

Package ‘ReporterScore’

January 20, 2025

Type Package

Title Generalized Reporter Score-Based Enrichment Analysis for Omics Data

Version 0.1.9

Description Inspired by the classic 'RSA', we developed the improved 'Generalized Reporter Score-based Analysis (GRSA)' method, implemented in the R package 'ReporterScore', along with comprehensive visualization methods and pathway databases. 'GRSA' is a threshold-free method that works well with all types of biomedical features, such as genes, chemical compounds, and microbial species. Importantly, the 'GRSA' supports multi-group and longitudinal experimental designs, because of the included multi-group-compatible statistical methods.

License GPL-3

Encoding UTF-8

RoxygenNote 7.2.3

Imports magrittr, dplyr, stats, ggplot2 ($\geq 3.2.0$), pcutils ($\geq 0.2.5$), utils, scales, ggnewscale, ggrepel, reshape2, stringr, foreach

Suggests knitr, rmarkdown, plyr, e1071, factoextra, snow, doSNOW, pheatmap, readr, R.utils, KEGGREST, clusterProfiler, enrichplot, pathview, GSA, vegan, MetaNet, igraph, ggraph, PADOG, safe, rSEA, GSVA

Depends R ($\geq 4.2.0$)

VignetteBuilder knitr

BugReports <https://github.com/Asa12138/ReporterScore/issues>

URL <https://github.com/Asa12138/ReporterScore>

NeedsCompilation no

Author Chen Peng [aut, cre] (<<https://orcid.org/0000-0002-9449-7606>>)

Maintainer Chen Peng <pengchen2001@zju.edu.cn>

Repository CRAN

Date/Publication 2024-11-28 14:10:06 UTC

Contents

cm_test_k	3
combine_rs_res	4
Compound_htable	5
CPDlist	5
custom_modulelist	6
custom_modulelist_from_org	7
export_report_table	8
gene2ko	8
genedf	9
get_features	9
get_reporter_score	10
Golist	11
hsa_kegg_pathway	11
ko.test	12
KOlist	13
KO_abundance	13
KO_enrich	14
KO_fisher	15
KO_gsa	16
KO_gsea	17
KO_gsva	18
KO_htable	19
KO_padog	19
KO_safe	20
KO_sea	21
load_CARDinfo	22
load_Golist	23
load_htable	23
mmu_kegg_pathway	25
modify_description	25
Module_htable	26
Pathway_htable	26
plot.cm_res	26
plot_enrich_res	27
plot_features_box	28
plot_features_distribution	30
plot_features_heatmap	31
plot_features_in_pathway	32
plot_features_network	33
plot_htable	34
plot_KEGG_map	35
plot_report	36
plot_report_circle_packing	37
plot_significance	38
print.reporter_score	39
print.rs_by_cm	39

<code>cm_test_k</code>	3
pvalue2zs	40
reporter_score	42
reporter_score_res	44
RSA_by_cm	45
update_CARDinfo	47
update_GOlist	47
update_KEGG	48
up_level_KO	49
Index	50

<code>cm_test_k</code>	<i>Test the proper clusters k for c_means</i>
------------------------	-----------------------------------------------

Description

Test the proper clusters k for `c_means`
C-means cluster

Usage

```
cm_test_k(otu_group, filter_var, fast = TRUE)

c_means(otu_group, k_num, filter_var)
```

Arguments

<code>otu_group</code>	standardize data
<code>filter_var</code>	filter the highest var
<code>fast</code>	whether do the gap_stat?
<code>k_num</code>	cluster number

Value

ggplot
ggplot

See Also

Other C_means: [RSA_by_cm\(\)](#)

Examples

```

if (requireNamespace("e1071") && requireNamespace("factoextra")) {
  data(otutab, package = "pcutils")
  pcutils::hebing(otutab, metadata$Group) -> otu_group
  cm_test_k(otu_group, filter_var = 0.7)
  cm_res <- c_means(otu_group, k_num = 3, filter_var = 0.7)
  plot(cm_res, 0.8)
}

```

 combine_rs_res

Combine the results of 'step by step GRSA'

Description

Combine the results of 'step by step GRSA'

Usage

```
combine_rs_res(kodf, group, metadata, ko_stat, reporter_s, modulelist = NULL)
```

Arguments

kodf	KO_abundance table, rowname are feature ids (e.g. K00001 if feature="ko"; PEX111A if feature="gene"; C00024 if feature="compound"), colnames are samples.
group	The comparison groups (at least two categories) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kodf. And you can use factor levels to change order.
metadata	sample information data.frame contains group
ko_stat	result of pvalue2zs
reporter_s	result of get_reporter_score
modulelist	NULL or customized modulelist dataframe, must contain 'id', 'K_num', 'KOs', 'Description' columns. Take the 'KOList' as example, use custom_modulelist .

Value

reporter_score object

See Also

Other GRSA: [get_reporter_score\(\)](#), [ko.test\(\)](#), [pvalue2zs\(\)](#), [reporter_score\(\)](#)

Examples

```

data("KO_abundance_test")
ko_pvalue <- ko.test(KO_abundance, "Group", metadata)
ko_stat <- pvalue2zs(ko_pvalue, mode = "directed")
reporter_s1 <- get_reporter_score(ko_stat, perm = 499)
reporter_res <- combine_rs_res(KO_abundance, "Group", metadata, ko_stat, reporter_s1)

```

Compound_htable	<i>Compound htable from 'KEGG'</i>
-----------------	------------------------------------

Description

Compound htable from 'KEGG'

See Also

Other data: [CPDlist](#), [Golist](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

CPDlist	<i>The CPDlist used for enrichment.</i>
---------	-----------------------------------------

Description

an list contains two data.frame named pathway and module.

Format

four columns in each data.frame.

id "map0010" or "M00001"

K_num contains how many Compounds in this pathway or module

KOs Compounds name

Description the description of this pathway or module

See Also

Other data: [Compound_htable](#), [Golist](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

custom_modulelist *Build a custom modulelist*

Description

Build a custom modulelist

Transform a modulelist to a list

Usage

```
custom_modulelist(pathway2ko, pathway2desc = NULL, verbose = TRUE)
```

```
transform_modulelist(mymodulelist, mode = 1)
```

Arguments

pathway2ko	user input annotation of Pathway to KO mapping, a data.frame of 2 column with pathway and ko.
pathway2desc	user input of Pathway TO Description mapping, a data.frame of 2 column with pathway and description.
verbose	verbose
mymodulelist	mymodulelist
mode	1~2

Value

a custom modulelist

modulelist

See Also

Other modulelist: [custom_modulelist_from_org\(\)](#), [get_features\(\)](#)

Other modulelist: [custom_modulelist_from_org\(\)](#), [get_features\(\)](#)

Examples

```
mydat <- data.frame(pathway = paste0("PATHWAY", rep(seq_len(2), each = 5)), ko = paste0("K", 1:10))
mymodulelist <- custom_modulelist(mydat)
print(mymodulelist)
transform_modulelist(mymodulelist)
```

`custom_modulelist_from_org`*Custom modulelist from a specific organism*

Description

Custom modulelist from a specific organism

Usage

```
custom_modulelist_from_org(  
  org = "hsa",  
  feature = "ko",  
  gene = "symbol",  
  verbose = TRUE  
)
```

Arguments

<code>org</code>	kegg organism, listed in https://www.genome.jp/kegg/catalog/org_list.html , default, "hsa"
<code>feature</code>	one of "ko", "gene", "compound"
<code>gene</code>	one of "symbol", "id"
<code>verbose</code>	logical

Value

modulelist

See Also

Other modulelist: [custom_modulelist\(\)](#), [get_features\(\)](#)

Examples

```
hsa_pathway <- custom_modulelist_from_org(org = "hsa", feature = "gene")
```

export_report_table *Export report score result tables*

Description

Export report score result tables

Usage

```
export_report_table(reporter_res, dir_name, overwrite = FALSE)
```

Arguments

reporter_res a reporter_score object or rs_by_cm object
 dir_name the directory to save the report tables
 overwrite overwrite the existed files or not, default is FALSE.

