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Plot and Manipulate Multigraphs

Description

Functions to create and manipulate multigraphs, bipartite graphs, and weighted multigraphs

Details

Package:  multigraph
Type:      Package
Version:   0.75 (devel)
Depends:   multiplex (>= 2.6)
Date:      1 November 2017
License:   GPL-3

This package contains functions to create, plot and manipulate multigraphs, weighted multigraphs, and bipartite graphs with multiple edges. It depends on routines from the multiplex package with version 2.5 or higher.

Author(s)

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See Also

multiplex-package, incubs, zbind, transf

bmgraph  

Bipartite multigraph

Description

A function to create and manipulate bipartite multigraphs with different layouts

Usage

bmgraph(net, layout = c("bip", "bip3", "bip3e", "bip4", "force", "rand", "circ", "stress", "CA", "circ2"), scope, coord, tcex, alpha = c(1,1,1), showLbs, showAtts, att = NULL, lbat = "1", main = NULL, cexNmain, bg, mar, directed, weighted, collRecip, cex, pos, lwd, lty, ecol, vcol, vcol0, asp, seed = NULL, maxiter = 100, bwd, clu, pch, tcol, rot, mirrorX, mirrorY, col, hds, vedist, jitter, add, ...)
Arguments

net  data frame or array representing the two-mode network (see details)
layout the visualization layout:
bip (default) bipartite graph
bip3 bipartite graph with three columns
bip3e bipartite graph with three columns for events
bip4 “square” bipartite graph
force force-directed algorithm
rand random
circ circular
stress stress-majorization algorithm
CA correspondence analysis
circ2 two semi-circles
scope (optional) the scope of the graph (see details)
coord (optional) data frame with the coordinates of the vertices. If coordinates are
  given then the layout option is ignored
tex  size of the vertex labels. If NULL, it depends on the value of cex
alpha vector (vertex, edge, bg) with the alpha color transparecy
showLbs (optional and logical) whether or not show the vertex labels when dimnames
available
showAtts (optional and logical) whether or not show the vertex attribute labels
att  (optional) a vector or an array representing the vertices’ attributes
lab  (optional) the labels for the vertices’ attributes
main (optional) title of the plot
cex.main (optional) the size of the plot’s title
bg  (optional) the background color of the plot
mar  (optional) the margins of the plot
directed (optional and logical) whether or not the graph is directed or undirected
weighted (optional and logical) whether or not the graph is weighted or dichotomous
collRecip (optional and logical) whether or not collapse reciprocated edges in the unidrected
  graph
cex  (optional) the size of the vertices
pos  (optional) the position of the vertices’ labels (0 means “at the center of the vert-
  ex”)
lwd (optional) the width of the edges. Ignored if weighted is set to TRUE
lty  (optional) the shape of the edges
ecol  (optional) the color of the edges
vcol  (optional) the color of the vertices
vcol0 (optional) the color of the vertices’ contour (only works for pch 21 through 25
asp (optional) the aspect ratio of the plot
seed (optional) the random seed number for the vertices’ initial coordinates. Ignored except for force, stress and rand
maxiter (optional) the maximum number of iterations in layout algorithms. Ignored except for force, stress and rand
bwd (optional) the width of the bundle edges. Ranges from 0 (edges collapsed) to the default 1 (depending on the vertices’ size). For weighted a value greater than one is possible
clu (optional) the clustering of the vertices (see details)
pch (optional) the symbol representing the vertices
tcol (optional) the color of the vertices’ labels
rot (optional) clockwise rotation of the graph in degrees
mirrorX (optional) mirror of the X axis
mirrorY (optional) mirror of the Y axis
col (optional) alias for vcol
hds (optional and experimental) arcs’ head scale
vedist (optional and experimental) a real number with vertex - edge distance
jitter (optional) the jitter in stress or CA
add (experimental) nodes to add to the graph
... Additional argument items (see e.g. par)

Details

Bipartite graphs are visualization devices for two-mode networks. Although this type of data would typically record as a data frame, it is possible to use even three dimensional arrays where each level corresponds to a particular type of tie, and thus the bipartite graphs in this case will be depicted with parallel edges. Besides, it is possible to obtain a graph of the bipartite network using the binomial approach to two-mode data, and plot it with a forced directed algorithm.

