Package ‘mirIntegrator’

March 21, 2024

Version 1.32.0
Date 2016-07-02
Type Package
Title Integrating microRNA expression into signaling pathways for pathway analysis
Author Diana Diaz <dmd at wayne dot edu>
Maintainer Diana Diaz <dmd@wayne.edu>
Depends R (>= 3.3)
Imports graph, ROntoTools, ggplot2, org.Hs.eg.db, AnnotationDbi, Rgraphviz
Suggests RUnit, BiocGenerics
Description Tools for augmenting signaling pathways to perform pathway analysis of microRNA and mRNA expression levels.
License GPL (>=3)
URL http://datad.github.io/mirIntegrator/
biocViews Network, Microarray, GraphAndNetwork, Pathways, KEGG
NeedsCompilation no
git_url https://git.bioconductor.org/packages/mirIntegrator
git_branch RELEASE_3_18
git_last_commit 236a2ec
git_last_commit_date 2023-10-24
Repository Bioconductor 3.18
Date/Publication 2024-03-20

R topics documented:
augmented_pathways ................................................. 2
GSE43592_miRNA ...................................................... 3
GSE43592_mRNA ...................................................... 4
augmented_pathways

Description

Human signaling KEGG pathways augmented with validated miRNA-target interactions from mirTarBase using the mirIntegrator package. These interactions represent the biological miRNA repression over its target genes and are included in the model as negative links.

Usage

data("augmented_pathways")

Value

A list of graphNEL objects where each graph is a pathway that were augmented with miRNA-target interactions. The name of each pathway is its KEGG pathway identifier.

Source

Generated using the mirIntegrator package. A script that constructs the augmented_pathways object may be found in 'inst/scripts/get_augmented_pathways.R', see the example.

References


See Also

mirTarBase and kegg_pathways
Examples

```r
data(augmented_pathways)
head(augmented_pathways)

script <- system.file("scripts", "get_augmented_pathways.R", 
                      package = "mirIntegrator")
script
readLines(script)
```

---

**GSE43592_miRNA**  
*Top table of preprocessed miRNA of GSE43592 dataset.*

Description

A data frame with the Log fold change and p-value of preprocessed miRNA expression of GSE43592 dataset.

Usage

```r
data(GSE43592_miRNA)
```

Value

A data frame with 881 miRNAs with the following 8 variables: entre, ID, logFC, AveExpr, t, P.Value, adj.P.Val, B.

Source


References


Examples

```r
data(GSE43592_miRNA)
head(GSE43592_miRNA)
```
GSE43592_mRNA  Top table of preprocessed mRNA of GSE43592 dataset.

Description

A data.frame with the Log fold change and p-value of preprocessed mRNA expression of GSE43592 dataset.

Usage

data(GSE43592_mRNA)

Value

A data frame with 19611 mRNAs with the following 8 variables: entre, ID, logFC, AveExpr, t, P.Value, adj.P.Val, B.

Source


References


Examples

data(GSE43592_mRNA)
head(GSE43592_mRNA)

---

integrate_mir  Produce augmented pathways

Description

This function takes each pathway of the input list of signaling pathways and adds the miRNAs that are related to it.
Usage

\texttt{integrate_mir(original\_pathways, targets\_db)}

Arguments

- \texttt{original\_pathways}
  - A list of \texttt{graph::graphNEL} objects where each of the nodes is named with '<gene\_ID>'.
  - Gene IDs used to identify the nodes must be the same gene IDs used to identify the genes on the miRNA-target interactions \texttt{data.frame}, \texttt{targets\_db}. i.e. If the genes are identified by Entrez ID on the \texttt{original\_pathways} \texttt{graph::graphNEL} list, then the \texttt{targets\_db} \texttt{data.frame} must identify the genes by Entrez ID as well. Nodes of each \texttt{graph::graphNEL} represent the genes involved in the pathway and edges represent the biological interactions (activation or repression) among those genes (activation or repression).

- \texttt{targets\_db}
  - A \texttt{data.frame} with columns: 'miRNA' which names the miRNAs and 'Target\_ID' which gives the gene ID of the target gene. The Gene IDs used to identify the 'Target\_ID' column must be the same gene IDs used on the nodes of the \texttt{original\_pathways}. i.e. If the genes are identified by Entrez ID on the \texttt{original\_pathways} \texttt{graph::graphNEL} list, then the \texttt{targets\_db} \texttt{data.frame} must identify the genes by Entrez ID as well.