Value

No return value

gene2ko *Transfer gene symbol table to KO table*

Description

You can use 'clusterProfiler::bitr()' to transfer your table from other gene_id to gene_symbol.

Usage

```
gene2ko(genedf, org = "hsa")
```

Arguments

genedf ,rowname is gene symbol (e.g. PFKM), colnames is samples
 org kegg organism, listed in 'https://www.genome.jp/kegg/catalog/org_list.html', default, 'hsa'

Value

kodf

Examples

```
data("genedf")
K0df <- gene2ko(genedf, org = "hsa")
```

genedf	<i>human gene table</i>
--------	-------------------------

Description

human gene table

See Also

Other test_data: [KO_abundance](#), [reporter_score_res](#)

get_features	<i>get features in a modulelist</i>
--------------	-------------------------------------

Description

get features in a modulelist

Usage

```
get_features(map_id = "map00010", ko_stat = NULL, modulelist = NULL)
```

Arguments

map_id	map_id in modulelist
ko_stat	NULL or ko_stat result from pvalue2zs
modulelist	NULL or customized modulelist dataframe, must contain 'id', 'K_num', 'KOs', 'Description' columns. Take the 'KOlist' as example, use custom_modulelist .

Value

KOids, or data.frame with these KOids.

See Also

Other modulelist: [custom_modulelist_from_org\(\)](#), [custom_modulelist\(\)](#)

Examples

```
get_features(map_id = "map00010")
```

get_reporter_score *Calculate reporter score*

Description

Calculate reporter score

Usage

```
get_reporter_score(
  ko_stat,
  type = c("pathway", "module")[1],
  feature = "ko",
  threads = 1,
  modulelist = NULL,
  perm = 4999,
  verbose = TRUE,
  p.adjust.method2 = "BH",
  min_exist_KO = 3,
  max_exist_KO = 600
)
```

Arguments

ko_stat	ko_stat result from pvalue2zs
type	'pathway' or 'module' for default KOList for microbiome, 'CC', 'MF', 'BP', 'ALL' for default GOList for homo sapiens. And org in listed in 'https://www.genome.jp/kegg/catalog/org_ such as 'hsa' (if your kodf is come from a specific organism, you should specify type here).
feature	one of 'ko', 'gene', 'compound'
threads	default 1
modulelist	NULL or customized modulelist dataframe, must contain 'id', 'K_num', 'KOs', 'Description' columns. Take the 'KOList' as example, use custom_modulelist .
perm	permutation number, default: 4999.
verbose	logical
p.adjust.method2	p.adjust.method for the correction of ReporterScore, see p.adjust
min_exist_KO	min exist KO number in a pathway (default, 3, when a pathway contains KOs less than 3, there will be no RS)
max_exist_KO	max exist KO number in a pathway (default, 600, when a pathway contains KOs more than 600, there will be no RS)

Value

reporter_res data.frame

See Also

Other GRSA: [combine_rs_res\(\)](#), [ko.test\(\)](#), [pvalue2zs\(\)](#), [reporter_score\(\)](#)

Examples

```
data("KO_abundance_test")
ko_pvalue <- ko.test(KO_abundance, "Group", metadata)
ko_stat <- pvalue2zs(ko_pvalue, mode = "directed")
reporter_s1 <- get_reporter_score(ko_stat, perm = 499)
```

Golist

The Golist used for enrichment.

Description

an list contains three data.frame named BP, CC, MF.

Format

four columns in each data.frame.

id "map0010" or "M00001"

K_num contains how many Genes in this GO term

KOs Genes name

Description the description of this GO term

See Also

Other data: [CPDlist](#), [Compound_htable](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

hsa_kegg_pathway

pathway information for "hsa"

Description

pathway information for "hsa"

See Also

Other data: [CPDlist](#), [Compound_htable](#), [Golist](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [Pathway_htable](#), [mmu_kegg_pathway](#)

 ko.test

Differential analysis or Correlation analysis for KO-abundance table

Description

Differential analysis or Correlation analysis for KO-abundance table

Usage

```
ko.test(
  kofd,
  group,
  metadata = NULL,
  method = "wilcox.test",
  pattern = NULL,
  p.adjust.method1 = "none",
  threads = 1,
  verbose = TRUE
)
```

Arguments

kofd	KO_abundance table, rowname are feature ids (e.g. K00001 if feature="ko"; PEX111A if feature="gene"; C00024 if feature="compound"), colnames are samples.
group	The comparison groups (at least two categories) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kofd. And you can use factor levels to change order.
metadata	sample information data.frame contains group
method	the type of test. Default is 'wilcox.test'. Allowed values include: <ul style="list-style-type: none"> • t.test (parametric) and wilcox.test (non-parametric). Perform comparison between two groups of samples. If the grouping variable contains more than two levels, then a pairwise comparison is performed. • anova (parametric) and kruskal.test (non-parametric). Perform one-way ANOVA test comparing multiple groups. • 'pearson', 'kendall', or 'spearman' (correlation), see cor.
pattern	a named vector matching the group, e.g. c('G1'=1,'G2'=3,'G3'=2), use the correlation analysis with specific pattern to calculate p-value.
p.adjust.method1	p.adjust.method for 'ko.test', see p.adjust
threads	default 1
verbose	logical

Value

ko_pvalue data.frame

See Also

Other GRSA: [combine_rs_res\(\)](#), [get_reporter_score\(\)](#), [pvalue2zs\(\)](#), [reporter_score\(\)](#)

Examples

```
data("KO_abundance_test")
ko_pvalue <- ko.test(KO_abundance, "Group", metadata)
```

KOlise

The KOlise used for enrichment.

Description

an list contains two data.frame named pathway and module.

Format

four columns in each data.frame.

id "map0010" or "M00001"

K_num contains how many KOs in this pathway or module

KOs KOs name

Description the description of this pathway or module

See Also

Other data: [CPDlist](#), [Compound_htable](#), [Golist](#), [KO_htable](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

KO_abundance

The KOs abundance table and group table.

Description

The KOs abundance table and group table.

The KOs abundance table and group table.

See Also

Other test_data: [genedf](#), [reporter_score_res](#)

KO_enrich

*Perform enrichment analysis***Description**

This function performs KO enrichment analysis using the ‘clusterProfiler’ package.