Value

A plot of the two-mode networks as bipartite graph or multigraph

Author(s)

Antonio Rivero Ostoic

See Also

multigraph, frcd, stsm, conc
Examples

```r
## Create the data: two binary relations among three elements
arr <- round( replace( array(runif(18), c(3,3,2)), array(runif(18), c(3,3,2))>.5, 3 ) )

## Plot this network as bipartite (multi)graph
bmgraph(arr)

## As weighted bipartite graph
bmgraph(arr, weighted = TRUE)

## Now with a stress majorization algorithm
bmgraph(arr, layout = "stress")

## With a correspondence analysis method
bmgraph(arr, layout = "CA", asp = NA)
```

---

conc

### Concentric layout

**Description**

A function to compute the graph coordinated system with a concentric layout

**Usage**

`conc(net, nr, irot, inv, flip, mirror=c("N","X","Y","D","L"), ...)`

**Arguments**

- `net`: an array representing the network relations
- `nr`: a scalar with the number of radii, or a vector with the clustering of the actors.
- `irot`: a scalar or vector with the “internal rotation” for each circle from closer to the center point to further away
- `inv`: (optional and logical) should the circles be with an inverted ordering?
- `flip`: (optional and logical) should the alternating circles be flipped?
- `mirror`: mirror transformation
  - `N`: identity (default)
  - `X`: reflection through the vertical center line
  - `Y`: reflection through the horizontal center line
  - `D`: reflection across diagonal Y=X
  - `L`: reflection across diagonal Y=-X
- `...`: Additional argument items
**Details**

In a Euclidean plane computes the coordinated system with a concentric layout with at least two radii (unless \( n = 1 \)). In case \( nr \) is not specified, approx. half of the vertices are located at one radius and half in another one.

The clustering of the actors may be used to establish the location of the vertices in different radii as a numerical, character, or a factor vector.

**Value**

A data frame with the coordinated system with two columns representing the abscissa and the ordinate in a two-dimensional rectangular Cartesian coordinate system.

**Author(s)**

Antonio Rivero Ostoic

**See Also**

* multigraph, bmgraph, frcd, stsm

**Examples**

```r
## Create the data: two binary relations among three elements
arr <- round(replace(array(runif(18), c(3,3,2)), array(runif(18), c(3,3,2))>.5, 3 ) )

## Coordinates for the concentric layout with two radii
coord <- conc(arr, nr = 2)

## Plot multigraph with costumized coordinates
multigraph(arr, coord = coord)
```

---

**frcd**

*Force directed layout*

**Description**

A function to compute the graph coordinated system with a force directed layout algorithm

**Usage**

```
frcd(net, seed = seed, maxiter, drp, ...)
```
Arguments

- **net**: an array representing the network relations
- **seed**: (mandatory) the seed of the initial layout (see details)
- **maxiter**: (optional) the maximum number of iterations
- **drp**: (optional) for weighted networks, drop values less than specified
- **...**: Additional argument items

Details

This function was meant as an internal routine for graph visualization; however, it can be used with the coord option both in multigraph and bmgraph where a random seed is stated by NULL

Value

A data frame with the coordinated system with two columns representing the abscissa and the ordinate in a two-dimensional rectangular Cartesian coordinate system.

Author(s)

Antonio Rivero Ostoic

References


See Also

- `multigraph`
- `bmgraph`
- `stsm`
- `conc`

Examples

```r
# Create the data: two binary relations among three elements
arr <- round(replace(array(runif(18), c(3,3,2)), array(runif(18), c(3,3,2))>.5, 3 ))

# Coordinates for the force directed layout with random start
coord <- frcd(arr, seed = NULL)

# Plot multigraph with costumized coordenates
multigraph(arr, coord = coord)
```
multigraph

Description
A function to create and manipulate multigraphs and weighted multigraphs with different layout options

Usage
multigraph(net, layout = c("circ", "force", "stress", "conc", "rand"), scope, directed = TRUE, main = NULL, seed = NULL, maxiter = 100, alpha = c(1, 1, 1), collRecip, showLbs, showAtts, weighted, cex.main, coord, clu, cex, lwd, pch, lty, bwd, tcol, tceX, att, bg, mar, pos, asp, ecol, vcol, vcol0, hds, vedist, rot, mirrorX, mirrorY, col, lbat, drp, swp, loops, swp2, signed, scl, add, mirrorD, mirrorL, ...)

Arguments
net
an array; usually with three dimensions of stacked matrices where the multiple relations are placed.

