Package 'multigraph'

February 28, 2020

Type Package

Title Plot and Manipulate Multigraphs

Version 0.93

Depends R (>= 3.6.0), multiplex (>= 2.9)

Imports methods

Date 2020-02-28

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Description Functions to plot and manipulate multigraphs, signed and valued graphs, bipartite graphs, multilevel graphs, and Cayley graphs with different layout options. Please note that this package still under a devel version.

URL http://github.com/mplex/multigraph/

BugReports https://github.com/mplex/multigraph/issues/

Repository CRAN

License GPL-3

NeedsCompilation no

Date/Publication 2020-02-28 16:10:05 UTC

R topics documented:

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multigraph-package   *Plot and Manipulate Multigraphs*

Description

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

Details

Package:	multigraph
Type:	Package
Version:	0.93 (devel)
Depends:	**multiplex** (>= 2.9)
Date:	28 February 2020
License:	GPL-3

This package contains functions to plot diverse types of graphs representing complex network structures. For one-mode data, it is possible to depict signed and valued multigraphs, and bipartite graphs for two-mode data as well. Moreover, multilevel graphs that *combine* one- and two-mode network data are represented with the latest function. Finally, Cayley graphs serve to depict relations among the ties with multiple edges.

Please note that this package still under current development.

Author(s)

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References

Ostoic, J.A.R. 'Algebraic Analysis of Multiple Social Networks with multiplex.' *Journal of Statistical Software*, 91(11), 1-41. <doi:10.18637/jss.v092.i11>

See Also

[multiplex-package](), [incubs](), [zbind](), [transf]()

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bmgraph   *Bipartite multigraph*

Description

A function to create and manipulate bipartite multigraphs

Usage

```
bmgraph(net, layout = c("bip", "bip3", "bip3e", "bipc", "force", "rand", "circ",
     "stress", "CA", "circ2"), scope, coord, alpha = c(1, 1, 1), showLbs, showAtts,
        att = NULL, lbat = "1", main = NULL, cex.main, bg, mar, directed, valued,
         collRecip, cex, pos, lwd, lty, col, ecol, vcol, vcol0, asp, seed = NULL,
       maxiter = 100, bwd, clu, pch, rot, mirrorX, mirrorY, mirrorV, mirrorH, hds,
      vedist, jitter, sort, add, adc, perm, ffamily, fstyle, fsize, fcol, vclu, ...)
```

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 bipc "clustered" 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
alpha	vector (vertex, edge, bg) with the alpha color transparency
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 vertex attributes
lbat	(optional) the labels for the vertex 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
valued	(optional and logical) whether or not the graph is valued or with dichotomous data
collRecip	(optional and logical) whether or not collapse reciprocated edges in the undirected graph
cex	(optional) the size of the vertices

pos	(optional) the position of the vertices' labels (0 means "at the center of the vertex")
lwd	(optional) the width of the edges. Ignored if valued is set to TRUE
lty	(optional) the shape of the edges
col	(optional) alias for vcol
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 valued a value greater than one is possible
clu	(optional) the clustering of the vertices (see *details*)
pch	(optional) the symbol representing the vertices
rot	(optional) clockwise rotation of the graph in degrees
mirrorX	(optional) mirror of the X axis
mirrorY	(optional) mirror of the Y axis
mirrorV	*same as* mirrorX
mirrorH	*same as* mirrorY
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
sort	(optional and logical) sort the vertex labels
add	(optional) add nodes to the graph's domain
adc	(optional) add nodes to the graph's codomain
perm	(optional) a list of vectors for the permutation of network members in both the domain and codomain
ffamily	(optional) the font family
fstyle	(optional) the font style
fsize	(optional) the font size
fcol	(optional) the font color
vclu	(optional) a list of vectors the clustering information in both the domain and the codomain
...	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. Thus the bipartite graphs, in this case, will be depicted with parallel edges. Besides, it is possible to obtain a figure of the bipartite network using the binomial approach to two-mode data and plot it with a force-directed algorithm.