Usage

```
KO_enrich(
  ko_stat,
  padj_threshold = 0.05,
  logFC_threshold = NULL,
  add_mini = NULL,
  p.adjust.method = "BH",
  type = c("pathway", "module")[1],
  feature = "ko",
  modulelist = NULL,
  verbose = TRUE
)

as.enrich_res(gsea_res)
```

Arguments

ko_stat	ko_stat dataframe from ko.test .
padj_threshold	p.adjust threshold to determine whether a feature significant or not. p.adjust < padj_threshold, default: 0.05
logFC_threshold	logFC threshold to determine whether a feature significant or not. abs(logFC)>logFC_threshold, default: NULL
add_mini	add_mini when calculate the logFC. e.g (10+0.1)/(0+0.1), default 0.05*min(avg_abundance)
p.adjust.method	The method used for p-value adjustment (default: "BH").
type	"pathway" or "module" for default Kolist_file.
feature	one of "ko", "gene", "compound"
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the ‘Kolist’ as example, use custom_modulelist .
verbose	logical
gsea_res	gsea_res from KO_gsea

Value

A data frame containing the enrichment results.

enrich_res object

See Also

Other common_enrich: [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

 KO_fisher

Perform fisher's exact enrichment analysis

Description

Perform fisher's exact enrichment analysis

Usage

```
KO_fisher(
  ko_stat,
  padj_threshold = 0.05,
  logFC_threshold = NULL,
  add_mini = NULL,
  p.adjust.method = "BH",
  type = c("pathway", "module")[1],
  feature = "ko",
  modulelist = NULL,
  verbose = TRUE
)
```

Arguments

ko_stat	ko_stat dataframe from ko.test .
padj_threshold	p.adjust threshold to determine whether a feature significant or not. p.adjust < padj_threshold, default: 0.05
logFC_threshold	logFC threshold to determine whether a feature significant or not. abs(logFC)>logFC_threshold, default: NULL
add_mini	add_mini when calculate the logFC. e.g (10+0.1)/(0+0.1), default 0.05*min(avg_abundance)
p.adjust.method	The method used for p-value adjustment (default: "BH").
type	"pathway" or "module" for default Kolist_file.
feature	one of "ko", "gene", "compound"
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'Kolist' as example, use custom_modulelist .
verbose	logical

Value

data.frame

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `fisher.test` from the `stats` package.
data("reporter_score_res")
fisher_res <- KO_fisher(reporter_score_res)
```

KO_gsa	<i>Perform gene set analysis</i>
--------	----------------------------------

Description

Perform gene set analysis

Usage

```
KO_gsa(
  reporter_res,
  method = "Two class unpaired",
  p.adjust.method = "BH",
  verbose = TRUE,
  perm = 1000,
  ...
)
```

Arguments

reporter_res	reporter_res
method	Problem type: "quantitative" for a continuous parameter; "Two class unpaired" ; "Survival" for censored survival outcome; "Multiclass" : more than 2 groups, coded 1,2,3...; "Two class paired" for paired outcomes, coded -1,1 (first pair), -2,2 (second pair), etc
p.adjust.method	"BH"
verbose	TRUE
perm	1000
...	additional parameters to GSA

Value

enrich_res object

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `GSA` from the `GSA` package.
if (requireNamespace("GSA")) {
  data("reporter_score_res")
  gsa_res <- KO_gsa(reporter_score_res, p.adjust.method = "none", perm = 200)
  plot(gsa_res)
}
```

 KO_gsea

Perform gene set enrichment analysis

Description

Perform gene set enrichment analysis

Usage

```
KO_gsea(
  ko_stat,
  weight = "logFC",
  add_mini = NULL,
  p.adjust.method = "BH",
  type = c("pathway", "module")[1],
  feature = "ko",
  modulelist = NULL,
  verbose = TRUE
)
```

Arguments

ko_stat	ko_stat dataframe from ko.test .
weight	the metric used for ranking, default: logFC
add_mini	add_mini when calculate the logFC. e.g (10+0.1)/(0+0.1), default 0.05*min(avg_abundance)
p.adjust.method	The method used for p-value adjustment (default: "BH").
type	"pathway" or "module" for default Kolist_file.
feature	one of "ko", "gene", "compound"
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'Kolist' as example, use custom_modulelist .
verbose	logical

Value

DOSE object

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
message("The following example require some time to run:")

## use `GSEA` from the `clusterProfiler` package.
if (requireNamespace("clusterProfiler")) {
  data("reporter_score_res")
  gsea_res <- KO_gsea(reporter_score_res, p.adjust.method = "none")
  enrichplot::gseaplot(gsea_res, geneSetID = data.frame(gsea_res)$ID[1])
  gsea_res_df <- as.enrich_res(gsea_res)
  plot(gsea_res_df)
}
```

KO_gsva

Perform Gene Set Variation Analysis

Description

Perform Gene Set Variation Analysis

Usage

```
KO_gsva(
  reporter_res,
  verbose = TRUE,
  method = "wilcox.test",
  p.adjust.method = "BH",
  ...
)
```

Arguments

reporter_res	reporter_res
verbose	verbose
method	see ko.test
p.adjust.method	p.adjust.method
...	additional parameters to gsva

Value

enrich_res

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `gsva` from the `GSVA` package.
if (requireNamespace("GSVA")) {
  data("reporter_score_res")
  gsva_res <- KO_gsva(reporter_score_res, p.adjust.method = "none")
}
```

KO_htable	<i>KO htable from 'KEGG'</i>
-----------	------------------------------

Description

KO htable from 'KEGG'

See Also

Other data: [CPDlist](#), [Compound_htable](#), [GOList](#), [KOList](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

KO_padog	<i>Perform Pathway Analysis with Down-weighting of Overlapping Genes (PADOG)</i>
----------	----------------------------------------------------------------------------------

Description

Perform Pathway Analysis with Down-weighting of Overlapping Genes (PADOG)

Usage

```
KO_padog(
  reporter_res,
  verbose = TRUE,
  perm = 1000,
  p.adjust.method = "BH",
  ...
)
```

Arguments

reporter_res The input reporter result.
 verbose If TRUE, print verbose messages. Default is TRUE.
 perm The number of permutations. Default is 1000.
 p.adjust.method Method for p-value adjustment. Default is "BH".
 ... Additional parameters to be passed to [padog](#) function.

Value

A data frame containing PADOG results for KO enrichment.

A data frame with columns "ID," "Description," "K_num," "Exist_K_num," "p.value," and "p.adjust."

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `PADOG` from the `PADOG` package.
if (requireNamespace("PADOG")) {
  data("reporter_score_res")
  padog_res <- KO_padog(reporter_score_res,
    verbose = TRUE,
    perm = 200, p.adjust.method = "none"
  )
}
```

 KO_safe

Perform Significance Analysis of Function and Expression

Description

Perform Significance Analysis of Function and Expression

Usage

```
KO_safe(
  reporter_res,
  verbose = TRUE,
  perm = 1000,
  C.matrix = NULL,
  p.adjust.method = "BH",
  ...
)
```

Arguments

reporter_res	The input reporter result.
verbose	If TRUE, print verbose messages. Default is TRUE.
perm	The number of permutations. Default is 1000.
C.matrix	The contrast matrix. Default is NULL, and it will be generated from the module list.
p.adjust.method	Method for p-value adjustment. Default is "BH".
...	Additional parameters to be passed to safe function.

Value

A data frame containing SAFE results for KO enrichment.

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_sea\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `safe` from the `safe` package.
if (requireNamespace("safe")) {
  data("reporter_score_res")
  safe_res <- KO_safe(reporter_score_res,
    verbose = TRUE,
    perm = 200, p.adjust.method = "none"
  )
}
```

 KO_sea

Perform Simultaneous Enrichment Analysis

Description

Perform Simultaneous Enrichment Analysis

Usage

```
KO_sea(reporter_res, verbose = TRUE, ...)
```

Arguments

reporter_res	The input reporter result.
verbose	If TRUE, print verbose messages. Default is TRUE.
...	Additional parameters to be passed to SEA function.

