Package ‘intergraph’

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Description  Functions implemented in this package allow to coerce (i.e. convert) network data between classes provided by other R packages. Currently supported classes are those defined in packages: network and igraph.

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Author  Michał Bojanowski [aut, cre] (<https://orcid.org/0000-0001-7503-852X>)
Maintainer  Michał Bojanowski <michal2992@gmail.com>
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Description

This package contains methods for coercion between various classes used to represent network data in R.

Details

Functions implemented in this package allow to coerce (i.e. convert) network data between classes provided by other R packages. Currently supported classes are: "network" from package network, "igraph" from package igraph.

The main functions are:

- asNetwork and its methods to create objects of class "network".
- asIgraph and its methods to create objects of class "igraph".

See their help pages for more information and examples.

As all the supported packages are written using S3 methods, so are the methods in this package.

If you find this package useful in your work please cite it. Type citation(package="intergraph") for the information how to do that.

Author(s)

Written and maintained by Michal Bojanowski <m.bojanowski@icm.edu.pl>.

See Also

Useful links:

- [https://mbojan.github.io/intergraph/](https://mbojan.github.io/intergraph/)
- Report bugs at [https://github.com/mbojan/intergraph/issues](https://github.com/mbojan/intergraph/issues)
Examples

```r
# example of converting objects between classes 'network' and 'igraph'
# needs packages igraph and network attached
if( require(network) & require(igraph) )
{

    ### convert 'network' -> 'igraph'

    # example network as object of class "network"
    summary(exNetwork)

    # convert to class "igraph"
    g <- asIgraph(exNetwork)

    # check if 'exNetwork' and 'g' are the same
    # (dropping some aux attributes)
    all.equal( structure(as.matrix(exNetwork, "edgelist"), n=NULL, vnames=NULL),
               igraph::as_edgelist(g) )

    # compare results using 'netcompare'
    netcompare(exNetwork, g)

    ### convert 'igraph' -> 'network'

    # example network as object of class "igraph"
    summary(exIgraph)

    # convert to class "network"
    gg <- asNetwork(exIgraph)

    # check if they are the same
    # (dropping some attributes)
    all.equal( get.edgelist(exIgraph),
               structure(as.matrix(gg, "edgelist"), n=NULL, vnames=NULL))
    netcompare(exIgraph, gg)
}
```

---

**asDF**

Convert network to data frame(s)

**Description**

Convert a network data object to, possibly two, data frames: a data frame with an edge list with edge attributes (if any), and a data frame of vertexes with vertex attributes (if any). This is a generic function, see below for available methods.
Usage

```r
asDF(object, ...)  
```

## S3 method for class 'network'
```r
asDF(object, ...)  
```

## S3 method for class 'igraph'
```r
asDF(object, ...)  
```

Arguments

- `object`: R object representing a network, see below for available methods
- `...`: other arguments passed to/from other methods

Details

Currently there are methods for `object` being in one of the following classes: "network", "igraph".

The function first gets the graph edge list using the appropriate function depending on the class of `object` (see below). Edge attributes, if any, are then extracted using `dumpAttr` and added to it.

The vertex data frame is constructed with a vertex id as a sequence of integer numbers. Details are method-specific, see below. Vertex attributes are extracted with `dumpAttr` and added to this data frame.

Method-specific notes:

For objects of class "network". Objects of this class store the vertex ids as integer numbers. There is also an attribute "vertex.names" which is always created when using graph constructors provided in the package `network`. `asDF` adds "vertex.names" to the vertex data frame as a normal attribute and does not use it as a vertex id in the edge list.

The edge list is created using `as.matrix.network` function and contains integer vertex ids.

Objects of class "igraph", as provided by the `igraph` package. Vertex ids in these objects integers starting from 1 (in `igraph` version prior to 0.6-0 vertex ids started from 0). However, it is also possible to provide a vertex attribute "name". It is added to the vertex data frame as a normal vertex attribute and is not used on the edge list data frame.

The edge list is created using `get.edgelist` function with argument `names` set to `FALSE` so that integer vertex ids are used.

