Package 'mully'

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Type Package

Title Create, Modify and Visualize Multi-Layered Networks

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Description Allows the user to create graph with multiple layers. The user can also modify the layers, the nodes, and the edges. The graph can also be visualized.
Zaynab Hammoud and Frank Kramer (2018) ¡doi:10.3390/genes9110519¿.
More about multilayered graphs and their usage can be found in our review paper:
Zaynab Hammoud and Frank Kramer (2020) ¡doi:10.1186/s41044-020-00046-0¿.

URL https://github.com/frankkramer-lab/mully

BugReports https://github.com/frankkramer-lab/mully/issues

License GPL (¿= 2)

Encoding UTF-8

RoxygenNote 7.1.1

Imports igraph, rgl, randomcoloR, shape

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

R topics documented:

`mully-package`   *The mully package*

Description

R package to create, modify and visualize graphs with multiple layers.

Introduction

Network theory has been used for many years in the modeling and analysis of complex systems, as epidemiology, biology and biomedicine . As the data evolves and becomes more heterogeneous and complex, monoplex networks become an oversimplification of the corresponding systems. This imposes a need to go beyond traditional networks into a richer framework capable of hosting objects and relations of different scales, called Multilayered Network **Mully**, **mul****ti****l**a**y**er networks, is an R package that provides a multilayer network framework. Using this package, the user can create, modify and visualize graphs with multiple layers. This package is an extension to the [igraph package](https://github.com/igraph/rigraph) that provides a monolayer graph framework. The package is implemented as a part of [the Multipath Project](https://www.sys-med.de/en/junior-research-groups/multipath/) directed by [Dr. Frank Kramer](https://www.uni-augsburg.de/de/fakultaet/fai/informatik/prof/misit/mitarbeiter/)

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Creating graphs

mully, addLayer, addNode, addEdge, removeLayer, removeNode, removeEdge, getNodeAttributes, getEdgeAttributes

Visualization

plot.mully, plot3d

Further information

More information and references can be found in the mully paper:

https://www.mdpi.com/2073-4425/9/11/519

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addEdge *Add an edge*

Description

Add an edge

Usage

```
addEdge(g, nodeStart, nodeDest, attributes)
```

Arguments

g   The input graph

nodeStart   The first endpoint of the edge

nodeDest   The second endpoint of the edge

attributes   The attributes to assign to the edge

Value

The graph, with the added edge

Examples

```
g=mully::demo()
addEdge(g,"dr3","g2",attributes=list(name="newEdge"))
```

---

addLayer *Add a layer or a set of layers to a graph*

Description

Add a layer or a set of layers to a graph

Usage

```
addLayer(g, nameLayer)
```

Arguments

g   The input graph.

nameLayer   The name or the list of the names of the layers to be added. The layer
               names must be unique.

Value

The graph, with the layers added.

Examples

```
g = mully("MyFirstMully",direct = FALSE)
g = addLayer(g, c("Gene", "Drug", "Disease"))
```

---

addNode *Add a node with assigned layer and attributes to a graph*

Description

Add a node with assigned layer and attributes to a graph

Usage

```
addNode(g, nodeName, layerName, attributes = NA)
```

Arguments

g	The input graph.
nodeName	The name of the node to add.
layerName	The name of the layer to be assigned to the node.
attributes	The attributes of the node to add. This argument must be a named list.

Value

The graph, with the new node.

Examples

```
g=mully::demo()
attributes=list("specie"="Homo Sapiens")
addNode(g = g,nodeName = "g3",layerName = "Gene",attributes = attributes)
```

---

demo *A demo function to test the package*

Description

A demo function to test the package

Usage

```
demo()
```

Value

A mully graph

exportCSV	*Export mully into CSV files*

Description

Export mully into CSV files

Usage

```
exportCSV(g, target)
```

Arguments

g	The input graph
target	The target file in which the files will be generated. By default the WD.

Examples

```
## Not run:
g=mully::demo()
exportCSV(g)

## End(Not run)
```

getEdgeAttributes	*Get the attributes of the edges connecting two nodes*

Description

Get the attributes of the edges connecting two nodes

Usage

```
getEdgeAttributes(g, nodeStart, nodeDest)
```

Arguments

g	The input graph
nodeStart	The first endpoint of the edge
nodeDest	The second endpoint of the edge

Value

A dataframe containing the edges with their attributes. If both nodes' arguments are missing, it returns all the edges with their attributes.