Value

enrich_res

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [plot_enrich_res\(\)](#)

Examples

```
## use `SEA` from the `rSEA` package.  
if (requireNamespace("rSEA")) {  
  data("reporter_score_res")  
  sea_res <- KO_sea(reporter_score_res, verbose = TRUE)  
}
```

load_CARDinfo

Load the CARDinfo (from CARD database)

Description

Load the CARDinfo (from CARD database)

Usage

```
load_CARDinfo(verbose = TRUE)
```

Arguments

verbose logical

Value

CARDinfo

load_GOlist	<i>Load the GOlist (from 'GO' database)</i>
-------------	---------------------------------------------

Description

Load the GOlist (from 'GO' database)

Load the GOinfo (from GO)

Usage

```
load_GOlist(verbose = TRUE)
```

```
load_GOinfo(verbose = TRUE)
```

Arguments

verbose logical

Value

GOlist

GOinfo

load_htable	<i>Load the specific table (from 'KEGG')</i>
-------------	----------------------------------------------

Description

Load the specific table (from 'KEGG')

Load the KOList (from 'KEGG')

Load the CPDlist (from 'KEGG')

Load the KO description (from 'KEGG')

Load the KO_htable (from 'KEGG')

Load the Pathway_htable (from 'KEGG')

Load the Module_htable (from 'KEGG')

Load the Compound_htable (from 'KEGG')

Load the pathway information for an organism (from 'KEGG')

Usage

```
load_htable(type, verbose = TRUE)

load_KOlist(verbose = TRUE)

load_CPDlist(verbose = TRUE)

load_KO_desc(verbose = TRUE)

load_KO_htable(verbose = TRUE)

load_Pathway_htable(verbose = TRUE)

load_Module_htable(verbose = TRUE)

load_Compound_htable(verbose = TRUE)

load_org_pathway(org = "hsa", verbose = TRUE)
```

Arguments

type	"ko", "module", "pathway", "compound" ...
verbose	logical
org	kegg organism, listed in https://www.genome.jp/kegg/catalog/org_list.html , default, "hsa"

Value

```
KO_htable
KOlist
CPDlist
KO description
KO_htable
Pathway_htable
Module_htable
Compound_htable
KOlist
```

Examples

```
Pathway_htable <- load_htable("pathway")
head(Pathway_htable)
```

mmu_kegg_pathway	<i>pathway information for "mmu"</i>
------------------	--------------------------------------

Description

pathway information for "mmu"

See Also

Other data: [CPDlist](#), [Compound_htable](#), [Golist](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [Pathway_htable](#), [hsa_kegg_pathway](#)

modify_description	<i>Modify the pathway description before plotting</i>
--------------------	-------------------------------------------------------

Description

Modify the pathway description before plotting

Usage

```
modify_description(  
  reporter_res,  
  pattern = " - Homo sapiens (human)",  
  replacement = ""  
)
```

Arguments

reporter_res	reporter_res
pattern	str, like " - Homo sapiens (human)"
replacement	str, like ""

Value

reporter_res

Examples

```
data("reporter_score_res")  
modify_description(reporter_score_res, pattern = " - Homo sapiens (human)")
```

Module_htable	<i>Module htable from 'KEGG'</i>
---------------	----------------------------------

Description

Module htable from 'KEGG'

See Also

Other data: [CPDlist](#), [Compound_htable](#), [Golist](#), [KO_htable](#), [Kolist](#), [Pathway_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

Pathway_htable	<i>Pathway htable from 'KEGG'</i>
----------------	-----------------------------------

Description

Pathway htable from 'KEGG'

See Also

Other data: [CPDlist](#), [Compound_htable](#), [Golist](#), [KO_htable](#), [Kolist](#), [Module_htable](#), [hsa_kegg_pathway](#), [mmu_kegg_pathway](#)

plot.cm_res	<i>Plot c_means result</i>
-------------	----------------------------

Description

Plot c_means result

Usage

```
## S3 method for class 'cm_res'  
plot(  
  x,  
  filter_membership,  
  mode = 1,  
  show.clust.cent = TRUE,  
  show_num = TRUE,  
  ...  
)
```

Arguments

x	a cm_res object
filter_membership	filter membership
mode	1~2
show.clust.cent	show cluster center?
show_num	show number of each cluster?
...	additional

Value

ggplot

plot_enrich_res	<i>Plot enrich_res</i>
-----------------	------------------------

Description

Plot enrich_res

Plot enrich_res

Usage

```

plot_enrich_res(
  enrich_res,
  mode = 1,
  padj_threshold = 0.05,
  show_ID = FALSE,
  Pathway_description = TRUE,
  facet_level = FALSE,
  facet_anno = NULL,
  str_width = 50,
  facet_str_width = 15,
  ...
)

## S3 method for class 'enrich_res'
plot(
  x,
  mode = 1,
  padj_threshold = 0.05,
  show_ID = FALSE,
  Pathway_description = TRUE,
  facet_level = FALSE,

```

```

    facet_anno = NULL,
    str_width = 50,
    facet_str_width = 15,
    ...
  )

```

Arguments

enrich_res	enrich_res object
mode	plot style: 1~2
padj_threshold	p.adjust threshold
show_ID	show pathway id
Pathway_description	show KO description rather than KO id.
facet_level	facet plot if the type is "pathway" or "module"
facet_anno	annotation table for facet, two columns, first is level summary, second is pathway id.
str_width	default: 50
facet_str_width	str width for facet label
...	add
x	enrich_res object

Value

ggplot
ggplot

See Also

Other common_enrich: [KO_enrich\(\)](#), [KO_fisher\(\)](#), [KO_gsa\(\)](#), [KO_gsea\(\)](#), [KO_gsva\(\)](#), [KO_padog\(\)](#), [KO_safe\(\)](#), [KO_sea\(\)](#)

plot_features_box *Plot features boxplot*

Description

Plot features boxplot

Usage

```
plot_features_box(
  kodf,
  group = NULL,
  metadata = NULL,
  map_id = "map00780",
  select_ko = NULL,
  only_sig = FALSE,
  box_param = NULL,
  modulelist = NULL,
  KO_description = FALSE,
  str_width = 50
)
```

Arguments

kodf	KO_abundance table, rowname is ko id (e.g. K00001), colnames is samples. or result of 'get_reporter_score'
group	The compare group (two category) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kodf.
metadata	metadata
map_id	the pathway or module id
select_ko	select which ko
only_sig	only show the significant features
box_param	parameters pass to group_box
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'KOlist' as example, use custom_modulelist .
KO_description	show KO description rather than KO id.
str_width	str_width to wrap

Value

ggplot

Examples

```
data("reporter_score_res")
plot_features_box(reporter_score_res,
  select_ko = c("K00059", "K00208", "K00647", "K00652", "K00833", "K01012"),
  box_param = list(p_value1 = FALSE, trend_line = TRUE)
)
plot_features_box(reporter_score_res,
  select_ko = "K00059", KO_description = TRUE,
  box_param = list(p_value1 = FALSE, trend_line = TRUE)
)
```

`plot_features_distribution`*plot the Z-score of features distribution*

Description

plot the Z-score of features distribution

Usage

```
plot_features_distribution(  
  reporter_res,  
  map_id,  
  text_size = 4,  
  text_position = NULL,  
  rug_length = 0.04  
)
```

Arguments

<code>reporter_res</code>	result of 'reporter_score'
<code>map_id</code>	the pathway or module id
<code>text_size</code>	<code>text_size=4</code>
<code>text_position</code>	text_position, e.g. <code>c(x=3,y=0.4)</code>
<code>rug_length</code>	<code>rug_length=0.04</code>

