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Description Functions for computing, comparing and demonstrating top informative centrality measures within a network.

License GPL-3

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calculate_centralities

Centrality measure calculation

Description

This function computes multitude centrality measures of an igraph object.

Usage

```
calculate_centralities(x, except = NULL, include = NULL, weights = NULL)
```

Arguments

x	the component of a network as an igraph object
except	A vector containing names of centrality measures which could be omitted from the calculations.
include	A vector including names of centrality measures which should be computed.
weights	A character scalar specifying the edge attribute to use.(default=NULL)

Details

This function calculates various types of centrality measures which are applicable to the network topology and returns the results as a list. In "except" argument, you can specify centrality measures which is not necessary to calculate.

Value

A list concluding centrality measure values in which the columns indicate centralities and the rows show the vertices.

Author(s)

Mino Ashtiani, Mohieddin Jafari

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See Also

[alpha centrality](#), [bonpow](#), [constraint](#), [centr_degree](#), [eccentricity](#), [eigen centrality](#), [coreness](#), [authority_score](#), [hub_score](#), [transitivity](#), [page_rank](#), [betweenness](#), [subgraph centrality](#), [flowbet](#), [infocent](#), [loadcent](#), [stresscent](#), [topocoefficient](#), [closeness.currentflow](#), [closeness.latora](#), [communibet](#), [communitycent](#), [crossclique](#), [entropy](#), [epc](#), [laplacian](#), [leverage](#), [mnc](#), [hubbell](#), [semilocal](#), [closeness.vitality](#), [closeness.residual](#), [lobby](#), [markovcent](#), [radiality](#), [lincen](#), [geokpath](#), [katzcent](#), [diffusion.degree](#), [dmnc](#), [centroid](#), [closeness.freeman](#), [clusterrank](#), [decay](#), [barycenter](#), [bottleneck](#), [averagedis](#)

Examples

```
data("zachary")
p <- proper_centralities(zachary)
calculate_centralities(zachary, include = "Degree Centrality")
```

cortex

Macaque Visual Cortex Network

Description

A graph describing the macaque visual cortex network. Nodes are neocortical areas, 25 of them are participated in visual function in the macaque, and 7 of which are associated with them

Usage

```
data("cortex")
```

Format

an igraph object with "gml" format

References

D.J. Felleman and D.C. van Essen, "Distributed hierarchical processing in the primate cerebral cortex." *Cerebral Cortex* 1(1), 1-47 (1991).

Examples

```
data("cortex")
print(cortex)
```

`drugtarget`*Drug Target Network*

Description

A bipartite graph extracted from DrugBank 1.0 database. The network includes two set of nodes including Food and Drug Administration (FDA)-approved drugs and their corresponding protein targets designated by their Uniprot ID. The 1080 drugs and their 519 target proteins are connected via 3766 interactions. Please note that it is a shrunken network in which metabolizing enzymes, carriers and transporters associated with drug metabolism are filtered and solely targets directly related to their pharmacological effects are included. It is also an example of unconnected graphs.

Usage`drugtarget`**Format**

an igraph object with "gml" format

References

Barneh, F., Jafari, M., & Mirzaie, M. (2015). Updates on drug–target network; facilitating polypharmacology and data integration by growth of DrugBank database. Briefings in Bioinformatics, bbv094. <https://doi.org/10.1093/bib/bbv094>

Examples

```
data("drugtarget")
print(drugtarget)
```

`giant_component_extract`*Giant component extraction of a graph*

Description

This function extracts the largest connected or the giant component of the input graph which can be an "igraph" object or a "network" object and convert them as "igraph" objects. For the bipartite graph, this will apply projection before extracting the components.

Usage

```
giant_component_extract(x, directed = TRUE, bipartite_proj = FALSE,
  num_proj = 1)
```

Arguments

x	An igraph or a network object
directed	Whether to create a directed graph(default=TRUE)
bipartite_proj	Whether the bipartite network must be projected or not(default=FALSE)
num_proj	A number which shows the number of projects especially for bipartite graphs.(default=1)

Details

This function distinguishes the largest component of an "igraph" or a "network" object and illustrates them as a list which contains the edgelist of the giant component. If the input graph was bipartite and the "bipartite_proj" was TRUE, it will project it and you can decide to which project you want to continue to work with that.