Examples

```
g=mully::demo()
#Print all Edges
getEdgeAttributes(g)
#Get a Single Edge
getEdgeAttributes(g,"d2","g1")
```

---

getIDEdge   *Get the ids of the edges connecting two nodes*

Description

Get the ids of the edges connecting two nodes

Usage

```
getIDEdge(g, nodeStart, nodeDest)
```

Arguments

g	The input graph
nodeStart	The first endpoint of the edge
nodeDest	The second endpoint of the edge

Value

A list containing the ids of the edges connecting the nodes

Examples

```
g=mully::demo()
getIDEdge(g,"d2","dr1")
```

---

getIDNode   *Get the id of a node*

Description

Get the id of a node

Usage

```
getIDNode(g, nameNode)
```

Arguments

g	The input graph
nameNode	The name of the node

Value

The id of the specified node

Examples

```
g=mully::demo()
getIDNode(g,"g1")
```

---

getLayer   *Get the nodes on a layer in a graph*

Description

Get the nodes on a layer in a graph

Usage

```
getLayer(g, nameLayer)
```

Arguments

g   The input graph.

nameLayer   The name of the layer.

Value

A List of the nodes on the given layer.

Examples

```
g = mully::demo()
getLayer(g,"gene")
```

---

getLayersCount   *Get the number of layers in a graph*

Description

Get the number of layers in a graph

Usage

```
getLayersCount(g)
```

Arguments

g   The input graph.

Value

The count of the layers.

Examples

```
g = mully("MyFirstMully",direct = FALSE)
g = addLayer(g, c("Gene", "Drug", "Disease"))
getLayersCount(g)
```

---

getNode *Get a node from a graph*

Description

Get a node from a graph

Usage

```
getNode(g, nameNode)
```

Arguments

g	The input graph.
nameNode	The name of the node.

Value

The node as igraph.vs

Examples

```
g=mully::demo()
getNode(g,"g1")
```

---

getNodeAttributes *Get the attributes of a node*

Description

Get the attributes of a node

Usage

```
getNodeAttributes(g, nameNode, layerByName = FALSE)
```

Arguments

g	The input graph
nameNode	The name of the node
layerByName	A boolean to specify whether to export the layers by name or by ID

Value

A dataframe containing the attributes of the specified node

Examples

```
g=mully::demo()
getNodeAttributes(g,layerByName = TRUE)
```

---

importEdgesCSV	*Import Edges to a mully graph from a CSV file*

Description

Import Edges to a mully graph from a CSV file

Usage

```
importEdgesCSV(g, file)
```

Arguments

g	The mully graph to which the nodes will be added. The graph should already have the layers and the nodes.
file	The path to the CSV file containing the edges' information

Value

The mully graph with the added edges

---

importGraphCSV	*Import a mully graph from CSV files*

Description

Import a mully graph from CSV files

Usage

```
importGraphCSV(name, direct = FALSE, layers, nodes, edges)
```

Arguments

name	The name of the graph
direct	A boolean to indicate if the graph is directed or not
layers	The path to the CSV file containing the layers' information
nodes	The path to the CSV file containing the nodes' information
edges	The path to the CSV file containing the edges' information

Value

A new mully graph

---

importLayersCSV	*Import Layers to a mully graph from a CSV file*

Description

Import Layers to a mully graph from a CSV file

Usage

```
importLayersCSV(g, file)
```

Arguments

g	The mully graph to which the layers will be added. If missing, a new mully graph is created
file	The path to the CSV file containing the layers' information

Value

The mully graph with the added layers

---

importNodesCSV	*Import Nodes to a mully graph from a CSV file*

Description

Import Nodes to a mully graph from a CSV file

Usage

```
importNodesCSV(g, file, name = "name")
```

Arguments

g	The mully graph to which the nodes will be added. The graph should already have the layers.
file	The path to the CSV file containing the nodes' information
name	The name of the column containing the names of the nodes

Value

The mully graph with the added nodes

`is.mully`	*Is this a mully graph?*

Description

Is this a mully graph?

Usage

```
is.mully(g)
```

Arguments

g   The input graph

Value

A boolean whether the graph is or not a mully object

`isLayer`	*Verify if the layer exists in a graph*

Description

Verify if the layer exists in a graph

Usage

```
isLayer(g, name)
```

Arguments

g   The input graph.

name   The name of the layer.

Value

A boolean value.