Value

List with two components:

- `edges`: containing an edge list data frame at first two columns and edge attributes on further ones.
- `vertexes`: with vertex id in the first column, named `id` and any vertex attributes in the other columns.
Examples

```r
# using method for 'network' objects
d1 <- asDF(exNetwork)
str(d1)

# using method for 'igraph' objects
d2 <- asDF(exIgraph)
str(d2)
```

Description

Coerce objects to class "igraph".

Usage

```r
asIgraph(x, ...)
```

## S3 method for class 'network'
```r
asIgraph(x, amap = attrmap(), ...)
```

## S3 method for class 'data.frame'
```r
asIgraph(x, directed = TRUE, vertices = NULL, vnames = NULL, ...)
```

Arguments

- **x**: R object to be converted
- **...**: other arguments from/to other methods
- **amap**: data.frame with attribute copy/rename rules, see `attrmap`
- **directed**: logical, whether the created network should be directed
- **vertices**: NULL or data frame, optional data frame containing vertex attributes
- **vnames**: character, name of the column in vertices to be used as a name vertex attribute, if NULL no vertex names are created

Details

`asIgraph` is a generic function with methods written for data frames and objects of class "network". If `x` is a data frame, the method used is a wrapper around `graph.data.frame` in package `igraph`. The `vnames` argument was added so that the user can specify which vertex attribute from the data frame supplied through `vertices` argument is used for vertex names (the name attribute in igraph objects) in the returned result. By default the vertex names are not created.

If `x` is of class "network" (package `network`) the function uses `asDF` to extract data on edges and vertex with their attributes (if present). Network attributes are extracted as well. Not all vertex/edge/network attributes are worth preserving though. Attributes are copied, dropped or renamed
based on rules given in the amap argument, see attrmap for details. The function currently does not support objects that represent neither bipartite networks nor hypergraphs.

Value

Object of class "igraph".

See Also

graph.data.frame

Examples

### using 'asIgraph' on objects of class 'network'

```r
# g <- asIgraph(exNetwork)
```

```r
# compare adjacency matrices
netmat <- as.matrix(exNetwork, "adjacency")
imat <- as.matrix(g, "adjacency")
# drop the dimnames in 'netmat'
dimnames(netmat) <- NULL
# compare
identical( netmat, imat )
```

### using 'asIgraph' on data.frames

```r
# data frame with vertex ids and vertex attributes
v <- 1:4
vd <- data.frame(id = v + 5, label=letters[1:4])
print(vd)
```

```r
# edge list (first two columns) and edge attributes
e <- c(1,2, 2,3, 3,4, 4,1)
ed <- data.frame(id1 = e[seq(1,8, by=2)]+5, id2=e[seq(2, 8, by=2)]+5, a=letters[1:4])
print(ed)
```

```r
# build the network
# without vertex attributes
# g <- asIgraph(ed, directed=FALSE)
# with vertex attributes
gv <- asIgraph(ed, vertices=vd, directed=FALSE)
```

```r
# NOTE: Even though vertex ids start at 6 the network has 4 nodes:
range(vd$id) # min and max of node ids
if(require(igraph)) igraph::vcount(gv) # number of nodes in 'gv'
```
asNetwork

Convert objects to class "network"

Description

Convert objects to class "network"

Usage

asNetwork(x, ...)

## S3 method for class 'data.frame'
asNetwork(x, directed = TRUE, vertices = NULL, ...)

## S3 method for class 'igraph'
asNetwork(x, amap = attrmap(), ...)

Arguments

x

an R object to be coerced, see Details for the description of available methods

...

other arguments from/to other methods

directed

logical, whether the created network should be directed

vertices

NULL or data frame, optional data frame containing vertex attributes

amap

data.frame with attribute copy/rename rules, see attrmap

Details

This is a generic function which dispatches on argument x. It creates objects of class "network" from other R objects.

The method for data frames is inspired by the similar function in package igraph: graph.data.frame. It assumes that first two columns of x constitute an edgelist. The remaining columns are interpreted as edge attributes. Optional argument vertices allows for including vertex attributes. The first column is assumed to vertex id, the same that is used in the edge list. The remaining columns are interpreted as vertex attributes.

The method for objects of class "igraph" takes the network of that class and converts it to data frames using asDF. The network is recreated in class "network" using asNetwork.data.frame. The function currently does not support bipartite "igraph" networks.

Value

Object of class "network".