Value

A plot of the two-mode network as a bipartite graph or multigraph with a projection

Author(s)

Antonio Rivero Ostoic

See Also

multigraph, frcd, stsm, conc

Examples

```
## 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 graph
bmgraph(arr)

## Now with a Force Directed algorithm
bmgraph(arr, layout = "force")

## And with a Correspondence Analysis method
bmgraph(arr, layout = "CA", asp = NA)
```

---

ccgraph   *Cayley colour graph*

Description

A function to create and manipulate bipartite Cayley colour graphs

Usage

```
ccgraph(x, main = NULL, seed = 0, maxiter = 100, alpha = c(1, 1, 1), scope, loops,
      collRecip, undRecip, showLbs, cex.main, conc, coord, clu, cex, lwd, pch,
     lty, bwd, bwd2, att, bg, mar, pos, asp, ecol, vcol, vcol0, lbs, col, lbat,
     swp, swp2, scl, mirrorX, mirrorY, mirrorD, mirrorL, mirrorV, mirrorH, rot,
      hds, vedist, ffamily, fstyle, fsize, fcol, ...)
```

Arguments

x	an algebraic structure, typically a "Semigroup" object class
main	(optional) title 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
alpha	vector (vertex, edge, bg) with the alpha color transparency
scope	(optional) the scope of the graph (see details)
loops	(optional, logical, and experimental) plot graph loops?
collRecip	(optional and logical) whether or not collapse reciprocated edges in the undirected graph
undRecip	(optional and logical) whether or not plot reciprocated edges as undirected
showLbs	(optional and logical) whether or not show the vertex labels when dimnames available
cex.main	(optional) the size of the plot's title
conc	(optional and logical) whether the layout is concentric or not
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 valued 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 valued a value greater than one is possible
bwd2	(optional) the width of the bundle loop edges.
att	(optional) a vector or an array representing the vertex 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 "at the center of the vertex")
asp	(optional) the aspect ratio of the plot
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
lbs	(optional) the vertex labels
col	(optional) alias for vcol

lbat	(optional) the labels for the vertex attributes
swp	(optional and logical) whether or not swap the bundle patterns
swp2	(optional and logical) whether or not swap reciprocals
scl	(optional and experimental) numerical scalar (x and y) or vector (x, y) of the graph's scale
mirrorX	(optional) mirror of the X axis
mirrorY	(optional) mirror of the Y axis
mirrorD	(optional) mirror reflection across diagonal Y=X
mirrorL	(optional) mirror reflection across diagonal Y=-X
mirrorV	same as mirrorX
mirrorH	same as mirrorY
rot	(optional) clockwise rotation of the graph in degrees
hds	(optional and experimental) arcs' head scale
vedist	(optional and experimental) a real number with vertex - edge distance
ffamily	the font family
fstyle	the font style
fsize	the font size
fcol	the font color
...	Additional argument items (see e.g. [par](par))

Details

The Cayley colour graph is a graphical representation of the relationships among relations in the relational structure of a given multiplex network. Both nodes and directed edges represent string relations, and each shape (and color) corresponds to a specific generator relation of the semigroup structure.

Value

A plot of the semigroup or group structure.

Author(s)

Antonio Rivero Ostoic

See Also

semigroup, multigraph, frcd, conc

Examples

```
## Create an abstract semigroup from image matrices in existing data set
data(incubD)

S <- semigroup(incubD$IM)

## plot its Cayley graph
ccgraph(S)
```

---

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 a 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

```
## 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 coordenates
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, scl, mov, ...)
```

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 valued networks, drop values less than specified
...	Additional argument items
scl	(optional and experimental) numerical scalar (x and y) or vector (x, y) of the graph's scale
mov	(optional and experimental) numerical scalar (x and y) or vector (x, y) to move the graph

Details

This function is meant as an internal routine for graph visualization. However, it can be used for the `coord` option both in `multigraph` and in `bmgraph` where `NULL` in `seed` implies a random seed based on the clock watch of the computer.

Value

A data frame with a 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

Fruchterman, T.M.J., & Reingold, E.M. Graph drawing by force-directed placement. *Software-Practice & Experience*, 21(11), 1129-1164. 1991.

