Package ‘rTRM’

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Type Package

Title Identification of transcriptional regulatory modules from PPI networks

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Author Diego Diez

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Maintainer Diego Diez <diego10ruiz@gmail.com>

Description rTRM identifies transcriptional regulatory modules (TRMs) from protein-protein interaction networks.

License GPL-3

LazyLoad yes

ByteCompile yes

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biocViews Transcription, Network, GeneRegulation, GraphAndNetwork

URL https://github.com/ddiez/rTRM

BugReports https://github.com/ddiez/rTRM/issues

NeedsCompilation no

R topics documented:

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rTRM-package

Identification transcription regulatory modules (TRMs)

Description

This package identifies transcriptional regulatory modules (TRMs) from PPI networks.

Details

Package: rTRM
Type: Package
Version: 1.0
Date: 2013-02-01
License: GPL-3

Author(s)

Diego Diez
Maintainer: Diego Diez <diego10ruiz@gmail.com>
**annotateFreq**

**Examples**
```
getAnnotations()
```

<table>
<thead>
<tr>
<th>annotateFreq</th>
<th>Annotate a graph with frequency of nodes/edges in other graphs.</th>
</tr>
</thead>
</table>

**Description**

Returns an annotated graph with node size and edge width proportional at the number of occurrences of nodes/edges in a supplied list of graphs.

**Usage**
```
annotateFreq(g, graph_list)
```

**Arguments**
- `g`: target graph to annotate.
- `graph_list`: list of graph to extract information from.

**Details**

Commonly `graph_list` refers to a list of predicted TRMs (with `findTRM`) and `g` is the combined TRM. This function annotates the nodes/edges in `g` to known their frequency in the original list of graphs.

**Author(s)**

Diego Diez

---

**annotateModule**

**Annotate a network module with information**

**Description**

Uses information about expression, enrichment and parent PPI network to annotate a subgraph.

**Usage**
```
annotateModule(g, enrich, trm, targets, ppi, exprs, tfs)
```

**Arguments**
- `g`: graph to annotate in igraph format.
- `enrich`: list of enriched transcription factors (or motifs).
- `trm`: TRM to compare with (to identify bridges).
- `targets`: list of target transcription factors (typically those with ChIP-seq data).
- `ppi`: parent PPI network (to check membership of nodes).
- `exprs`: list of entrezgene ids representing expressed genes.
- `tfs`: list of transcription factors.
annotateTRM

Annotate a network object with information about clusters.

Description

This function takes a network object and includes cluster information as piecolor attribute, suitable to be plotted with plotTRM().

Usage

annotateTRM(g, target)

Arguments

g
  a network object.

target
  target node (from findTRM())

Author(s)

Diego Diez

biogrid_hs

Network dataset of class ‘igraph’

Description

Human protein-protein interaction (PPI) dataset from the BioGRID database release.

Usage

data(biogrid_hs)

Format

An igraph object.

Author(s)

Diego Diez
biogrid_mm

Network dataset of class ‘igraph’

Description

Mouse protein-protein interaction (PPI) dataset from the BioGRID database.

Usage

data(biogrid_mm)

Format

An igraph object.

Author(s)

Diego Diez

findTRM

Identifies a TRM associated with a target node and one or more query nodes.

Description

This is the main function used to identify TRMs. It takes a graph object and use it to search in the neighborhood of a target node for query nodes that are separated a maximum distance (controlled by max.bridge parameter).

Usage

findTRM(g, target, query, method = "nsa", max.bridge = 1, extended = FALSE, strict = FALSE, type = "igraph")

Arguments

g
  the network used to identify TRMs (typically a PPI network)
target
  character variable with the name of a target node.
query
  character vector with the list of query nodes.
method
  method to use.
max.bridge
  maximum number of nodes allowed between the target and query nodes.
extended
  whether to allow distance restrictions to include both target and query nodes.
strict
  whether to return a single component (using decompose.graph())
type
  type of graph object to return, either an "igraph" (the default) or a "graphNEL"

Details

Currently only "first" and "nsa" methods are available. First is used for tests and returns the first neighborhood of the target node. Method "nsa" implements the TRM finding algorithm.
getAnnotations

Value

A network in igraph format or NULL.

