

Package ‘netmap’

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Title Represent Network Objects on a Map

Version 0.1.4

Description Represent 'network' or 'igraph' objects whose vertices can be represented by features in an 'sf' object as a network graph surmising a 'sf' plot. Fits into 'ggplot2' grammar.

License GPL (>= 3)

Encoding UTF-8

RoxygenNote 7.3.1

URL <https://github.com/artod83/netmap>

BugReports <https://github.com/artod83/netmap/issues>

Imports ggnetwork, igraph, network, rlang, sf, sna

Suggests rmarkdown, knitr, testthat (>= 3.0.0)

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Contents

check_network_sf	2
fvomap	3
ggcentrality	3
ggconn_area	5
ggnetmap	6

is_lookup_table	7
is_network	7
is_sf	8
link_network_map	8
link_network_map2	9
netmap	9
netmap_plot	10
network.layout.extract_coordinates	11
reduce_to_map	11

Index 13

check_network_sf	<i>Internal checks before gnetmap and ggcentrality</i>
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Description

Checks whether the proper packages are installed, whether the parameters are of the proper classes, whether the network-map link is possible, then performs the link.

Usage

```
check_network_sf(n, m, lkp = NULL, m_name = NULL, n_name = "vertex.names")
```

Arguments

n	A network or igraph object.
m	A sf object.
lkp	An optional lookup table.
m_name	Optional character, name of field in m and of column in lkp.
n_name	Optional character, name of vertex attribute in n and of column in lkp.

Value

A list with a network or igraph object with only the vertices present in the sf object as the first element and a list with two vectors, one of features in m present both in the lookup table and in n, the other of nodes in n present both in the lookup table and in m

fvgmap	<i>Map of municipality borders in the Friuli Venezia Giulia region, Italy</i>
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Description

An sf object containing the ISTAT municipality codes, geometry and the municipality names in the Friuli Venezia Giulia region in northeastern Italy, based on official ISTAT shapefiles.

Usage

```
fvgmap
```

Format

An sf object with 215 features and 6 fields:

Cod_reg region code, always =6 (Friuli Venezia Giulia)

Cod_pro province code (93=Pordenone, 30=Udine, 31=Gorizia, 32=Trieste)

Pro_com municipality code, consists of province code + progressive code of the municipality within the province

Shape_leng length of municipality perimeter

Shape_area municipality area

geometry a MULTIPOLYGON

Source

<https://www.istat.it/it/archivio/104317>

ggcentrality	<i>Calculate centrality indices for vertices linked to a sf object</i>
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Description

Given a sf object with features that can be linked to a network or igraph object, obtain centrality indices for linked features.

Usage

```
ggcentrality(
  n,
  m,
  lkp = NULL,
  m_name = NULL,
  n_name = "vertex.names",
  par.deg = NULL,
  par.bet = NULL,
  par.clo = NULL
)
```

Arguments

n	A network or igraph object.
m	A sf object.
lkp	An optional lookup table.
m_name	Optional character, name of field in m and of column in lkp.
n_name	Optional character, name of vertex attribute in n and of column in lkp.
par.deg	List with additional optional parameters to functions degree or degree .
par.bet	List with additional optional parameters to functions betweenness or betweenness .
par.clo	List with additional optional parameters to functions closeness or closeness .

Value

An sf object, input m with added columns for centrality indices (degree, betweenness, closeness; existing columns with the same name will be overwritten) and with only the features linked to vertices in input n.

Examples

```
net=network::network(matrix(c(0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0), nrow=4, byrow=TRUE))
network::set.vertex.attribute(net, "name", value=c("a", "b", "c", "d"))
wkb = structure(list("0101000020407100000000000000801A064100000000AC5C1641",
"0101000020407100000000000000801A084100000000AC5C1441",
"0101000020407100000000000000801A044100000000AC5C1241",
"0101000020407100000000000000801A024100000000AC5C1841"), class = "WKB")
map=sf::st_sf(id=c("a1", "b2", "c3", "d4"), sf::st_as_sf(wkb, EWKB=TRUE))
lkptbl=data.frame(id=c("a1", "b2", "c3", "d4"), name=c("a", "b", "c", "d"))
netmap::ggcentrality(net, map, lkptbl, "id", "name")
```

ggconn_area	<i>Calculate connectedness to a specific vertex for vertices linked to a sf object</i>
-------------	--

Description

Given a sf object with features that can be linked to a network or igraph object and given a node with id id in said graph that can be linked to the sf object, obtain an indicator variable denoting, for each node, a connection to id.

Usage

```
ggconn_area(n, m, id, lkp = NULL, m_name = NULL, n_name = "vertex.names")
```

Arguments

n	A network or igraph object.
m	A sf object.
id	The identifier (as vertex attribute n_name of object n) of the feature that needs to be checked for connections.
lkp	An optional lookup table.
m_name	Optional character, name of field in m and of column in lkp.
n_name	Optional character, name of vertex attribute in n and of column in lkp.