See Also

[multigraph](), [bmgraph](), [stsm](), [conc]()

Examples

```
## 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)
```

---

  mlgraph   *Multilevel graph*

Description

A function to create and manipulate multilevel graphs

Usage

```
mlgraph(net, layout = c("circ", "force", "stress", "rand", "conc", "bip"), main = NULL,
    seed = NULL, maxiter = 100, directed = TRUE, alpha = c(1, 1, 1), scope, collRecip,
    undRecip, showLbs, showAtts, cex.main, coord, clu, cex, lwd, pch, lty, bwd, bwd2,
        att, bg, mar, pos, asp, ecol, vcol, vcol0, col, lbat, swp, loops, swp2,
      mirrorX, mirrorY, mirrorD, mirrorL, lbs, mirrorV, mirrorH, rot, hds, scl, vedist,
          ffamily, fstyle, fsize, fcol, valued, modes, elv, lng, ...)
```

Arguments

net	a "Multilevel" class object or a 3D array with clustering information
layout	the visualization layout:
	circ circular
	force force-directed
	stress stress-majorization
	rand random
	conc concentric
	bip as bipartite graph
main	(optional) title 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
directed	(logical) whether or not the graph is directed or undirected
alpha	vector (vertex, edge, bg) with the alpha color transparency
scope	(optional) the scope of the graph (see details)
collRecip	(optional and logical) whether or not collapse reciprocated edges in the undirected graph
undRecip	(optional and logical) whether or not plot reciprocated edges as undirected
showLbs	(optional and logical) whether or not show the vertex labels
showAtts	(optional and logical) whether or not show the vertex attribute labels
cex.main	(optional) the size of the plot's title
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 valued 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 valued a value greater than one is possible

bwd2	(optional) the width of the bundle loop edges.
att	(optional) a vector or an array representing the vertex 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 "at the center of the vertex")
asp	(optional) the aspect ratio of the plot
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
col	(optional) alias for vcol
lbat	(optional) the labels for the vertex attributes
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
mirrorX	(optional) mirror of the X axis
mirrorY	(optional) mirror of the Y axis
mirrorD	(optional) mirror reflection across diagonal Y=X
mirrorL	(optional) mirror reflection across diagonal Y=-X
lbs	(optional) the vertex labels
mirrorV	same as mirrorX
mirrorH	same as mirrorY
rot	(optional) clockwise rotation of the graph in degrees
hds	(optional and experimental) arcs' head scale
scl	(optional and experimental) numerical scalar (x and y) or vector (x, y) of the graph's scale
vedist	(optional and experimental) a real number with vertex - edge distance
ffamily	the font family
fstyle	the font style
fsize	the font size
fcol	the font color
valued	(optional and logical) whether the graph is depicyed as valued or not
modes	(optional) a vector indicating which matrices are domains and which codomains (works only with a "Multilevel" class object)
elv	(experimental) control loops 1
lng	(experimental) control loops 2
...	Additional argument items (see e.g. par)

Details

Multilevel graphs serve to represent networks with different "levels" such as different domains in the network structure. A characteristic of multilevel networks is the existence of ties within and across domains.

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.

The bundle width specified by bwd and bwd2 ranges from 0 (edges collapsed) to the default 1 (depending on the vertices' size). For the valued option, a number greater than one is possible.

Value

A plot of the multilevel graph structure for the network

Author(s)

Antonio Rivero Ostoic

See Also

[mlvl](), [multigraph](), [bmgraph](), [frcd](), [stsm](), [conc]()

Examples

```
# create multilevel class object


# plot the multilevel graph
```

---

multigraph	*Multigraphs and valued multigraphs*

Description

A function to create and manipulate multigraphs and valued multigraphs with different layout options

Usage

```
multigraph(net, layout = c("circ", "force", "stress", "conc", "rand"), scope,
        directed = TRUE, loops, signed, valued, values, lbs, showLbs, att, lbat,
   showAtts, main = NULL, cex.main, col.main, font.main, coord, collRecip,
   undRecip, seed = NULL, maxiter = 100, clu, cex, cex2, pch, lwd, lty, vcol,
   vcol0, col, ecol, bwd, bwd2, pos, bg, bg2, asp, drp, add, swp, swp2,
   alpha = c(1, 1, 1, 1), rot, mirrorX, mirrorY, mirrorD, mirrorL, mirrorV,
   mirrorH, scl, hds, vedist, mar, ffamily, fstyle, fsize, fsize2, fcol, fcol2,
   lclu, ...)
```