Value

ggplot

Examples

```
data("reporter_score_res")  
plot_features_distribution(reporter_score_res, map_id = c("map05230", "map03010"))
```

plot_features_heatmap *Plot features heatmap*

Description

Plot features heatmap

Usage

```
plot_features_heatmap(
  kodf,
  group = NULL,
  metadata = NULL,
  map_id = "map00780",
  select_ko = NULL,
  only_sig = FALSE,
  columns = NULL,
  modulelist = NULL,
  KO_description = FALSE,
  str_width = 50,
  heatmap_param = list()
)
```

Arguments

kodf	KO_abundance table, rowname is ko id (e.g. K00001), colnames is samples. or result of 'get_reporter_score'
group	The compare group (two category) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kodf.
metadata	metadata
map_id	the pathway or module id
select_ko	select which ko
only_sig	only show the significant KOs
columns	change columns
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'KOlist' as example, use custom_modulelist .
KO_description	show KO description rather than KO id.
str_width	str_width to wrap
heatmap_param	parameters pass to pheatmap

Value

ggplot

Examples

```
if (requireNamespace("pheatmap")) {
  data("reporter_score_res")
  plot_features_heatmap(reporter_score_res, map_id = "map00780")
}
```

plot_features_in_pathway

Plot features trend in one pathway or module

Description

Plot features trend in one pathway or module

Usage

```
plot_features_in_pathway(
  ko_stat,
  map_id = "map00780",
  modulelist = NULL,
  select_ko = NULL,
  box_color = reporter_color,
  show_number = TRUE,
  scale = FALSE,
  feature_type = "KOs",
  line_color = c(Depleted = "seagreen", Enriched = "orange", None = "grey", Significant =
    "red2")
)
```

Arguments

ko_stat	ko_stat result from pvalue2zs or result of ‘get_reporter_score’
map_id	the pathway or module id
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the ‘KOList’ as example, use custom_modulelist .
select_ko	select which ko
box_color	box and point color, default: c("#e31a1c", "#1f78b4")
show_number	show the numbers.
scale	scale the data by row.
feature_type	show in the title ,default: KOs
line_color	line color, default: c("Depleted"="seagreen", "Enriched"="orange", "None"="grey")

Value

ggplot

Examples

```
data("reporter_score_res")
plot_features_in_pathway(ko_stat = reporter_score_res, map_id = "map00860")
```

plot_features_network *Plot features network*

Description

Plot features network

Usage

```
plot_features_network(
  ko_stat,
  map_id = "map00780",
  near_pathway = FALSE,
  modulelist = NULL,
  kos_color = c(Depleted = "seagreen", Enriched = "orange", None = "grey", Significant =
    "red2", Pathway = "#80b1d3"),
  pathway_label = TRUE,
  kos_label = TRUE,
  pathway_description = FALSE,
  kos_description = FALSE,
  str_width = 50,
  mark_module = FALSE,
  mark_color = NULL,
  return_net = FALSE,
  ...
)
```

Arguments

ko_stat	ko_stat result from pvalue2zs or result of 'get_reporter_score'
map_id	the pathway or module id
near_pathway	show the near_pathway if any features exist.
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'KOlis' as example, use custom_modulelist .
kos_color	default, c("Depleted"="seagreen", "Enriched"="orange", "None"="grey", "Significant"="red2")
pathway_label	show pathway_label?
kos_label	show kos_label?
pathway_description	show the pathway description?

```

kos_description      show the kos description?
str_width            str width
mark_module          mark the modules?
mark_color            mark colors, default, c("Depleted"="seagreen", "Enriched"="orange", "None"="grey", "Significant"="red2
return_net           return the network
...                  additional arguments for c_net_plot

```

Value

network plot

Examples

```

if (requireNamespace("MetaNet")) {
  data("reporter_score_res")
  plot_features_network(reporter_score_res, map_id = "map05230")
  plot_features_network(reporter_score_res, map_id = "map00780", near_pathway = TRUE)
}

```

plot_htable

Plot htable levels

Description

Plot htable levels

Usage

```
plot_htable(type = "ko", select = NULL, htable = NULL)
```

Arguments

```

type          "ko", "module", "pathway", "compound"
select        select ids
htable        custom a htable

```

Value

ggplot

Examples

```

data("KO_abundance_test")
plot_htable(select = rownames(KO_abundance))

```

plot_KEGG_map	<i>plot_KEGG_map</i>
---------------	----------------------

Description

plot_KEGG_map

Usage

```
plot_KEGG_map(
  ko_stat,
  map_id = "map00780",
  modulelist = NULL,
  type = "pathway",
  feature = "ko",
  color_var = "Z_score",
  save_dir,
  color = c("seagreen", "grey", "orange")
)
```

Arguments

ko_stat	ko_stat result from pvalue2zs or result of 'get_reporter_score'
map_id	the pathway or module id
modulelist	NULL or customized modulelist dataframe, must contain "id", "K_num", "KOs", "Description" columns. Take the 'KOl原因' as example, use custom_modulelist .
type	"pathway" or "module" for default KOl原因 for microbiome, "CC", "MF", "BP", "ALL" for default GOlist for homo sapiens. And org in listed in 'https://www.genome.jp/kegg/catalog/org' such as "hsa" (if your kodf is come from a specific organism, you should specify type here).
feature	one of "ko", "gene", "compound"
color_var	use which variable to color
save_dir	where to save the png files
color	color

Value

png files

References

<https://zhuanlan.zhihu.com/p/357687076>

Examples

```

message("The following example will download some files, run yourself:")

if (requireNamespace("pathview")) {
  output_dir <- tempdir()
  data("reporter_score_res")
  plot_KEGG_map(reporter_score_res$ko_stat,
    map_id = "map00780", type = "pathway",
    feature = "ko", color_var = "Z_score", save_dir = output_dir
  )
}

```

plot_report

Plot the reporter_res

Description

Plot the reporter_res

Usage

```

plot_report(
  reporter_res,
  rs_threshold = 1.64,
  mode = 1,
  y_text_size = 13,
  str_width = 100,
  show_ID = FALSE,
  Pathway_description = TRUE,
  facet_level = FALSE,
  facet_anno = NULL,
  facet_str_width = 15,
  plot_line = TRUE,
  reorder = FALSE
)

```

Arguments

reporter_res	result of ‘get_reporter_score’ or ‘reporter_score’
rs_threshold	plot threshold vector, default:1.64
mode	1~3 plot style.
y_text_size	y_text_size
str_width	str_width to wrap
show_ID	show pathway id

Pathway_description	show KO description rather than KO id.
facet_level	facet plot if the type is "pathway" or "module"
facet_anno	annotation table for facet, two columns, first is level summary, second is pathway id.
facet_str_width	str width for facet label
plot_line	plot line or not
reorder	reorder the order of the pathways

Value

ggplot

Examples

```
data("reporter_score_res")
plot_report(reporter_score_res, rs_threshold = c(2.5, -2.5), y_text_size = 10, str_width = 40)
```

plot_report_circle_packing
Plot the reporter_res as circle_packing

Description

Plot the reporter_res as circle_packing

Usage

```
plot_report_circle_packing(  
  reporter_res,  
  rs_threshold = 1.64,  
  mode = 2,  
  facet_anno = NULL,  
  show_ID = FALSE,  
  Pathway_description = TRUE,  
  str_width = 10,  
  show_level_name = "all",  
  show_tip_label = TRUE  
)
```

Arguments

reporter_res	result of 'get_reporter_score'
rs_threshold	plot threshold vector, default:1.64
mode	1~2 plot style.
facet_anno	annotation table for facet, more two columns, last is pathway name, last second is pathway id.
show_ID	show pathway id
Pathway_description	show KO description rather than KO id.
str_width	str_width to wrap
show_level_name	show the level name?
show_tip_label	show the tip label?