Value

An sf object, input m with an added column conn_area with an indicator variable set to 1 if the feature is connected to the feature with vertex id id, 0 otherwise. In directed graphs, only outgoing links are considered a connection. Any existing column with the same name will be overwritten, the result will contain only the features linked to vertices in input. If the vertex id is not present in object n, conn_area will be set to 0 for all vertices.

Examples

```
net=network::network(matrix(c(0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0), nrow=4, byrow=TRUE))
network::set.vertex.attribute(net, "name", value=c("a", "b", "c", "d"))
wkb = structure(list("010100002040710000000000000801A064100000000AC5C1641",
"010100002040710000000000000801A084100000000AC5C1441",
"010100002040710000000000000801A044100000000AC5C1241",
"010100002040710000000000000801A024100000000AC5C1841"), class = "WKB")
map=sf::st_sf(id=c("a1", "b2", "c3", "d4"), sf::st_as_sf(wkb, EWKB=TRUE))
lkptbl=data.frame(id=c("a1", "b2", "c3", "d4"), name=c("a", "b", "c", "d"))
ggconn_area(net, map, "b", lkptbl, "id", "name")
```

`ggnetmap`*Fortify a network over a map*

Description

Link a network or `igraph` and a `sf` object in a `data.frame` for subsequent representation on a plot using `ggplot2`.

Usage

```
ggnetmap(  
  n,  
  m,  
  lkp = NULL,  
  m_name = NULL,  
  n_name = "vertex.names",  
  scale = FALSE,  
  ...  
)
```

Arguments

<code>n</code>	A network or <code>igraph</code> object.
<code>m</code>	A <code>sf</code> object.
<code>lkp</code>	An optional lookup table.
<code>m_name</code>	Optional character, name of field in <code>m</code> and of column in <code>lkp</code> .
<code>n_name</code>	Optional character, name of vertex attribute in <code>n</code> and of column in <code>lkp</code> .
<code>scale</code>	Whether coordinates should be scaled (defaults to <code>FALSE</code> since the network should be overlaid with the non-scaled <code>sf</code> object).
<code>...</code>	Additional parameters passed to <code>fortify</code> .

Details

Using a network or `igraph` and a `sf` object as inputs, with an optional lookup table (a `data.frame`) in case the IDs don't match, produces a `data.frame` that can be used with `ggnetwork`'s `geom_edges` and `geom_nodes` functions to represent the network as overlaid on a `sf` object in a `ggplot2` graph. Only vertices with a corresponding feature in the `sf` object are included.

Value

A `data.frame`, produced by `fortify`, which can be used as data source in `ggplot2` graphs.

Examples

```
net=network::network(matrix(c(0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0), nrow=4, byrow=TRUE))
network::set.vertex.attribute(net, "name", value=c("a", "b", "c", "d"))
wkb = structure(list("010100002040710000000000000801A064100000000AC5C1641",
"010100002040710000000000000801A084100000000AC5C1441",
"010100002040710000000000000801A044100000000AC5C1241",
"010100002040710000000000000801A024100000000AC5C1841"), class = "WKB")
map=sf::st_sf(id=c("a1", "b2", "c3", "d4"), sf::st_as_sf(wkb, EWKB=TRUE))
lkptbl=data.frame(id=c("a1", "b2", "c3", "d4"), name=c("a", "b", "c", "d"))
ggnetmap(net, map, lkptbl, "id", "name")
```

is_lookup_table	<i>Is data frame a lookup table?</i>
-----------------	--------------------------------------

Description

Checks whether a data.frame is a valid lookup table.

Usage

```
is_lookup_table(lkp, m_name = NULL, n_name = NULL)
```

Arguments

lkp	A data.frame.
m_name	Optional, a character string with the name of the column in lkp to check against m.
n_name	Optional, a character string with the name of the column in lkp to check against n.

Value

FALSE on error, a vector with m_name and n_name if the lookup table is valid.

is_network	<i>Is object a network?</i>
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Description

Checks whether an object is a network object or an igraph object, returns message if it's not

Usage

```
is_network(n)
```

Arguments

n Object of class network or igraph.

Value

TRUE if object of class network, FALSE otherwise.

is_sf	<i>Is object a map?</i>
-------	-------------------------

Description

Checks whether an object is an sf object, returns message if it's not

Usage

```
is_sf(m)
```

Arguments

m Object of class sf.

Value

TRUE if object of classes sf and data.frame, FALSE otherwise.

link_network_map	<i>Link a network and a map</i>
------------------	---------------------------------

Description

Checks which vertices of a network object can be represented with features of a sf object.

Usage

```
link_network_map(m, n, m_name, n_name = "vertex.names")
```

Arguments

m Object of class sf.
n Object of class network or igraph.
m_name Name of the map field to use for the link.
n_name Name of the vertex attribute to use for the link, defaults to vertex.names.

Value

On success a list with two vectors, one of features in m present in n, the other of nodes in n present in m, -1 on error.

link_network_map2	<i>Link a network and a map with a lookup table</i>
-------------------	---

Description

Checks which vertices of a network object can be represented with features of a sf object with a lookup table.