Value

the giant componet of the input as igraph object

Author(s)

Minoo Ashtiani, Mohieddin Jafari

References

Newman, M. (2010). Networks. Oxford University Press.

See Also

[induced.subgraph,clusters](#)

Examples

```
# a graph with 4 vertices  
  
data(zachary)  
giant_component_extract(zachary)
```

graph_extract_components

Component extraction of a graph

Description

This function extracts all connected components of the input which can be an "igraph" object or a "network" object and convert them as "igraph" objects.

Usage

```
graph_extract_components(x, directed = TRUE, bipartite_proj = FALSE,  
  num_proj = 1)
```

Arguments

x	An igraph or a network object
directed	Whether to create a directed graph(default=TRUE)
bipartite_proj	Whether the bipartite network must be projected or not(default=FALSE)
num_proj	Numbers 1 or 2 which shows the number of projects for bipartite graphs.(default=1)

Details

This function separates different components of an "igraph" or a "network" object and illustrates them as a list of independent graphs. If the input graph was bipartite and the "bipartite_proj" was TRUE, it will project it and you can decide in which project you want to continue to work with.

Value

a list including the components of the input as igraph objects

Author(s)

Mino Ashtiani, Mohieddin Jafari

See Also

[induced.subgraph](#), [components](#)

Examples

```
data(zachary)  
graph_extract_components(zachary)
```

kangaroo

Kangaroo Network

Description

An undirected graph based on interactions between free-ranging grey kangaroos. A node displays a kangaroo and an edge between two kangaroos demonstrates an interaction. The weights indicate the total count of interactions.

Usage

```
kangaroo
```

Format

an igraph object with "gml" format

References

Kangaroo network dataset – KONECT, October 2016.

TR Grant. Dominance and association among members of a captive and a free-ranging group of grey kangaroos (*Macropus giganteus*). *Animal Behaviour*, 21(3):449–456, 1973.

Examples

```
data("kangaroo")
print(kangaroo)
```

```
misc_extract_components
```

Component extraction of miscellaneous graph formats

Description

This function extracts all components of the input with various formats and convert them as "igraph" objects.

Usage

```
misc_extract_components(x, directed = TRUE, mode = "directed",
  weighted = NULL, unibipartite = FALSE, diag = TRUE)
```

Arguments

<code>x</code>	The input could be an edgelist and an adjacency matrix
<code>directed</code>	Whether to create a directed graph.(default=TRUE)
<code>mode</code>	Character scalar, explain how should demonstrate the supplied matrix. Possible values are: directed, undirected, upper, lower, max, min, plus.(default="directed")
<code>weighted</code>	An argument for specifying whether the graph should be weighted or not. If it is NULL then an unweighted graph is created.(default=NULL)
<code>unibipartite</code>	A boolean parameter describing whether the input edge list is corresponding to a bipartite graph. TRUE value specifies the bipartite graph and vice versa.(default=FALSE)
<code>diag</code>	Logical scalar, whether to consider the diagonal of the matrix or not. If it was FALSE then the diagonal spotted as zeros.(default=TRUE)

Details

This function assert components of the input object which can be an edgelist, an adjacency matrix and a graphNEL object. The result would be a list including components as seperated graphs.

Value

a list including the componets of the input as igraph objects

Author(s)

Mino0 Ashtiani, Mohieddin Jafari

See Also

[induced.subgraph,components,graph_from_adjacency_matrix](#)

pca_centralities

Ranking centrality measure based on contributions

Description

This function demonstrates ranks of centrality measures in order of information levels.

Usage

```
pca_centralities(x, scale.unit = TRUE, cut.off = 80, ncp = 5,
  graph = FALSE, axes = c(1, 2))
```

Arguments

x	a list containg the computed centrality values
scale.unit	a boolean constant, whether data should be scaled to unit variance(default=TRUE)
cut.off	The intensity that must be exceeded in cumulative percentage of variance of eigen values.(default=80)
ncp	number of dimensions in final results (default=5)
graph	a boolean constant, whether the graph shoul be displayed
axes	a length 2 vector describing the number of components to plot(default=c(1,2))

Details

This function represents centralities in the ranking list based on variable contribution to make principal components. PCA is a method for drawing out important variables from a data set. It helps user to reduced the dimensions in high dimensional data. It is more common to use for more than 3 dimensional datasets.