Author(s)

Diego Diez

Examples

# load example network.
load(system.file(package = "rTRM", "extra/example.rda"))

# define target and query nodes.
target = "N6"
query = c("N7", "N12", "N28")

# find TRM:
s = findTRM(g, target = target, query = query, method = "nsa", max.bridge = 1)

getAnnotations

Obtain the 'pwm' table fromt the database, containing PWM's annotations.

Description

Obtain the 'pwm' table fromt the database, containing PWM's annotations.

Usage

getAnnotations(filter, dbname = NULL)

Arguments

filter       one or more PWM ids.
dbname       the location of the database (to load custom databases).

Author(s)

Diego Diez

Examples

ann = getAnnotations()
getBiogridData  

**Downloads network data from BioGRID in TAB2 format.**

**Description**
This function is used to generate igraph network objects from BioGRID data. It downloads the database into a data.frame object that can be used later with processBiogrid().

**Usage**
getBiogridData(release)

**Arguments**
- **release**: release of BioGRID to download.

**Details**
The release to download must be specified as currently there is no way to download automatically the latests release.

**Value**
An data.frame object.

**Author(s)**
Diego Diez

getConcentricList  

**Returns a list with nodes membership to be used in a graph with a concentric layout**

**Description**
Specify target and enriched motifs and returns a list with circle membership. This information is used by layout.concentric to position the nodes in plots.

**Usage**
getConcentricList(g, t, e, max.size = 60, order.by = "label")

**Arguments**
- **g**: graph to layout (extract the nodes).
- **t**: list of target nodes (will go in the center).
- **e**: list of enriched nodes (will go in the periphery).
- **max.size**: maximum number of nodes per layer.
- **order.by**: ordering attribute for list before split.
getLargestComp

**Description**

Returns the largest connected component from a graph.

**Usage**

getLargestComp(g)

**Arguments**

- **g**: an igraph object.

**Author(s)**

Diego Diez

---

getMaps

**Description**

Obtain the mapping between PWM and Entrez Gene identifiers.

**Usage**

getMaps(filter, dbname = NULL)

**Arguments**

- **filter**: vector of PWMs to filter results.
- **dbname**: 

**Author(s)**

Diego Diez

**Examples**

getMaps()
getMatrices

Obtain a list of PWMs.

Description

Returns a list of PWMs, by default all the PWMs in the database. Alternatively, filtered by the ids provided by filter.

Usage

getMatrices(filter, dbname = NULL)

Arguments

filter

list of PWMs to filter results.

dbname

Author(s)

Diego Diez

Examples

pwms = getMatrices()

getMotifsFromEntrezgene

Retrieve PWMs associated with genes provided as entrezgene identifiers.

Description

Retrieve PWMs associated with genes provided as entrezgene identifiers.

Usage

getMotifsFromEntrezgene(e, organism)

Arguments

e

vector of entrezgene identifiers to retrieve exiting PWMs.

organism

target organism.

Author(s)

Diego Diez
getMotifsFromSymbol  
Retrieve PWMs associated with genes provided as symbol.

Description
Retrieve PWMs associated with genes provided as symbol.

Usage
getMotifsFromSymbol(s, organism)

Arguments
s  vector of gene symbols.
organism  target organism.

Author(s)
Diego Diez

getOrthologFromMatrix  
Obtain gene identifiers for a target organism associated with a list of PWMs.

Description
Obtain gene identifiers for a target organism associated with a list of PWMs.

Usage
getOrthologFromMatrix(filter, organism = "human", dbname = NULL)

Arguments
filter  vector of matrices to filter results.
organism  target organism.
dbname  database- usually not need to specify.

Author(s)
Diego Diez
getOrthologs

Obtain the mapping to Entrez Gene identifiers in the given organism.

Description
Obtain the mapping to Entrez Gene identifiers in the given organism.

Usage
getOrthologs(filter, organism, dbname = NULL)

Arguments
- `filter` entrezgene identifiers for the original mapping (PWM to gene). These belong to diverse species and correspond to the "entrezgene" column obtained with getMaps() function.
- `organism` target organisms, currently supported "human" and "mouse"
- `dbname`

Details
If organism is not specified the entire table of orthologs (with all supported species) is returned.

Value
A data.frame object with ortholog information.