Value

Gene signaling pathways augmented with miRNA interactions. This is a list of \texttt{graph::graphNEL} objects where each of the nodes is named with '<gene\_ID>'. Nodes of each \texttt{graph::graphNEL} represent genes and miRNAs involved in the pathway and edges represent the biological interactions (activation or repression) among them.

Author(s)

Diana Diaz <dmd at wayne dot edu>

Examples

\begin{verbatim}
data(kegg\_pathways)
data(mirTarBase)
kegg\_pathways <- kegg\_pathways[1:5] #delete this for augmenting all pathways.
augmented\_pathways <- integrate\_mir(kegg\_pathways, mirTarBase)
\end{verbatim}

---

\textbf{Description}

This dataset contains 149 KEGG signaling pathways of human. The original pathways were parsed to a list of \texttt{graphNEL} objects using the ROntoTools package. The original KEGG pathways were published by Kanehisa Laboratories, release 73.0+/01-03, Jan 2015.
Usage

data("kegg_pathways")

Value

A list of graphNEL objects where each graph represents one KEGG signaling pathway. The name of each pathway is its KEGG pathway identifier.

Source

Obtained using the ROntoTools package Version 1.2.0 with KEGG database release 73.0+/01-03, Jan 2015. A script that constructs the kegg_pathways object may be found in 'inst/scripts/get_kegg_pathways.R', see the example.

References


Examples

data(kegg_pathways)
head(kegg_pathways)

script <- system.file("scripts", "get_kegg_pathways.R",
                      package = "mirIntegrator")
script
readLines(script)

mirTarBase

MicroRNA-target interactions in human.

Description

Dataset of miRNA-target interactions in human obtained from mirTarBase release 4.5: Nov. 1, 2013.

Usage

data(mirTarBase)
Format
A data.frame with 39083 interactions and 9 variables. The columns needed for this package are:

- **miRNA**: which contains the miRNA ID,
- **Target.ID**: contains the entrez ID of the gene targeted by the miRNA

Details
This dataset is licensed by its authors (Hsu et al.), see [http://mirtarbase.mbc.nctu.edu.tw/cache/download/LICENSE](http://mirtarbase.mbc.nctu.edu.tw/cache/download/LICENSE).

Value
A data.frame with human miRNA-targets interactions

Source
Downloaded from [http://mirtarbase.mbc.nctu.edu.tw/](http://mirtarbase.mbc.nctu.edu.tw/) on 4/1/2015. A script which downloads the file and constructs the mirTarBase object may be found in 'inst/scripts/get_mirTarBase.R', see the example.

References

Examples
```r
data(mirTarBase)
head(mirTarBase)

script <- system.file("scripts", "get_mirTarBase.R",
                      package = "mirIntegrator")
script
readLines(script)
```

---

**names_pathways**

*List of KEGG signaling pathways' names.*

Description
Names of the KEGG signaling pathways in human obtained with the ROntoTools package. The original KEGG pathways were published by Kanehisa Laboratories, release 73.0+/01-03, Jan 2015.

Usage
data("names_pathways")
Value
A list of KEGG signaling pathways' names.

Source
Obtained using the ROntoTools package Version 1.2.0 with KEGG database release 73.0+/01-03, Jan 2015. A script that constructs the names_pathways object may be found in ‘inst/scripts/get_names_pathways.R’, see the example.

References

Examples

data(names_pathways)
head(names_pathways)

script <- system.file("scripts", "get_names_pathways.R",
                  package = "mirIntegrator")
script
readLines(script)

---

**pathways2pdf**

Export augmented pathways to pdf

Description
This function creates a pdf file with plottings of a list of augmented pathways.

Usage

`pathways2pdf(original_pathways, augmented_pathways, pathway_names, file)`

Arguments

**original_pathways**
A list of graph::graphNEL objects where each of the nodes is named with `<gene_ID>`.
Nodes of each graph::graphNEL represent the genes involved in the pathway and edges represent the biological interactions (activation or repression) among those genes (activation or repression).
plot_augmented_pathway

augmented_pathways
A list of graph::graphNEL objects where each of the nodes is named with '<gene_ID>'. Nodes of each graph::graphNEL represent genes and miRNAs involved in the pathway and edges represent the biological interactions (activation or repression) among them.

pathway_names
A list of names of the pathways named by '<pathway_ID>'.

file
The name of the file where the plots will be saved.