Value

a plot illustrating significant centralities in the order of contribution

Author(s)

Mino0 Ashtiani, Mohieddin Jafari

References

Husson, F., L  , S., & Pag  s, J. (2010). Exploratory Multivariate Analysis by Example using R. Chapman & Hall/CRC Computer Science & Data Analysis, 40(April), 240.
<http://www.sthda.com/english/>

See Also

[PCA](#)

`print.calculate.centralities`

Print computed centrality measures results into a file

Description

This function prints all centrality measure results into a file

Usage

```
## S3 method for class 'calculate.centralities'  
print(x, file = NULL)
```

Arguments

<code>x</code>	a list containing the centrality measure values
<code>file</code>	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory.(default=NULL)

Value

Print out `calculate_centralities`function will be saved in the given directory.

Author(s)

Mino0 Ashtiani, Mohieddin Jafari

```
print.visualize.association
```

Print pairwise association plot among centrality measures into a file

Description

This function prints regression plot between pair of centrality measures

Usage

```
## S3 method for class 'visualize.association'  
print(x, y, scale = TRUE, file = NULL)
```

Arguments

x	a vector containing a centrality values as independent variable
y	a vector containing a centrality values as dependent variable
scale	Whether the centrality values should be scaled or not(default=TRUE)
file	A character string naming the file to print into. If NULL the result would be printed to the exist directory(default=NULL)

Value

The resulted plot of `visualize_association` function will be saved in the given directory.

Author(s)

Mino Ashtiani, Mohieddin Jafari

```
print.visualize.correlations
```

Print centrality correlation plot

Description

This function prints a plot including all pairwise correlation between centrality measures

Usage

```
## S3 method for class 'visualize.correlations'  
print(x, scale = TRUE,  
      method = c("pearson", "kendall", "spearman"), file = NULL)
```

Arguments

x	a list indicating calculated centrality measures which is the output of "calculate_centralities" function
scale	Whether the centrality values should be scaled or not(default=TRUE)
method	character string describing the type of correlation coefficient (or covariance) to be computed. The proper values are "pearson", "kendall", or "spearman". (default="pearson")
file	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory.(default=NULL)

Value

The resulted plot of `visualize_correlations` function will be saved in the given directory.
`@importFrom igraph alpha centrality`

Author(s)

Mino Ashtiani, Mohieddin Jafari

```
print.visualize.dendrogram
```

Print dendrogram plot of a graph

Description

This function prints dendrogram plot of a graph based on predefined centrality measures.

Usage

```
## S3 method for class 'visualize.dendrogram'
print(x, centrality.type = "Degree Centrality",
      computed centrality_value = NULL, k = 4, file = NULL)
```

Arguments

x	an igraph object
centrality.type	The type of centrality which should be calculated(default="Degree Centrality")
computed centrality_value	A vector containing the values of calculated centrality measure for each node(default=NULL)
k	number of clusters
file	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory.(default=NULL)

Value

The resulted plot of `visualize_dendrogram` function will be saved in the given directory. #' @importFrom igraph alpha centrality

Author(s)

Mino Ashtiani, Mohieddin Jafari

`print.visualize.graph` *Print visualized based on centrality values graph*

Description

This function prints visualized based on centrality values graph.

