene</code>	a vector of entrez gene id
<code>ont</code>	one of "HDO", "HPO" or "MPO"
<code>organism</code>	one of "hsa" and "mmu"
<code>pvalueCutoff</code>	pvalue cutoff
<code>pAdjustMethod</code>	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
<code>universe</code>	background genes
<code>minGSSize</code>	minimal size of genes annotated by ontology term for testing
<code>maxGSSize</code>	maximal size of each geneSet for analyzing
<code>qvalueCutoff</code>	qvalue cutoff
<code>readable</code>	whether mapping gene ID to gene Name

**Value**

A `enrichResult` instance.

**Author(s)**

Guangchuang Yu <https://yulab-smu.top>

**Examples**

```
data(geneList)  
gene = names(geneList)[geneList > 1]  
yy = enrichDO(gene, pvalueCutoff=0.05)  
summary(yy)
```

---

enrichNCG

*enrichNCG*

---

## Description

Enrichment analysis based on the Network of Cancer Genes database (<http://ncg.kcl.ac.uk/>)

## Usage

```
enrichNCG(  
  gene,  
  pvalueCutoff = 0.05,  
  pAdjustMethod = "BH",  
  universe,  
  minGSSize = 10,  
  maxGSSize = 500,  
  qvalueCutoff = 0.2,  
  readable = FALSE  
)
```

## Arguments

gene	a vector of entrez gene id
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
universe	background genes
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
qvalueCutoff	qvalue cutoff
readable	whether mapping gene ID to gene Name

## Details

given a vector of genes, this function will return the enrichment NCG categories with FDR control

## Value

A enrichResult instance

## Author(s)

Guangchuang Yu

gene2DO *convert Gene ID to DO Terms*

---

**Description**

provide gene ID, this function will convert to the corresponding DO Terms

**Usage**

```
gene2DO(gene, organism = "hsa", ont = "HDO")
```

**Arguments**

gene	entrez gene ID
organism	organism
ont	ont

**Value**

DO Terms

**Author(s)**

Guangchuang Yu <https://yulab-smu.top>

---

geneSim *geneSim*

---

**Description**

measuring similarities bewteen two gene vectors.

**Usage**

```
geneSim(  
  geneID1,  
  geneID2 = NULL,  
  ont = "HDO",  
  organism = "hsa",  
  measure = "Wang",  
  combine = "BMA"  
)
```

**Arguments**

geneID1	entrez gene vector
geneID2	entrez gene vector
ont	one of "HDO" and "MPO"
organism	one of "hsa" and "mmu"
measure	one of "Wang", "Resnik", "Rel", "Jiang", and "Lin".
combine	One of "max", "avg", "rcmax", "BMA" methods, for combining semantic similarity scores of multiple DO terms associated with gene/protein.

**Details**

provide two entrez gene vectors, this function will calculate their similarity.

**Value**

score matrix

**Author(s)**

Guangchuang Yu <https://yulab-smu.top>

**Examples**

```
g <- c("835", "5261", "241", "994")
geneSim(g)
```

---

gseDGN

*DisGeNET Gene Set Enrichment Analysis*

---

**Description**

perform gsea analysis

**Usage**

```
gseDGN(  
  geneList,  
  exponent = 1,  
  nPerm = 1000,  
  minGSSize = 10,  
  maxGSSize = 500,  
  pvalueCutoff = 0.05,  
  pAdjustMethod = "BH",  
  verbose = TRUE,  
  method = "multilevel",  
  adaptive = FALSE,  
  minPerm = 1000,  
  maxPerm = 10000,  
  ...  
)
```

**Arguments**

geneList	order ranked geneList
exponent	weight of each step
nPerm	permutation numbers
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
verbose	print message or not
method	method of GSEA, one of "multilevel", "permute", "sample"
adaptive	logical, use adaptive permutation or not (default: FALSE)
minPerm	minimum number of permutations for adaptive mode (default: 1000)
maxPerm	maximum number of permutations for adaptive mode (default: 10000)
...	other parameter

**Value**

gseaResult object

**Author(s)**

Guangchuang Yu

---

gseDO

*DO Gene Set Enrichment Analysis*

---

**Description**

perform gsea analysis

**Usage**

```
gseDO(
  geneList,
  ont = "HDO",
  organism = "hsa",
  exponent = 1,
  nPerm = 1000,
  minGSSize = 10,
  maxGSSize = 500,
  pvalueCutoff = 0.05,
  pAdjustMethod = "BH",
  verbose = TRUE,
  method = "multilevel",
  adaptive = FALSE,
  minPerm = 1000,
  maxPerm = 10000,
  ...
)
```