Author(s)
Diego Diez

Examples
getOrthologs(organism = "human")

getOrthologsFromBiomart

Returns ortholog genes for a target organism

Description
Returns ortholog genes for a target organism

Usage
getOrthologsFromBiomart(eg, target_org, mart)
**getSimilarityMatrix**

**Arguments**

- **eg** list of entrezgene ids to obtain orthologs.
- **target_org** target organism.
- **mart** mart object.

**Author(s)**

Diego Diez

---

**getSequencesFromGenome**

Retrieves a set of sequences from a BSgenome object and optionally appends a label to each sequence id.

**Description**

This is just a wrapper to getSeq() in package Biostrings that facilitates adding a label to each sequence.

**Usage**

getSequencesFromGenome(BED, genome, append.id)

**Arguments**

- **BED** file with peak locations in BED format.
- **genome** a BSgenome object (e.g. Mmusculus)
- **append.id** optional label to append to each sequence id.

**Author(s)**

Diego Diez

---

**getSimilarityMatrix** Compute similarity matrix of list of graphs.

**Description**

This function computes pair-wise similarity based on common nodes (default) or edges between the graphs passed as a list.

**Usage**

getSimilarityMatrix(g_list, type = "edges")

**Arguments**

- **g_list** list of graph objects.
- **type** type of similarity, either node or edge (default).
getTFclass

Author(s)
Diego Diez

getTFclass

Description
Return the ontology in the TFclass database associated with an entrezgene identifier.

Usage
getTFclass(dbname = NULL)

Arguments
dbname SQLite file to use as database.

Author(s)
Diego Diez

getTFclassFromEntrezgene

Description
Applies getTFclass sequentially to a vector of entrezgene identifiers.

Usage
getTFclassFromEntrezgene(x, subset = "Class", tfclass, dbname = NULL)

Arguments
x vector of entrezgene identifiers.
subset level in the ontology (subset in TFclass terminology. By default "Class")
tfclass data.frame with tfclass data to pass to the recursive function.
dbname SQLite file to use as database.

Author(s)
Diego Diez
getTfTerms

*Get terms associated with a specified TFclass subset.*

**Description**

Returns a vector of names (not ids) with the members of a particular subset in the TFclass database. By default it returns the Class subset.

**Usage**

```r
getTfTerms(subset = "Class", dbname = NULL)
```

**Arguments**

- `subset`: a subset in TFclass (default Class).
- `dbname`: SQLite file to use as database.

**Author(s)**

Diego Diez

---

initBiomart

*Initializes mart objects to identify ortholog genes*

**Description**

Initializes mart objects to identify ortholog genes

**Usage**

```r
initBiomart(filter, biomart = "ensembl", host)
```

**Arguments**

- `filter`: list of supported organisms
- `biomart`: biomart
- `host`

**Author(s)**

Diego Diez
### layout.arc

*Layouts a graph using arcs.*

**Description**

Generates a layout for graphs that places in the center the target transcription factors, in the sides the enriched transcription factors and in between of them the bridge proteins.

**Usage**

```r
layout.arc(g, target, query)
```

**Arguments**

- `g`: the graph object to layout.
- `target`: list of target nodes (typically target transcription factors.)
- `query`: list of query nodes (typically enriched transcription factors.)

**Value**

A matrix with the x and y locations of each node in the target graph.

**Author(s)**

Diego Diez

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### layout.concentric

*Generates a concentric layout for graphs*

**Description**

Generates a matrix with x,y coordinates for each node in a target graph, which layouts the nodes using concentric circles.

**Usage**

```r
layout.concentric(g, concentric = NULL, radius = NULL, order.by)
```

**Arguments**

- `g`: graph (igraph) to layout.
- `concentric`: list with the components of each layer.
- `radius`: radious of each layer.
- `order.by`: graph attributes to order nodes by.

**Author(s)**

Diego Diez
plotDegree

Plot degree distribution for network nodes

Description
Plots the degree distribution and fits a power law, returning in the legend the values of the fitted parameters.

Usage
plotDegree(g)

Arguments
- **g**: igraph object

Author(s)
Diego Diez

plotGraph

Plot an graph in igraph format.

Description
This function plots graphs of the class igraph.