Examples

```
g = mully("MyFirstMully",direct = FALSE)
g = addLayer(g, c("Gene", "Drug", "Disease"))
isLayer(g,"Drug")
```

---

merge   *Merge or unite two graphs*

Description

Merge or unite two graphs

Usage

```
merge(g1, g2)
```

Arguments

g1   The first graph to merge. This is the base of the merge.

g2   The second graph to merge. All of its elements are added to the first
                graph.

Value

The merge of the two graphs. The merge is based on the first given graph

---

mully   *Create an empty multilayered graph*

Description

Create an empty multilayered graph

Usage

```
mully(name = NA, direct = TRUE)
```

Arguments

name   The name to be assigned to the graph.

direct   A boolean value, if the graph is directed or not. By default TRUE.

Value

The created multilayered graph.

Examples

```
g = mully("MyFirstMully",direct = FALSE)
```

---

plot.mully *Plot the graph in 2D*

Description

Plot the graph in 2D

Usage

```
## S3 method for class 'mully'
plot(x, layout, ...)
```

Arguments

x	The input graph
layout	The layout. Can either be random or scaled
...	Other arguments to be passed to plot.igraph

Examples

```
g=mully::demo()
plot(g,"Scaled")
```

---

plot3d *Plot the graph in 3D using rgl*

Description

Plot the graph in 3D using rgl

Usage

```
plot3d(
  g,
  layers = TRUE,
  vertex.label = NA,
  vertex.label.color = NA,
  vertex.plac = "circle",
  edge.color = NA,
  edge.width = 5,
  edge.arrow.size = 10,
  edge.arrow.width = 1
)
```

Arguments

`g`	The input graph
`layers`	A boolean whether to add the layers or not
`vertex.label`	The vertices' labels
`vertex.label.color`	
	The vertices' colors. If not specified, the colors will be chosen randomly
`vertex.plac`	The placement form of the vertices on the layer. Can either be "circle" which will place them on a circle, or "disc" which will place them randomly on a disc. The default is "circle"
`edge.color`	The edges' colors. If not specified, inter-edges are black, and intra-edges have the same color as the nodes on the layer
`edge.width`	The edge width. Default set to 5.
`edge.arrow.size`	
	The edges' arrow size. Default set to 10
`edge.arrow.width`	
	The edges' arrow width. Default set to 1

Note

This function can take the following arguments supported and not ignored by rglplot: vertex.label, vertex.label.color, edge.color, edge.width, edge.arrow.size,edge.arrow.width.

Examples

```
g=mully::demo()
labels=getNodeAttributes(g)$name
plot3d(g, layers=TRUE, vertex.label=labels,edge.width=6)
```

---

print.mully	*Print function*

Description

Print function

Usage

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

Arguments

`x`	The input graph
`...`	Other arguments to be passed to `print`

Examples

```
g=mully::demo()
print(g)
```

---

removeEdge *Delete an edge*

Description

Delete an edge

Usage

```
removeEdge(g, nodeStart, nodeDest, attributes = NA, multi = FALSE)
```

Arguments

g	The input graph
nodeStart	The first endpoint of the edge
nodeDest	The second endpoint of the edge
attributes	The attributes of the edge to delete. Required if the nodes are multi-connected
multi	A boolean. Specifies whether to delete multiple edges or not, in case they exist.

Value

The graph with the deleted edges

Examples

```
g=mully::demo()
removeEdge(g,"dr1","d2",multi=TRUE)
```

---

removeLayer *Delete a layer or a set of layers from a graph*

Description

Delete a layer or a set of layers from a graph

Usage

```
removeLayer(g, name, trans = FALSE)
```

Arguments

g	The input graph.
name	The name or the list of the names of the layers to be deleted.
trans	A boolean whether to insert transitive edges or not

Value

The graph, with the given layer and its corresponding nodes and edges removed.

Examples

```
g = mully::demo()
removeLayer(g,"gene",trans=TRUE)
```

---

removeNode   *Delete a node or a set of nodes from a graph*

Description

Delete a node or a set of nodes from a graph

Usage

```
removeNode(g, name, trans = FALSE)
```

Arguments

g	The input graph.
name	The name or the list of names of the nodes to be deleted.
trans	A boolean whether to insert transitive edges or not

Value

The graph, with the nodes deleted.

Examples

```
g=mully::demo()
removeNode(g,"dr1",trans=TRUE)
```

Index