See Also

graph.data.frame
asigraph for conversion in the other direction.
Examples

```r
# require package 'network' as 'asNetwork' generic is defined there
if(require(network, quietly=TRUE))
{
  ### demonstrating method for data frames
  l <- asDF(exNetwork)
  g <- asNetwork(l$edges, vertices=l$vertexes)
  stopifnot(all.equal(g, exNetwork))

  ### method for igraph objects
  ig <- asNetwork(exIgraph)
  identical(as.numeric(as.matrix(g, "adjacency")),
            as.numeric(as.matrix(ig, "adjacency")))
}
```

attrmap

### Network attribute copying/renaming table

Description

Setting and retrieving rules through which network/edge/vertex attributes are copied or renamed when converting network objects.

Usage

```r
attrmap(newdf = NULL)
```

Arguments

- `newdf` data.frame, new set of copy/rename rules, see Details

Details

Different classes for network data use different attribute names to store the same information. Some of the classes define attributes not used by other classes. This function is used to retrieve or set the rules in which these attributes are copied, renamed or dropped when converting network objects.

The rules are stored in a data frame with the following columns (all of mode character):

- `type` type, or level of the attribute, one of "vertex", "edge" or "network"
- `fromcls` name of the class which is being coerced
- `fromattr` name of the "source" attribute
- `tocls` name of the class to which coercion is being done
- `toattr` name of the attribute in the result of coercion, or NA

When converting network x, of class xclass to network y of class yclass the coercion method looks up the rows in this table for which fromcls=xclass and tocls=yclass. If network x has any of the attributes listed in the fromattr in the resulting subset of the table then, it is renamed to the corresponding value of toattr. If toattr is NA the attribute is dropped from the result.
dumpAttr

Value

If newdf is NULL, a data frame with the current copy/rename rules. Otherwise newdf are set as new rules and the old ones are returned invisibly, much like par.

See Also

This is used by asIgraph and asNetwork

Examples

# Current values
attrmap()

dumpAttr

Dump network attributes to a list

Description

Given a network return a list of all the attributes.

Usage

dumpAttr(x, ...)

## S3 method for class 'network'
dumpAttr(x, type = c("all", "network", "vertex", "edge"), ...)

## S3 method for class 'igraph'
dumpAttr(x, type = c("all", "network", "vertex", "edge"), ...)

Arguments

x

network object

...

other arguments from/to other methods

type

character, type of attributes to dump

Value

If type is one of "network", "vertex" or "edge" then a list of corresponding attributes.
If type is "all" then lists of lists of attributes.
Examples

```r
# using 'igraph' object
l <- dumpAttr( exIgraph )  # all attributes
equal( dumpAttr(exIgraph, "network"), l$network )
equal( dumpAttr(exIgraph, "vertex"), l$vertex )
equal( dumpAttr(exIgraph, "edge"), l$edge )

# using 'network' object
l <- dumpAttr( exNetwork )  # all attributes
equal( dumpAttr(exNetwork, "network"), l$network )
equal( dumpAttr(exNetwork, "vertex"), l$vertex )
equal( dumpAttr(exNetwork, "edge"), l$edge )
```

---

**exNetwork**

*Sample network structure*

---

**Description**

An example of networks together with network, edge and vertex attributes used primarily for testing. The same networks are stored in objects of class `network` and `igraph`.

**Format**

- `exNetwork, exNetwork2` is of class `network`
- `exIgraph, exIgraph2` is of class `igraph`

Objects `exNetwork` and `exIgraph` store directed version of the network. Objects `exNetwork2` and `exIgraph2` store the undirected version: all direction information from the edges is removed.

The network consists of 15 vertices and 11 edges.

- Vertex 1 is an isolate.
- Vertices 2-6 constitute a star with vertex 2 as a center.
- Vertices 7-8 and 9-10 make two dyads
- Vertices 11, 12, 13, 14 and 15 make a stem-and-leaf network.

**Details**

Vertices and edges has attribute `label`. For vertices these are simply letters from "a" to "o". For edges these are two-letter sequences corresponding to the neighboring vertices, i.e. the label for the edges linking nodes "b" and "c" will be "bc". The order is irrelevant.

In the `exNetwork` object the `label` attribute is also copied to the `vertex.names` attribute to facilitate plotting.