Usage

```
## S3 method for class 'visualize.graph'
print(x, computed_centrality_value = NULL,
      centrality.type = "Degree Centrality", file = NULL)
```

Arguments

<code>x</code>	an igraph object
<code>computed_centrality_value</code>	A vector containing the values of calculated centrality measure for each node (default=NULL)
<code>centrality.type</code>	The type of centrality which should be calculated (default="Degree Centrality")
<code>file</code>	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory. (default=NULL)

Value

The resulted plot of `visualize_graph` function will be saved in the given directory. #' @importFrom igraph alpha centrality

Author(s)

Mino Ashtiani, Mohieddin Jafari

```
print.visualize.heatmap
```

Print the heatmap plot of centrality measures

Description

This function prints the heatmap plot

Usage

```
## S3 method for class 'visualize.heatmap'  
print(x, scale = TRUE, file = NULL)
```

Arguments

x	a list indicating calculated centrality measures
scale	Whether the centrality values should be scaled or not(default=TRUE)
file	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory.(default=NULL)

Value

The resulted plot of `visualize_heatmap` function will be saved in the given directory.

Author(s)

Mino Ashtiani, Mohieddin Jafari

```
print.visualize.pair.correlation
```

Print pairwise correlation and histogram plots between two centrality measures

Description

This function prints pairwise correlation of centrality measures and histogram plot.

Usage

```
## S3 method for class 'visualize.pair.correlation'  
print(x, y, scale = TRUE, file = NULL)
```


Arguments

x	a vector containing a centrality measure
y	a vector containing another centrality measure
scale	Whether the centrality values should be scaled or not(default=TRUE)
file	A character string naming the .pdf file to print into. If NULL the result would be printed to the exist directory.

Value

The resulted plot of [visualize_pair_correlation](#) function will be saved in the given directory.

Author(s)

Minoo Ashtiani, Mohieddin Jafari

proper_centralities *Proper centrality measure representation*

Description

This function indicates proper centrality measures of an igraph object based on the network topology

Usage

```
proper_centralities(x)
```

Arguments

x	an igraph object
---	------------------

Details

This function represents a list including the names of centrality measures which are applicable for the input graph based on the topology

Value

a list including the name of centrality measures which are suitable for the input graph

Author(s)

Minoo Ashtiani, Mohieddin Jafari

See Also

[calculate_centralities](#)

Examples

```
data("zachary")
proper_centralities(zachary)
```

rhesus

Moreno Rhesus Network

Description

A directed graph including observed grooming episodes between free ranging rhesus macaques (*Macaca mulatta*) in Cayo Santiago during a two month period in 1963. Cayo Santiago is an island off the coast of Puerto Rico, which also is named as Isla de los monos (Island of the monkeys). A node indicates a monkey and a directed edge in which a rhesus macaque groomed another rhesus macaque. The weights of edges demonstrates how often this behaviour was seen.

Usage

```
rhesus
```

Format

an igraph object with "gml" format

References

Rhesus network dataset – KONECT, October 2016.

DS Sade. Sociometrics of macaca mulatta I. linkages and cliques in grooming matrices. *Folia Primatologica*, 18(3-4):196–223, 1972.

Examples

```
data("rhesus")
print(rhesus)
```

`summary.calculate.centralities`*Summarize centrality measure calculation results*

Description

This function computes minimum, first quarter, median, mean, third quarter and maximum values of computed centrality measures.

Usage

```
## S3 method for class 'calculate.centralities'  
summary(x)
```

Arguments

x centrality measure calculation results

Value

a list concluding summary results for each centrality measure value

The result values of `calculate_centralities` function will be saved in the given directory.
@importFrom igraph alpha centrality

Author(s)

Mino Ashtiani, Mohieddin Jafari

`summary.graph.extract.components`*Summarize component extraction of a graph*

Description

This function summarizes all components of the input which can be an "igraph" object or a "network" object

Usage

```
## S3 method for class 'graph.extract.components'  
summary(x, directed = TRUE,  
        bipartite_proj = FALSE, num_proj = 1)
```

Arguments

x	An igraph or a network object
directed	a boolean constant, Whether to create a directed graph(default=TRUE)
bipartite_proj	Whether the bipartite network must be projected or not(default=FALSE)
num_proj	A number which shows the number of projects especially for bipartite graphs.(default=1)

Value

The result values of `graph_extract_components` function will be saved in the given directory.#'
@importFrom igraph alpha centrality

Author(s)

Mino Ashtiani, Mohieddin Jafari

summary.pca.centralities

Summarize PCA result related to centrality measures

Description

This function summarizes PCA result related to centrality measures.