layout
the visualization layout:
circ circular
force force-directed
stress stress-majorization
conc concentric
rand random

scope
(optional) the scope of the graph (see details)
directed
(logical) whether or not the graph is directed or undirected
main
(optional) title of the plot
seed
(optional) the random seed number for the vertices’ initial coordinates. Ignored for circ and conc
maxiter
(optional) the maximum number of iterations in layout algorithms. Ignored for circ and conc
alpha
vector (vertex, edge, bg) with the alpha color transparency
collRecip
(optional and logical) whether or not collapse reciprocated edges in the undirected graph
showLbs
(optional and logical) whether or not show the vertex labels
showAtts
(optional and logical) whether or not show the vertex attribute labels
weighted
(optional and logical) whether or not the graph is weighted or dichotomous
cex.main
(optional) the size of the plot’s title
multigraph

coord (optional) data frame with the coordinates of the vertices. If coordinates are given then the layout option is ignored
clu (optional) the clustering of the vertices (see details)
cex (optional) the size of the vertices
lwd (optional) the width of the edges. Ignored if weighted is set to TRUE
pch (optional) the symbol representing the vertices
lty (optional) the shape of the edges
bwd (optional) the width of the bundle edges. Ranges from 0 (edges collapsed) to the default 1 (depending on the vertices' size). For weighted a value greater than one is possible
tcol (optional) the color of the vertices' labels
tcex size of the vertex labels. If NULL, it depends on the value of cex
att (optional) a vector or an array representing the vertices' attributes
bg (optional) the background color of the plot
mar (optional) the margins of the plot
pos (optional) the position of the vertices' labels (0 means "in the middle of the vertex")
asp (optional) the aspect ratio of the plot
ecol (optional) the color of the edges
tvcol (optional) the color of the vertices
vcol0 (optional) the color of the vertices' contour (only works for pch 21 through 25
hds (optional and experimental) arcs' head scale
vedist (optional and experimental) a real number with vertex - edge distance
rot (optional) clockwise rotation of the graph in degrees
mirrorX (optional) mirror of the X axis
mirrorY (optional) mirror of the Y axis
col (optional) alias for vcol
lbat (optional) the labels for the vertices' attributes
drp (optional) for weighted networks, drop values less than specified
... Additional argument items (see e.g. par)
swp (optional and logical) whether or not swap the bundle patterns
loops (optional, logical, and experimental) plot graph loops?
swp2 (optional and logical) whether or not swap reciprocals
signed (optional and logical) whether or not the graph is a signed structure
scl (optional and experimental) numerical scalar (x and y) or vector (x, y) of the graph's scale
add (optional) nodes to add to the graph
mirrorD (optional) mirror reflection across diagonal Y=X
mirrorL (optional) mirror reflection across diagonal Y=-X
Details

Multigraph are graphs having parallel edges depicting different types of relations in a network. By default, a circular layout is applied where each type of tie has a distinctive shape and gray color scale. For a better visualization, undirected multigraphs automatically collapse the reciprocal ties, and there is an argument to prevent this from happening. It is possible to combine the symbols and color of vertices by assigning a class to each network member in the clustering option. Vertices can also have different sizes by specifying the argument with a vector with a length size similar to the network order.

Since this function can handle a large number of arguments, these can be stored as a list object that is passed through the `scope` option. In this case, a vector made of lists and scalars or combinations of these are accepted.

Value

A plot of the network as a multigraph or a weighted multigraph.

Author(s)

Antonio Rivero Ostoic

See Also

`bmgraph`, `frcd`, `stsm`, `conc`

Examples

```r
## Create the data: two binary relations among three elements
arr <- round( replace( array(runif(18), c(3,3,2)), array(runif(18), c(3,3,2))>.5, 3 ) )

## Plot the multigraph of this network
multigraph(arr)

## Now with a force-directed algorithm
multigraph(arr, layout = "force")

## As weighted graph
multigraph(arr, weighted = TRUE)

## As signed graph
multigraph(arr, signed = TRUE)

## With loops and a customized vertex size
multigraph(arr, cex = 3, loops = TRUE)
```
Description

A function to compute the graph coordinated system with a stress majorization layout algorithm.

Usage

```r
stsm(net, seed = seedL maxiter = TPL drpL jitterL methodL NNN)
```

Arguments

- `net`: an array representing the network relations
- `seed` (mandatory): the seed of the initial layout (see details)
- `maxiter` (optional): the maximum number of iterations
- `drp` (optional): for weighted networks, drop values less than specified
- `jitter` (optional): jitter in the layout
- `method` (optional): initial distance method (default binary)
- `...`: Additional argument items

Details

This function was meant as an internal routine for graph visualization; however, it can be used with the coord option both in multigraph and bmgraph where a random seed is stated by NULL.

Value

A data frame with the coordinated system with two columns representing the abscissa and the ordinate in a two-dimensional rectangular Cartesian coordinate system.

Author(s)

Antonio Rivero Ostoic

References


See Also

`multigraph`, `bmgraph`, `frcd`, `conc`
## Examples

```r
## Create the data: two binary relations among three elements
arr <- round(replace(array(runif(18), c(3,3,2)), array(runif(18), c(3,3,2)) > .5, 3))

## Coordinates for the stress majorization layout with random start
coord <- stsm(arr, seed = NULL)

## Plot multigraph with customized coordinates
multigraph(arr, coord = coord)
```
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