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
`loops`	(optional, logical) plot graph loops?
`signed`	(optional and logical) whether or not the graph is a signed structure
`valued`	(optional and logical) whether the graph is depicyed as valued or not
`values`	(optional and logical) print the values of the bonds in edges?
`lbs`	(optional) the vertices labels
`showLbs`	(optional and logical) whether or not show the vertex labels
`att`	(optional) a vector or an array representing the vertex attributes
`lbat`	(optional) the labels for the vertices' attributes
`showAtts`	(optional and logical) whether or not show the vertex attribute labels
`main`	(optional) title of the plot
`cex.main`	(optional) the size of the plot's title
`col.main`	(optional) the color of the plot's title
`font.main`	(optional) the font family of the plot's title
`coord`	(optional) data frame with the coordinates of the vertices. If coordinates are given then the `layout` option is ignored
`collRecip`	(optional and logical) whether or not collapse reciprocated edges in the undirected graph
`undRecip`	(optional and logical) whether or not plot reciprocated edges as undirected
`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. Only for `force`, `stress`, and `rand`
`clu`	(optional) the clustering of the vertices (see *details*)
`cex`	(optional) the size of the vertices
`cex2`	(optional) the size of the background for the values with the `valued` option
`pch`	(optional) the symbol representing the vertices
`lwd`	(optional) the width of the edges. Ignored if `valued` is set to `TRUE`
`lty`	(optional) the shape 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
col	(optional) alias for vcol
ecol	(optional) the color of the edges
bwd	(optional) the width of the bundle edges.
bwd2	(optional and experimental) the width of the bundle loop edges.
pos	(optional) the position of the vertices' labels (0 means "in the middle of the vertex")
bg	(optional) the background color of the plot
bg2	(optional) the background color for values
asp	(optional) the aspect ratio of the plot
drp	(optional) for valued networks, drop values less than the specified
add	(optional) nodes to add to the graph
swp	(optional and logical) whether or not swap the bundle patterns
swp2	(optional and logical) whether or not swap reciprocals
alpha	(optional) vector (vertex, edge, bg) with the alpha color transparency
rot	(optional) clockwise rotation of the graph in degrees
mirrorX	(optional) mirror of the X axis
mirrorY	(optional) mirror of the Y axis
mirrorD	(optional) mirror reflection across diagonal Y=X
mirrorL	(optional) mirror reflection across diagonal Y=-X
mirrorV	(optional) same as mirrorX
mirrorH	(optional) same as mirrorY
scl	(optional and experimental) numerical scalar (x and y) or vector (x, y) of the graph's scale
hds	(optional and experimental) arcs' head scale
vedist	(optional and experimental) a real number with vertex - edge distance
mar	(optional) the margins of the plot
ffamily	(optional) the font family
fstyle	(optional) the font style
fsize	(optional) the font size
fsize2	(optional) the font size for values
fcol	(optional) the font color
fcol2	(optional) the font color for values
lclu	(optional, vector) the "levels" in clu (see Details)
...	(optional) Additional argument items (see e.g. par)

Details

Multigraphs 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 better visualization, undirected multigraphs automatically collapse the reciprocal relations, and there as an argument to prevent this from happening. It is possible to combine the symbols and colors 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 is accepted.

The bundle width specified by bwd (and bwd2 for loops) ranges from 0 (edges collapsed) to the default 1 (depending on the vertices' size). For the valued option, numbers higher than one are possible.

In some cases, such as when working with dynamic networks, it is needed to specify the ordering of the "levels" of the clustering information given in clu, and this is done in argument lclu.

Value

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

Author(s)

Antonio Rivero Ostoic

See Also

bmgraph, ccgraph, frcd, stsm, conc

Examples

```
## 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 valued graph
multigraph(arr, valued = TRUE)

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

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

---

stsm   *Stress majorization layout*

Description

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

Usage

```
stsm(net, seed = seed, maxiter = 40, drp, jitter, method, ...)
```

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 valued 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 is meant as an internal routine for graph visualization. However, it can be used with the coord option both in multigraph and in bmgraph where NULL in seed implies a random seed based on the clock watch of the computer.

Value

A data frame with a 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

Gansner, E.R., Koren, Y., & North, S. *Graph drawing by stress majorization.* In Graph Drawing: 12th International Symposium, gd 2004, New York, NY, USA, September 29 - October 2, 2004, revised selected papers. Berlin Heidelberg: Springer. pp. 239-250. 2005.

See Also

[multigraph](), [bmgraph](), [frcd](), [conc]()

Examples

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

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