Usage

```
## S3 method for class 'pca.centralities'
summary(x, scale.unit = TRUE, ncp = 5)
```

Arguments

x	a list containing the computed centrality values
scale.unit	a boolean constant, whether data should be scaled to unit variance(default=TRUE)
ncp	number of dimensions in final results (default=5)

Value

The result values of `pca_centralities` function will be saved in the given directory.#' @import-
From igraph alpha centrality

Author(s)

Mino Ashtiani, Mohieddin Jafari

```
summary.tsne.centralities
```

Summarize t-Distributed Stochastic Neighbor Embedding (t-SNE) on centrality measures

Description

This function summarize tsne analysis results on centrality measures

Usage

```
## S3 method for class 'tsne.centralities'  
summary(x, dims = 2, perplexity = 5,  
        scale = TRUE)
```

Arguments

x	a list containing the computed centrality values
dims	integer; number of the output dimensions(default=2)
perplexity	numeric; A flexible measure of the efficient number of neighbors. The performance of SNE is fairly robust to changes in the perplexity, and typical values are between 5 and 50.(default=5)
scale	Whether the centrality values should be scaled or not(default=TRUE)

Value

It returns a list containing below values:

Y Matrix containing the new representations for the objects

costs The cost for every object after the final iteration

Author(s)

Mino Ashtiani, Mohieddin Jafari

See Also

[Rtsne](#)

tsne_centralities	<i>t-Distributed Stochastic Neighbor Embedding (t-SNE) on centrality measures</i>
-------------------	---

Description

This function applies t-SNE, dimensionality reduction algorithm, on centrality measures.

Usage

```
tsne_centralities(x, dims = 2, perplexity = 5, scale = TRUE)
```

Arguments

x	a list containing the computed centrality values
dims	integer; number of the output dimensions(default=2)
perplexity	numeric; A flexible measure of the efficient number of neighbors. The performance of SNE is fairly robust to changes in the perplexity, and typical values are between 5 and 50.(default=5)
scale	Whether the centrality values should be scaled or not(default=TRUE)

Details

t-SNE is a non-linear dimensionality reduction algorithm used for exploring high-dimensional data. Here, It maps multi-dimensional centrality measure data to less dimensions suitable to work with it.

Value

It returns cost plot of tsne results which displays centralities in order of their corresponding costs.

Author(s)

Mino Ashtiani, Mohieddin Jafari

References

van der Maaten, L. (2014). Accelerating t SNE using Tree Based Algorithms. *Journal of Machine Learning Research*, 15, 3221–3245. Van Der Maaten, L. J. P., & Hinton, G. E. (2008). Visualizing high dimensional data using t sne. *Journal of Machine Learning Research*, 9, 2579–2605.

See Also

[Rtsne](#)

visualize_association *Pairwise association plot between centrality measures*

Description

This function computes regression between pair of centrality measures to show more details of association among them.

Usage

```
visualize_association(x, y, scale = TRUE)
```

Arguments

x	a vector containing a centrality measure as independent variable
y	a vector containing a centrality measure as dependent variable
scale	Whether the centrality values should be scaled or not

Details

This function applies regression analysis on two different centrality values in order to find out the corresponding association between them. Regression analysis is a kind of statistical method for approximation the association between variables. It asserts that the value of dependent variable changes when the value of independent variable varies.

Value

The regression plot, and the values resulted by the regression process.

Author(s)

Mino Ashtiani, Mohieddin Jafari

References

CHAMBERS, & M., J. (1992). *Statistical Models in S*. Wadsworth. Pacific Grove, California. Retrieved from

Wilkinson, G. N., & Rogers, C. E. (1973). Symbolic Description of Factorial Models for Analysis of Variance. *Applied Statistics*, 22(3), 392.