**Arguments**

geneList	order ranked geneList
ont	one of "HDO", "HPO" or "MPO"
organism	one of "hsa" and "mmu"
exponent	weight of each step
nPerm	permutation numbers
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
verbose	print message or not
method	method of GSEA, one of "multilevel", "permute", "sample"
adaptive	logical, use adaptive permutation or not (default: FALSE)
minPerm	minimum number of permutations for adaptive mode (default: 1000)
maxPerm	maximum number of permutations for adaptive mode (default: 10000)
...	other parameter

**Value**

gseaResult object

**Author(s)**

Guangchuang Yu

---

gseNCG

*NCG Gene Set Enrichment Analysis*

---

**Description**

perform gsea analysis

**Usage**

```
gseNCG(
  geneList,
  exponent = 1,
  nPerm = 1000,
  minGSSize = 10,
  maxGSSize = 500,
  pvalueCutoff = 0.05,
  pAdjustMethod = "BH",
  verbose = TRUE,
  method = "multilevel",
  adaptive = FALSE,
  minPerm = 1000,
  maxPerm = 10000,
  ...
)
```

**Arguments**

geneList	order ranked geneList
exponent	weight of each step
nPerm	permutation numbers
minGSSize	minimal size of genes annotated by ontology term for testing
maxGSSize	maximal size of each geneSet for analyzing
pvalueCutoff	pvalue cutoff
pAdjustMethod	one of "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none"
verbose	print message or not
method	method of GSEA, one of "multilevel", "permute", "sample"
adaptive	logical, use adaptive permutation or not (default: FALSE)
minPerm	minimum number of permutations for adaptive mode (default: 1000)
maxPerm	maximum number of permutations for adaptive mode (default: 10000)
...	other parameter

**Value**

gseaResult object

**Author(s)**

Guangchuang Yu

---

mclusterSim

*mclusterSim*

---

**Description**

Pairwise semantic similarity for a list of gene clusters

**Usage**

```
mclusterSim(
  clusters,
  ont = "HDO",
  organism = "hsa",
  measure = "Wang",
  combine = "BMA"
)
```

**Arguments**

clusters	A list of gene clusters
ont	one of "HDO", "HPO" and "MPO"
organism	organism
measure	one of "Wang", "Resnik", "Rel", "Jiang", and "Lin".
combine	One of "max", "avg", "rcmax", "BMA" methods, for combining semantic similarity scores of multiple DO terms associated with gene/protein.

**Value**

similarity matrix

**Author(s)**

Guangchuang Yu

**Examples**

```
## Not run:
cluster1 <- c("835", "5261", "241")
cluster2 <- c("578", "582")
cluster3 <- c("307", "308", "317")
clusters <- list(a=cluster1, b=cluster2, c=cluster3)
mclusterSim(clusters, measure="Wang")

## End(Not run)
```

---

reexports

*Objects exported from other packages*

---

**Description**

These objects are imported from other packages. Follow the links below to see their documentation.

**ggplot2** [facet\\_grid](#)

**GOSemSim** [get\\_organism](#)

---

simplot

*simplot*

---

**Description**

plotting similarity matrix

**Usage**

```
simplot(
  sim,
  xlab = "",
  ylab = "",
  color.low = "white",
  color.high = "red",
  labs = TRUE,
  digits = 2,
  labs.size = 3,
  font.size = 14
)
```

**Arguments**

<code>sim</code>	similarity matrix
<code>xlab</code>	xlab
<code>ylab</code>	ylab
<code>color.low</code>	color of low value
<code>color.high</code>	color of high value
<code>labs</code>	logical, add text label or not
<code>digits</code>	round digit numbers
<code>labs.size</code>	lable size
<code>font.size</code>	font size

**Value**

ggplot object

**Author(s)**

Yu Guangchuang

---

theme\_dose

*theme\_dose*

---

**Description**

ggplot theme of DOSE

**Usage**

```
theme_dose(font.size = 14)
```

**Arguments**

<code>font.size</code>	font size
------------------------	-----------

**Value**

ggplot theme

**Examples**

```
library(ggplot2)
qplot(1:10) + theme_dose()
```

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