Usage
plotGraph(g, layout = layout.fruchterman.reingold, mar = .5, vertex.pch = 21, vertex.cex, vertex.col, vertex.bg, ... = TRUE, label.col, label.cex, label.pos = NULL, label.offset = 1.5, adjust.label.col = FALSE, normalize.layout = TRUE)

Arguments
- **g**: a network object.
- **layout**: graph layout, either a function or the output of a layout function.
- **mar**: plot margin.
- **vertex.pch**: node size.
- **vertex.cex**: node size.
- **vertex.col**: node line color.
- **vertex.bg**: node background color.
- **vertex.lwd**: node line width.
- **edge.col**: edge color.
- **edge.lwd**: edge line width.
- **edge.lty**: edge line type.
- **label**: logical; whether to plot labels.
- **label.col**: label color.
plotTRM

label.cex  label expansion.
label.pos  label position.
label.offset  label offset.
adjust.label.col  whether to automatically adjust label color depending on the luminance of the node’s color/s.
normalize.layout  whether to apply layout.norm (with limits xmin=-1, xmax=1, ymin=-1, ymax=1) to the layout.

Author(s)
Diego Diez

plotTRM

Plot an annotated TRM.

Description
This function plots the output findTRM() after it has been annotated with cluster information with annotateTRM() function. Cluster membership is plotted using a pie plot.

Usage
plotTRM(g, layout = layout.fruchterman.reingold, mar = .5, vertex.col, vertex.cex, vertex.lwd, edge.col, edge.lwd, edge.lty, label = TRUE, label.cex, label.col, label.pos = NULL, label.offset = 1.5, adjust.label.col = FALSE, normalize.layout = TRUE)

Arguments
g  a network object with cluster information (attribute piecolor).
layout  graph layout, either a function or the output of a layout function.
mar  plot margin.
vertex.col  node color.
vertex.cex  node size.
vertex.lwd  node border line width.
edge.col  edge color.
edge.lwd  edge line width.
edge.lty  edge line type.
label  logical; whether to plot labels.
label.cex  label expansion.
label.col  label color.
label.pos  label position.
label.offset  label offset.
adjust.label.col  whether to automatically adjust label color depending on the luminance of the node’s color.
normalize.layout  whether to apply layout.norm (with limits xmin=-1, xmax=1, ymin=-1, ymax=1) to the layout.
processBiogrid

Author(s)
Diego Diez

plotTRMlegend  
Plot the legend of a TRM with information about the cluster families.

Description
This function just plots a legend with the cluster membership of the provided list of genes. The legend includes the most prominent families of each cluster and there is some name polishing as well.

Usage
```r
plotTRMlegend(x, title = NULL, cex = 1)
```

Arguments
- `x`: list of family names or igraph object.
- `title`: title for the legend.
- `cex`: numeric value controlling the size of the legend's text.

Author(s)
Diego Diez

processBiogrid  
Process a data.frame with BioGRID data into a network for a target organism

Description
Process a data.frame with BioGRID data into a network for a target organism.

Usage
```r
processBiogrid(dblist, org = "human", simplify = TRUE, type = "physical", mimic.old = FALSE)
```

Arguments
- `dblist`: data.frame containing the BioGRID data.
- `org`: target organism (default: "human")
- `simplify`: whether to eliminate redundant edges (default: TRUE)
- `type`: type of interaction (physical or genetic) to include (default: "physical")
- `mimic.old`: mimic old behavior of processBiogrid() when interactions for multiple species could be retrieved. Used only for testing.


**Value**

An igraph object.

**Author(s)**

Diego Diez

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**removeVertices**

*Remove nodes from a graph and returns the largest component*

**Description**

Remove nodes from a graph and returns the largest component

**Usage**

`removeVertices(g, filter, keep.hanging = FALSE)`

**Arguments**

- `g`  
  graph to remove nodes.
- `filter`  
- `keep.hanging`  
  (logical) whether to return the largest component or not.

**Author(s)**

Diego Diez

---

**writeTRMreport**

*Export a table with TRM nodes and associated information.*

**Description**

This function generates a data.frame with the nodes in the provided graph and associated annotations.

**Usage**

`writeTRMreport(graph, file, organism, target, query, sort.by = "symbol")`

**Arguments**

- `graph`  
  a graph object.
- `file`  
  file name.
- `organism`  
  organisms for the annotations.
- `target`  
  target transcription factor.
- `query`  
  query transcription factors.
- `sort.by`  
  order the columns of the data.frame by (default: "symbol").
Author(s)

Diego Diez.
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