`visualize_correlations`*Correlation plot between centrality measures*

Description

This function draw correlation plot between pair of centrality measures

Usage

```
visualize_correlations(x, scale = TRUE, method = "pearson")
```

Arguments

<code>x</code>	a list indicating calculated centrality measures
<code>scale</code>	Whether the centrality values should be scaled or not(default=TRUE)
<code>method</code>	a character string describing the type of correlation coefficient (or covariance) to be computed. The proper values are "pearson", "kendall", or "spearman". (default="pearson")

Details

This function illustrates pairwise correlation plot of computed centrality measures. The names of centralities shown in the result plot is abbreviated and complete names can be seen in "proper_centralities" function. Colors from red to blue indicate the intensity of correlation value. If two centrality measures have an inverse relationship then their corresponding color in plot have to be red and vice versa.

Value

The pairwise correlation plot

Author(s)

Mino Ashtiani, Mohieddin Jafari

See Also

[ggpairs](#)

visualize_dendrogram *Dendrogram plot among centrality measures*

Description

This function demonstrates the vertice dendrogram of a graph based on a centrality type.

Usage

```
visualize_dendrogram(x, centrality.type = "Degree Centrality",  
  computed_centrality_value = NULL, k = 4)
```

Arguments

`x` an igraph object
`centrality.type` The type of centrality which should be considered.(default="Degree Centrality")
`computed_centrality_value` A vector containing the values of calculated centrality measure for each node.(default=NULL)
`k` number of clusters(default=4)

Details

This function represents node dendrogram of a graph based on a centrality measure. If the favor centrality is not computed yet, by specifying the name of that it will compute it and show the result.

Author(s)

Mino0 Ashtiani, Mohieddin Jafari

References

Galili, T. (2015). dendextend: an R package for visualizing, adjusting and comparing trees of hierarchical clustering. *Bioinformatics*, 31(22), 3718–3720.

See Also

[dendrogram](#)

visualize_graph	<i>Graph visualization based on a specific centrality measure</i>
-----------------	---

Description

This function demonstrates the input graph in which the size of nodes indicates calculated centrality value.

Usage

```
visualize_graph(x, computed_centrality_value = NULL,  
               centrality.type = "Degree Centrality")
```

Arguments

`x` an igraph object

`computed_centrality_value`
A vector containing the values of calculated centrality measure for each node.

`centrality.type`
The type of centrality which should be calculated.

Details

This function represents the graph in which size of nodes are based on computed centrality value. If the values of wanted centrality measure were computed then by placing them in `computed_centrality_value` argument to use it for drawing the plot. Otherwise, by only giving the name of favorite centrality measure in `centrality.type` argument, this function will calculate it and then demonstrates the corresponding graph.

Value

a plot illustrating the graph

Author(s)

Mino Ashtiani, Mohieddin Jafari

visualize_heatmap *Heatmap plot between centrality measures*

Description

This function draws heatmap between pair of centrality measures

Usage

```
visualize_heatmap(x, scale = TRUE)
```

Arguments

x a list indicating calculated centrality measures
scale Whether the centrality values should be scaled or not

Details

This function illustrates the heatmap plot of computed centrality measures.

Value

The correlation plot

Author(s)

Minoos Ashtiani, Mohieddin Jafari

visualize_pair_correlation
Pairwise correlation plot between two centrality measures

Description

This function computes and plots correlation between pair of centrality measures and histogram plots.

Usage

```
visualize_pair_correlation(x, y, scale = TRUE)
```

Arguments

x a vector containing a centrality measure
y a vector containing another centrality measure
scale Whether the centrality values should be scaled or not

Details

This function illustrates the correlation value between two centrality measures and their corresponding scatterplot and histograms.

Value

The correlation plot

Author(s)

Minoo Ashtiani, Mohieddin Jafari

References

Emerson, J. W., Green, W. A., Schloerke, B., Crowley, J., Cook, D., Hofmann, H., & Wickham, H. (2013). The Generalized Pairs Plot. *Journal of Computational and Graphical Statistics*, 22(1), 79–91.

See Also

[ggpairs](#)

zachary

Zachary Karate Club Network

Description

A graph describing friendships among members of a university karate club. Includes metadata for faction membership after a social partition.

Usage

zachary

Format

an igraph object with "gml" format

References

W. W. Zachary, "An information flow model for conflict and fission in small groups." *Journal of Anthropological Research* 33, 452-473 (1977).

Examples

```
data("zachary")
print(zachary)
```

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