Value

ggplot

Examples

```
data("reporter_score_res")
if (requireNamespace("igraph") && requireNamespace("ggraph")) {
  plot_report_circle_packing(reporter_score_res, rs_threshold = c(2, -2), str_width = 40)
}
```

plot_significance *Plot the significance of pathway*

Description

Plot the significance of pathway

Usage

```
plot_significance(reporter_res, map_id)
```

Arguments

reporter_res	result of 'get_reporter_score' or 'reporter_score'
map_id	the pathway or module id

Value

ggplot

Examples

```
data("reporter_score_res")  
plot_significance(reporter_score_res, map_id = c("map05230", "map03010"))
```

print.reporter_score *Print reporter_score*

Description

Print reporter_score

Usage

```
## S3 method for class 'reporter_score'  
print(x, ...)
```

Arguments

x	reporter_score
...	add

Value

No value

print.rs_by_cm *Print rs_by_cm*

Description

Print rs_by_cm

Usage

```
## S3 method for class 'rs_by_cm'  
print(x, ...)
```

Arguments

x	rs_by_cm
...	add

Value

No value

pvalue2zs

*Transfer p-value of KOs to Z-score***Description**

Transfer p-value of KOs to Z-score

Usage

```
pvalue2zs(
  ko_pvalue,
  mode = c("directed", "mixed")[1],
  p.adjust.method1 = "none"
)
```

Arguments

`ko_pvalue` data.frame from [ko.test](#), 'KO_id' and 'p.value' columns are required.

`mode` 'mixed' or 'directed' (default, only for two groups differential analysis or multi-groups correlation analysis.), see details in [pvalue2zs](#).

`p.adjust.method1` p.adjust.method for 'ko.test', see [p.adjust](#)

Details

'**mixed**' mode is the original reporter-score method from Patil, K. R. et al. PNAS 2005. In this mode, the reporter score is **undirected**, and the larger the reporter score, the more significant the enrichment, but it cannot indicate the up-and-down regulation information of the pathway! (Liu, L. et al. iMeta 2023.)

steps:

1. Use the Wilcoxon rank sum test to obtain the P value of the significance of each KO difference between the two groups (ie P_{koi} , i represents a certain KO);
2. Using an inverse normal distribution, convert the P value of each KO into a Z value (Z_{koi}), the formula:

$$Z_{koi} = \theta^{-1}(1 - P_{koi})$$

3. 'Upgrade' KO to pathway: Z_{koi} , calculate the Z value of the pathway, the formula:

$$Z_{pathway} = \frac{1}{\sqrt{k}} \sum Z_{koi}$$

where k means A total of k KOs were annotated to the corresponding pathway;

4. Evaluate the degree of significance: permutation (permutation) 1000 times, get the random distribution of $Z_{pathway}$, the formula:

$$Z_{adjustedpathway} = (Z_{pathway} - \mu_k) / \sigma_k$$

μ_k is The mean of the random distribution, σ_k is the standard deviation of the random distribution.

Instead, '**directed**' mode is a derived version of 'mixed', referenced from <https://github.com/wangpeng407/ReporterSc>

This approach is based on the same assumption of many differential analysis methods: the expression of most genes has no significant change.

steps:

1. Use the Wilcoxon rank sum test to obtain the P value of the significance of each KO difference between the two groups (ie P_{koi} , i represents a certain KO), and then divide the P value by 2, that is, the range of (0,1] becomes (0,0.5], $P_{koi} = P_{koi}/2$;

2. Using an inverse normal distribution, convert the P value of each KO into a Z value (Z_{koi}), the formula:

$$Z_{koi} = \theta^{-1}(1 - P_{koi})$$

since the above P value is less than 0.5, all Z values will be greater than 0;

3. Considering whether each KO is up-regulated or down-regulated, calculate *diff_KO*,

$$Z_{koi} = -Z_{koi} \quad (diff_KO < 0),$$

so Z_{koi} is greater than 0 Up-regulation, Z_{koi} less than 0 is down-regulation;

4. 'Upgrade' KO to pathway: Z_{koi} , calculate the Z value of the pathway, the formula:

$$Z_{pathway} = \frac{1}{\sqrt{k}} \sum Z_{koi}$$

where k means A total of k KOs were annotated to the corresponding pathway;

5. Evaluate the degree of significance: permutation (permutation) 1000 times, get the random distribution of $Z_{pathway}$, the formula:

$$Z_{adjustedpathway} = (Z_{pathway} - \mu_k) / \sigma_k$$

μ_k is The mean of the random distribution, σ_k is the standard deviation of the random distribution.

The finally obtained $Z_{adjustedpathway}$ is the Reporter score value enriched for each pathway. In this mode, the Reporter score is directed, and a larger positive value represents a significant up-regulation enrichment, and a smaller negative values represent significant down-regulation enrichment.

However, the disadvantage of this mode is that when a pathway contains about the same number of significantly up-regulates KOs and significantly down-regulates KOs, the final absolute value of Reporter score may approach 0, becoming a pathway that has not been significantly enriched.

Value

ko_stat data.frame

References

1. Patil, K. R. & Nielsen, J. Uncovering transcriptional regulation of metabolism by using metabolic network topology. *Proc Natl Acad Sci U S A* 102, 2685–2689 (2005).
2. Liu, L., Zhu, R. & Wu, D. Misuse of reporter score in microbial enrichment analysis. *iMeta* n/a, e95.
3. <https://github.com/wangpeng407/Reporter>

See Also

Other GRSA: [combine_rs_res\(\)](#), [get_reporter_score\(\)](#), [ko.test\(\)](#), [reporter_score\(\)](#)

Examples

```
data("KO_abundance_test")
ko_pvalue <- ko.test(KO_abundance, "Group", metadata)
ko_stat <- pvalue2zs(ko_pvalue, mode = "directed")
```

<code>reporter_score</code>	<i>One step to get the reporter score of your KO abundance table.</i>
-----------------------------	-----------------------------------------------------------------------

Description

One step to get the reporter score of your KO abundance table.

Usage

```
reporter_score(
  kodf,
  group,
  metadata = NULL,
  method = "wilcox.test",
  pattern = NULL,
  p.adjust.method1 = "none",
  mode = c("directed", "mixed")[1],
  verbose = TRUE,
  feature = "ko",
  type = c("pathway", "module")[1],
  p.adjust.method2 = "BH",
  modulelist = NULL,
  threads = 1,
  perm = 4999,
  min_exist_KO = 3,
  max_exist_KO = 600
)
```

Arguments

<code>kodf</code>	KO_abundance table, rowname are feature ids (e.g. K00001 if feature="ko"; PEX11A if feature="gene"; C00024 if feature="compound"), colnames are samples.
<code>group</code>	The comparison groups (at least two categories) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kodf. And you can use factor levels to change order.
<code>metadata</code>	sample information data.frame contains group
<code>method</code>	the type of test. Default is 'wilcox.test'. Allowed values include:

- `t.test` (parametric) and `wilcox.test` (non-parametric). Perform comparison between two groups of samples. If the grouping variable contains more than two levels, then a pairwise comparison is performed.
- `anova` (parametric) and `kruskal.test` (non-parametric). Perform one-way ANOVA test comparing multiple groups.
- 'pearson', 'kendall', or 'spearman' (correlation), see `cor`.