The `exIgraph` object has additional graph attribute `layout` so that by default Fruchterman-Reingold placement is used for plotting.
Examples

```r
if(require(network, quietly=TRUE) ) print(exNetwork)
if( require(igraph, quietly=TRUE) ) print(exIgraph)

# showing-off 'network' versions
if(require(network, quietly=TRUE))
{
  op <- par(mar=c(1,1,1,1))
  layout( matrix(1:2, 1, 2, byrow=TRUE) )
  # need to change the family to device default because of faulty 'igraph'
  plot(exNetwork, main="Directed, class 'network'", displaylabels=TRUE)
  plot(exNetwork2, main="Undirected, class 'network'", displaylabels=TRUE)
  par(op)
}

# not running because of a bug in 'igraph': plot.igraph wants to set default
# font for vertex labels to 'serif', which is not supported on all devices
if(FALSE) {
  # showing-off 'igraph' versions
  if(require(igraph, quietly=TRUE))
  {
    op <- par(mar=c(1,1,1,1))
    layout( matrix(1:2, 1, 2, byrow=TRUE) )
    plot(exIgraph, main="Directed, class 'igraph'")
    plot(exIgraph2, main="Undirected, class 'igraph'")
    par(op)
  }
}

# The data was generated with the following code
if(FALSE) {
  # directed igraph
g <- igraph::graph( c(2,1, 3,1, 4,1, 5,1, # star
                     6,7, 8,9, # two dyads
                    10,11, 11,12, 12,13, 13,14, 14,12), # stem-leaf
                   n=14, directed=TRUE)
  # add some vertex attributes
  vl <- letters[seq(1, vcount(g))]
g <- igraph::set_vertex_attr(g, "label", value=vl)
  # add some edge attributes
  m <- igraph::as_edgelist(g)
l <- matrix(vl[m+1], ncol=2)
el <- apply(l, 1, paste, collapse="")
g <- igraph::set_edge_attr(g, "label", value=el)
g <- igraph::set_graph_attr(g, "layout", igraph::layout_with_fr)
rm(vl, l, m, el)
exIgraph <- g

  # undirected igraph
exIgraph2 <- igraph::as.undirected(exIgraph)
```
netcompare

Comparing and testing network objects

Description

Compare or test network objects for (near) equality.

Usage

\[
\text{netcompare}(\text{target}, \text{current}, \text{test} = \text{FALSE}, \ldots)
\]

Arguments

- **target, current**
  - network objects, currently network and igraph classes are supported
- **test**
  - logical, whether to perform the test or return comparison data, see Details
- **...**
  - other arguments, currently ignored

Details

Arguments target and current can be network objects of one of the supported classes. They do not have to be of the same class though.

The function does a series of comparisons between target and current:

1. The network structure comparison is made based on adjacency matrices (mind this when using for huge networks).
2. Network/edge/vertex attributes are checked for presence in both objects.
3. Common network/edge/vertex attributes are checked for equality.

All the results are collected in a list of class netcompare with an associated print method. If test is TRUE then instead of the detailed test results the function returns TRUE or FALSE depending on some of the checks resulted positively. Currently attribute checks are ignored, i.e. what is taken into account is:

1. Equivalence of adjacency matrices
2. Directed / undirected character of the network
3. Edge set size
4. Vertex set size

Value

Depending on the value of test either an object of class netcompare containing the results of all the tests (if test=FALSE) or (if test=TRUE) a logical whether or not the networks are (nearly) the same.

See Also

all.equal, identical

Examples

```
netcompare( asIgraph(exNetwork), exNetwork)
netcompare( asIgraph(exNetwork), exNetwork, test=TRUE)
```
Index

* datasets
  exNetwork, 10

* package
  intergraph-package, 2

  all.equal, 13
  as.matrix.network, 4
  asDF, 3, 5, 7
  asIgraph, 2, 5, 7, 9
  asNetwork, 2, 7, 9
  attrmap, 5–7, 8

  dumpAttr, 4, 9

  exIgraph (exNetwork), 10
  exIgraph2 (exNetwork), 10
  exNetwork, 10
  exNetwork2 (exNetwork), 10

  get.edgelist, 4
  graph.data.frame, 5–7

  identical, 13
  intergraph (intergraph-package), 2
  intergraph-package, 2

  netcompare, 12

  par, 9