Value
A pdf file with the plottings of the augmented pathways.

Author(s)
Diana Diaz <dmd at wayne dot edu>

Examples

data(augmented_pathways)
data(kegg_pathways)
data(names_pathways)
# The following instruction writes a pdf with three pathways
pathways2pdf(kegg_pathways[18:20], augmented_pathways[18:20],
             names_pathways[18:20], "three_pathways.pdf")
# The following instruction writes a pdf with all the pathways:
# NOTE: It may take time.
# pathways2pdf(kegg_pathways, augmented_pathways,
#             names_pathways, "all_pathways.pdf")

plot_augmented_pathway

Plotting of augmented pathway

Description
Functions for plotting a particular augmented pathway. In the plot, miRNAs that were added to the original pathway are differentiated from proteins that were originally in the pathway. Blue boxes represent the proteins that were part of the original pathway, and black boxes represent the miRNAs that were added during augmentation.

Usage
plot_augmented_pathway(original_pathway, augmented_pathway,
                        pathway_name = " ", ...)
Arguments

original_pathway
A graph::graphNEL object where each of the nodes is named with '<gene_ID>'. Nodes of each graph::graphNEL represent the genes involved in the pathway and edges represent the biological interactions (activation or repression) among those genes.

augmented_pathway
A graph::graphNEL object where each of the nodes is named with '<gene_ID>'. Nodes of each graph::graphNEL represent genes and miRNAs involved in the pathway and edges represent the biological interactions (activation or repression) among them.

pathway_name
The name of the pathway.

... Other arguments for the '<plotPathway2Colors>' function.

Value
A plot of one augmented pathway with the new nodes highlighted in black.

Author(s)
Diana Diaz <dmd at wayne dot edu>

Examples

data(augmented_pathways)
data(kegg_pathways)
data(names_pathways)

plot_augmented_pathway(kegg_pathways[[18]], augmented_pathways[[18]],
                       pathway_name = names_pathways[[18]])

plot_change

Plotting the change in pathways order

Description
Function for plotting a lines plot of the difference in pathways’ order. The resultant plot shows the comparison between the order of the original pathways and the order of the augmented pathways. It also contains a line with the order difference (order of the augmented pathways minus order of the original pathways). The order of a biological pathway is the number of genes that are involved in it.

Usage
plot_change(original_pathways, augmented_pathways, pathway_names, ...)

plot_change
smallest_pathway

Arguments

original_pathways
A list of graph::graphNEL objects where each of the nodes is named with '<gene_ID>'.
Nodes of each graph::graphNEL represent the genes involved in the pathway and edges represent the biological interactions (activation or repression) among those genes (activation or repression).

augmented_pathways
A list of graph::graphNEL objects where each of the nodes is named with '<gene_ID>'.
Nodes of each graph::graphNEL represent genes and miRNAs involved in the pathway and edges represent the biological interactions (activation or repression) among them.

pathway_names
A list of names of the pathways named by '<pathway_ID>'.

... Other arguments for the '<plotLines>' function.

Value
A lines plot of the comparison of pathways order.

Author(s)
Diana Diaz <dmd at wayne dot edu>

Examples

data(augmented_pathways)
data(kegg_pathways)
data(names_pathways)
plot_change(kegg_pathways,augmented_pathways, names_pathways)

smallest_pathway Get the smallest pathway

Description
Find the pathway with the fewer number of nodes among a list of pathways. This simple function is an example of how to navigate the genes on a list of pathways.

Usage

smallest_pathway(pathways)

Arguments

pathways A list of graph::graphNEL objects.
smallest_pathway

Value

The index of the pathway with fewer number of nodes.

Author(s)

Diana Diaz <dmd at wayne dot edu>

Examples

data(augmented_pathways)
smallest_pathway(augmented_pathways)
smallest_pathway
Index

* datasets, pathway, microRNA, miRNA
  augmented_pathways, 2
  * datasets
    GSE43592_miRNA, 3
    GSE43592_mRNA, 4
    kegg_pathways, 5
    mirTarBase, 6
    names_pathways, 7
  augmented_pathways, 2
  GSE43592_miRNA, 3
  GSE43592_mRNA, 4
  integrate_mir, 4
  kegg_pathways, 2, 5
  mirTarBase, 2, 6
  names_pathways, 7
  pathways2pdf, 8
  plot_augmented_pathway, 9
  plot_change, 10
  smallest_pathway, 11