`pattern` a named vector matching the group, e.g. `c('G1'=1,'G2'=3,'G3'=2)`, use the correlation analysis with specific pattern to calculate p-value.

`p.adjust.method1` `p.adjust.method` for 'ko.test', see `p.adjust`

`mode` 'mixed' or 'directed' (default, only for two groups differential analysis or multi-groups correlation analysis.), see details in `pvalue2zs`.

`verbose` logical

`feature` one of 'ko', 'gene', 'compound'

`type` 'pathway' or 'module' for default KOList for microbiome, 'CC', 'MF', 'BP', 'ALL' for default GOList for homo sapiens. And org in listed in 'https://www.genome.jp/kegg/catalog/org_ such as 'hsa' (if your kodf is come from a specific organism, you should specify type here).

`p.adjust.method2` `p.adjust.method` for the correction of ReporterScore, see `p.adjust`

`modulelist` NULL or customized modulelist dataframe, must contain 'id', 'K_num', 'KOs', 'Description' columns. Take the 'KOList' as example, use `custom_modulelist`.

`threads` default 1

`perm` permutation number, default: 4999.

`min_exist_KO` min exist KO number in a pathway (default, 3, when a pathway contains KOs less than 3, there will be no RS)

`max_exist_KO` max exist KO number in a pathway (default, 600, when a pathway contains KOs more than 600, there will be no RS)

Value

reporter_score object:

<code>kodf</code>	your input KO_abundance table
<code>ko_stat</code>	ko statistics result contains p.value and z_score
<code>reporter_s</code>	the reporter score in each pathway
<code>modulelist</code>	default KOList or customized modulelist dataframe
<code>group</code>	The comparison groups in your data
<code>metadata</code>	sample information dataframe contains group

for the 'reporter_s' in result, whose columns represent:

ID	pathway id
Description	pathway description

K_num	total number of KOs/genes in the pathway
Exist_K_num	number of KOs/genes in your inputdata that exist in the pathway
Significant_K_num	number of kos/genes in your inputdata that are significant in the pathway
Z_score	$Z_{pathway} = \frac{1}{\sqrt{k}} \sum Z_{koi}$
BG_Mean	Background mean, μ_k
BG_Sd	Background standard deviation, σ_k
ReporterScore	ReporterScore of the pathway, $ReporterScore = (Z_{pathway} - \mu_k) / \sigma_k$
p.value	p.value of the ReporterScore
p.adjust	adjusted p.value by p.adjust.method2

See Also

Other GRSA: [combine_rs_res\(\)](#), [get_reporter_score\(\)](#), [ko.test\(\)](#), [pvalue2zs\(\)](#)

Examples

```
message("The following example require some time to run:")

data("KO_abundance_test")
reporter_score_res <- reporter_score(KO_abundance, "Group", metadata,
  mode = "directed", perm = 499
)
head(reporter_score_res$reporter_s)
reporter_score_res2 <- reporter_score(KO_abundance, "Group2", metadata,
  mode = "mixed",
  method = "kruskal.test", p.adjust.method1 = "none", perm = 499
)
reporter_score_res3 <- reporter_score(KO_abundance, "Group2", metadata,
  mode = "directed",
  method = "pearson", pattern = c("G1" = 1, "G2" = 3, "G3" = 2), perm = 499
)
```

reporter_score_res *'reporter_score()' result from KO_abundance_test*

Description

'reporter_score()' result from KO_abundance_test

'reporter_score()' result from KO_abundance_test

Format

a list contain 7 elements.

kodf your input KO_abundance table

ko_stat ko statistics result contains p.value and z_score

reporter_s the reporter score in each pathway

modulelist default Kolist or customized modulelist dataframe

group The compare group (two category) in your data

metadata sample information dataframe contains group

See Also

Other test_data: [KO_abundance](#), [genedf](#)

RSA_by_cm

Reporter score analysis after C-means clustering

Description

Reporter score analysis after C-means clustering

Extract one cluster from rs_by_cm object

Plot c_means result

Usage

```
RSA_by_cm(  
  kodf,  
  group,  
  metadata = NULL,  
  k_num = NULL,  
  filter_var = 0.7,  
  verbose = TRUE,  
  method = "pearson",  
  ...  
)  
  
extract_cluster(rsa_cm_res, cluster = 1)  
  
plot_c_means(  
  rsa_cm_res,  
  filter_membership,  
  mode = 1,  
  show.clust.cent = TRUE,  
  show_num = TRUE,  
  ...  
)
```

Arguments

kodf	KO_abundance table, rowname is ko id (e.g. K00001), colnames is samples.
group	The comparison groups (at least two categories) in your data, one column name of metadata when metadata exist or a vector whose length equal to columns number of kodf. And you can use factor levels to change order.
metadata	sample information data.frame contains group
k_num	if NULL, perform the cm_test_k, else an integer
filter_var	see c_means
verbose	verbose
method	method from reporter_score
...	additional
rsa_cm_res	a cm_res object
cluster	integer
filter_membership	filter membership 0~1.
mode	1~2
show.clust.cent	show cluster center?
show_num	show number of each cluster?

Value

rs_by_cm
reporter_score object
ggplot

See Also

Other C_means: [cm_test_k\(\)](#)

Examples

```
message("The following example require some time to run:")

if (requireNamespace("e1071") && requireNamespace("factoextra")) {
  data("KO_abundance_test")
  rsa_cm_res <- RSA_by_cm(KO_abundance, "Group2", metadata,
    k_num = 3,
    filter_var = 0.7, method = "pearson", perm = 199
  )
  extract_cluster(rsa_cm_res, cluster = 1)
}
```

update_CARDinfo	<i>update CARDinfo from (from 'CARD' database)</i>
-----------------	----------------------------------------------------

Description

update CARDinfo from (from 'CARD' database)

Usage

```
update_CARDinfo(download_dir = NULL, card_data = NULL)
```

Arguments

download_dir	download_dir
card_data	card_data from https://card.mcmaster.ca/download/0/broadstreet-v3.2.8.tar.bz2

Value

No value

update_GOlist	<i>Update the GO2gene files (from 'GO' database)</i>
---------------	------------------------------------------------------

Description

Download links: <http://geneontology.org/docs/download-ontology/> <https://asa12138.github.io/FileList/GO>

Usage

```
update_GOlist(download_dir = NULL, GO_file = NULL)
```

```
update_GOinfo(download_dir = NULL, obo_file = NULL)
```

Arguments

download_dir	download_dir
GO_file	GO_file
obo_file	obo_file from http://current.geneontology.org/ontology/go.obo

Value

No value

 update_KEGG

Update files from 'KEGG'

Description

Download links:

<https://rest.kegg.jp/list/pathway> <https://rest.kegg.jp/link/pathway/ko> <https://rest.kegg.jp/link/pathway/hsa>

<https://rest.kegg.jp/list/module> <https://rest.kegg.jp/link/module/ko> <https://rest.kegg.jp/link/module/hsa>

Usage

```
update_KEGG(download_dir)
```

```
update_KO_file(download_dir, RDSfile = NULL)
```

```
update_htable(type, keg_file = NULL, download = FALSE, download_dir = NULL)
```

```
update_org_pathway(
  org = "hsa",
  RDS_file = NULL,
  download = TRUE,
  download_dir = NULL
)
```

Arguments

download_dir	where to save the .keg file?
RDSfile	saved KO_files.RDS file
type	"ko", "module", "pathway", "compound" ...
keg_file	path of a .keg file, such as ko00001.keg from https://www.genome.jp/kegg-bin/download_htext?htext=ko00001&format=htext .
download	save the .keg file?
org	kegg organism, listed in https://www.genome.jp/kegg/catalog/org_list.html , default, "hsa"
RDS_file	path of a org.RDS file if you saved before.