Usage

```
link_network_map2(m, n, lkp, m_name = NULL, n_name = NULL)
```

Arguments

m	Object of class sf.
n	Object of class network or igraph.
lkp	Lookup table, a data.frame.
m_name	Optional character, name of field in m and of column in lkp (first column of lkp is used if NULL).
n_name	Optional character, name of vertex attribute in n and of column in lkp (second column of lkp is used if NULL).

Value

On success a list with two vectors, one of features in m present both in the lookup table and in n, the other of nodes in n present both in the lookup table and in m, -1 on error.

netmap	<i>netmap: Plot network and igraph objects on a sf map using ggplot2</i>
--------	--

Description

The netmap package extends the ggnetwork package by providing functions to plot networks, with vertices usually representing objects with a spatial attribute (cities, regions, countries, users with location data attached etc.) on a map, provided by a sf object (which in turn is able to represent more or less all spatial data available). Networks and maps need not have the same set of elements: if they don't, only the intersection will be represented.

netmap functions

The main function is `ggnetmap`, which produces a data.frame that is then used as data within ggplot2 calls. For those wishing to use the `plot.network` or the `plot.igraph` function to plot the network (without overlaying it on an sf object), both a custom layout function, `network.layout.extract_coordinates`, and a wrapper that provides convenient manipulation of network and sf objects, `netmap_plot`, are available.

netmap_plot	<i>Plot a network object with a layout based on an sf object</i>
-------------	--

Description

Wrapper for `plot.network` and `plot.igraph` using a custom network layout that extracts coordinates of centroids from a sf object. Only vertices with a corresponding feature are plotted.

Usage

```
netmap_plot(n, m, lkp = NULL, m_name = NULL, n_name = "vertex.names", ...)
```

Arguments

n	A network or igraph object.
m	A sf object.
lkp	An optional lookup table.
m_name	Optional character, name of field in m and of column in lkp.
n_name	Optional character, name of vertex attribute in n and of column in lkp.
...	Additional parameters passed to <code>plot.network</code> .

Value

A plot of the network.

Examples

```
net=network::network(matrix(c(0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0), nrow=4, byrow=TRUE))
network::set.vertex.attribute(net, "name", value=c("a", "b", "c", "d"))
wkb = structure(list("0101000020407100000000000000801A064100000000AC5C1641",
"0101000020407100000000000000801A084100000000AC5C1441",
"0101000020407100000000000000801A044100000000AC5C1241",
"0101000020407100000000000000801A024100000000AC5C1841"), class = "WKB")
map=sf::st_sf(id=c("a1", "b2", "c3", "d4"), sf::st_as_sf(wkb, EWKB=TRUE))
lkptbl=data.frame(id=c("a1", "b2", "c3", "d4"), name=c("a", "b", "c", "d"))
netmap::netmap_plot(net, map, lkptbl, "id", "name")
```

 network.layout.extract_coordinates

Layout of a network based on a sf object

Description

Custom layout for `plot.network`, extracting coordinates of vertices from a sf object. Its result can be used by `plot.igraph` as well.

Usage

```
network.layout.extract_coordinates(n, layout.par)
```

Arguments

n	A network or igraph object. Not used, only for compatibility with <code>plot.network</code> .
layout.par	A list of layout parameters (the only one implemented is <code>layout.par\$sf</code> , an sf object whose rows match the order of vertices in n).

Value

A matrix whose rows contain the x,y coordinates of the vertices of n.

Examples

```
net=network::network(matrix(c(0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0), nrow=4, byrow=TRUE))
network::set.vertex.attribute(net, "name", value=c("a", "b", "c", "d"))
wkb = structure(list("010100002040710000000000000801A064100000000AC5C1641",
"010100002040710000000000000801A084100000000AC5C1441",
"010100002040710000000000000801A044100000000AC5C1241",
"010100002040710000000000000801A024100000000AC5C1841"), class = "WKB")
map=sf::st_sf(id=c("a1", "b2", "c3", "d4"), sf::st_as_sfc(wkb, EWKB=TRUE))
lkptbl=data.frame(id=c("a1", "b2", "c3", "d4"), name=c("a", "b", "c", "d"))
netmap::network.layout.extract_coordinates(net, list(sf=map))
```

 reduce_to_map

Reduces network to vertices present on the map

Description

Removes vertices from a network or igraph object which are not present in the link vector produced by `link_network_map` or `link_network_map2`.

Usage

```
reduce_to_map(n, link, n_name)
```

Arguments

n	A network or igraph object.
link	A vector with the identifiers of the vertices to keep.
n_name	Name of the vertex attribute to filter on.

Value

A network or igraph object with only the vertices listed in link.

Index

* datasets

fvmap, 3

betweenness, 4

check_network_sf, 2

closeness, 4

degree, 4

fortify, 6

fvmap, 3

geom_edges, 6

geom_nodes, 6

ggcentrality, 3

ggconn_area, 5

ggnetmap, 6, 9

is_lookup_table, 7

is_network, 7

is_sf, 8

link_network_map, 8, 11

link_network_map2, 9, 11

netmap, 9

netmap_plot, 9, 10

network.layout.extract_coordinates, 9,
11

plot.igraph, 9–11

plot.network, 9–11

reduce_to_map, 11