Value

No value

up_level_KO	<i>Upgrade the KO level</i>
-------------	-----------------------------

Description

Upgrade the KO level

Usage

```
up_level_KO(  
  KO_abundance,  
  level = "pathway",  
  show_name = FALSE,  
  modulelist = NULL,  
  verbose = TRUE  
)
```

Arguments

KO_abundance	KO_abundance
level	one of 'pathway', 'module', 'level1', 'level2', 'level3', 'module1', 'module2', 'module3'.
show_name	logical
modulelist	NULL or customized modulelist dataframe, must contain 'id', 'K_num', 'KOs', 'Description' columns. Take the 'KOlist' as example, use custom_modulelist .
verbose	logical

Value

data.frame

Examples

```
data("KO_abundance_test")  
KO_level1 <- up_level_KO(KO_abundance, level = "level1", show_name = TRUE)
```

Index

- * **C_means**
 - cm_test_k, 3
 - RSA_by_cm, 45
- * **GRSA**
 - combine_rs_res, 4
 - get_reporter_score, 10
 - ko.test, 12
 - pvalue2zs, 40
 - reporter_score, 42
- * **common_enrich**
 - KO_enrich, 14
 - KO_fisher, 15
 - KO_gsa, 16
 - KO_gsea, 17
 - KO_gsva, 18
 - KO_padog, 19
 - KO_safe, 20
 - KO_sea, 21
 - plot_enrich_res, 27
- * **data**
 - Compound_htable, 5
 - CPDlist, 5
 - GOList, 11
 - hsa_kegg_pathway, 11
 - KO_htable, 19
 - KOList, 13
 - mmu_kegg_pathway, 25
 - Module_htable, 26
 - Pathway_htable, 26
- * **modulelist**
 - custom_modulelist, 6
 - custom_modulelist_from_org, 7
 - get_features, 9
- * **test_data**
 - genedf, 9
 - KO_abundance, 13
 - reporter_score_res, 44
- anova, 12, 43
- as.enrich_res (KO_enrich), 14
- c_means (cm_test_k), 3
- c_net_plot, 34
- cm_test_k, 3, 46
- combine_rs_res, 4, 11, 13, 41, 44
- Compound_htable, 5, 5, 11, 13, 19, 25, 26
- cor, 12, 43
- CPDlist, 5, 5, 11, 13, 19, 25, 26
- custom_modulelist, 4, 6, 7, 9, 10, 14, 15, 17, 29, 31–33, 35, 43, 49
- custom_modulelist_from_org, 6, 7, 9
- download_org_pathway (update_KEGG), 48
- export_report_table, 8
- extract_cluster (RSA_by_cm), 45
- gene2ko, 8
- genedf, 9, 13, 45
- get_features, 6, 7, 9
- get_KOs (get_features), 9
- get_org_pathway (update_KEGG), 48
- get_reporter_score, 4, 10, 13, 41, 44
- GOList, 5, 11, 11, 13, 19, 25, 26
- group_box, 29
- GRSA (reporter_score), 42
- GRSA_by_cm (RSA_by_cm), 45
- GSA, 16
- gsva, 18
- hsa_kegg_pathway, 5, 11, 11, 13, 19, 25, 26
- ko.test, 4, 11, 12, 14, 15, 17, 18, 40, 41, 44
- KO_abundance, 9, 13, 45
- KO_enrich, 14, 16–22, 28
- KO_fisher, 15, 15, 17–22, 28
- KO_gsa, 15, 16, 16, 18–22, 28
- KO_gsea, 15–17, 17, 19–22, 28
- KO_gsva, 15–18, 18, 20–22, 28
- KO_htable, 5, 11, 13, 19, 25, 26
- KO_padog, 15–19, 19, 21, 22, 28
- KO_safe, 15–20, 20, 22, 28

- KO_sea, [15–21](#), [21](#), [28](#)
- KOlist, [5](#), [11](#), [13](#), [19](#), [25](#), [26](#)
- kruskal.test, [12](#), [43](#)

- load_CARDinfo, [22](#)
- load_Compound_htable (load_htable), [23](#)
- load_CPDlist (load_htable), [23](#)
- load_GOinfo (load_GOlist), [23](#)
- load_GOlist, [23](#)
- load_htable, [23](#)
- load_KO_desc (load_htable), [23](#)
- load_KO_htable (load_htable), [23](#)
- load_KOlist (load_htable), [23](#)
- load_Module_htable (load_htable), [23](#)
- load_org_pathway (load_htable), [23](#)
- load_Pathway_htable (load_htable), [23](#)

- metadata (KO_abundance), [13](#)
- mmu_kegg_pathway, [5](#), [11](#), [13](#), [19](#), [25](#), [26](#)
- modify_description, [25](#)
- Module_htable, [5](#), [11](#), [13](#), [19](#), [25](#), [26](#), [26](#)

- p.adjust, [10](#), [12](#), [40](#), [43](#)
- padog, [20](#)
- Pathway_htable, [5](#), [11](#), [13](#), [19](#), [25](#), [26](#), [26](#)
- pheatmap, [31](#)
- plot.cm_res, [26](#)
- plot.enrich_res (plot_enrich_res), [27](#)
- plot_c_means (RSA_by_cm), [45](#)
- plot_enrich_res, [15–22](#), [27](#)
- plot_features_box, [28](#)
- plot_features_distribution, [30](#)
- plot_features_heatmap, [31](#)
- plot_features_in_pathway, [32](#)
- plot_features_network, [33](#)
- plot_htable, [34](#)
- plot_KEGG_map, [35](#)
- plot_KOs_box (plot_features_box), [28](#)
- plot_KOs_distribution
 (plot_features_distribution),
 [30](#)
- plot_KOs_heatmap
 (plot_features_heatmap), [31](#)
- plot_KOs_in_pathway
 (plot_features_in_pathway), [32](#)
- plot_KOs_network
 (plot_features_network), [33](#)
- plot_report, [36](#)
- plot_report_bar (plot_report), [36](#)

- plot_report_circle_packing, [37](#)
- plot_significance, [38](#)
- print.reporter_score, [39](#)
- print.rs_by_cm, [39](#)
- pvalue2zs, [4](#), [9–11](#), [13](#), [32](#), [33](#), [35](#), [40](#), [40](#), [43](#),
 [44](#)

- reporter_score, [4](#), [11](#), [13](#), [41](#), [42](#), [46](#)
- reporter_score_res, [9](#), [13](#), [44](#)
- reporter_score_res2
 (reporter_score_res), [44](#)
- RSA (reporter_score), [42](#)
- RSA_by_cm, [3](#), [45](#)

- safe, [21](#)
- SEA, [21](#)

- t.test, [12](#), [43](#)
- transform_modulelist
 (custom_modulelist), [6](#)

- up_level_KO, [49](#)
- update_CARDinfo, [47](#)
- update_GOinfo (update_GOlist), [47](#)
- update_GOlist, [47](#)
- update_htable (update_KEGG), [48](#)
- update_KEGG, [48](#)
- update_KO_file (update_KEGG), [48](#)
- update_org_pathway (update_KEGG), [48](#)

- wilcox.test, [12](#), [43](#)