Package ‘ResIN’

May 10, 2023

Type Package

Title Response Item Networks ('ResIN')

Version 0.1.0

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Description Contains various tools to perform and visualize Response Item Networks ('ResIN's). 'ResIN' binarizes ordered-categorical and qualitative response choices from (survey) data, calculates pairwise associations and maps the location of each item response as a node in a force-directed network. Please refer to <https://www.resinmethod.net/> for more details.

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URL https://github.com/pwarncke77/ResIN

BugReports https://github.com/pwarncke77/ResIN/issues

Depends R (>= 4.1.0)

Imports ggplot2 (>= 3.4.2), dplyr (>= 1.0.0), fastDummies (>= 1.6.3), qgraph (>= 1.9.4), igraph (>= 1.4.2), wCorr (>= 1.9.6), Matrix, DirectedClustering (>= 0.1.1)

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2023-05-10 13:50:06 UTC
R topics documented:

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lik_data  Likert-type simulated toy data for ResIN package examples

Description

An artificially created data-set (n=1000) of 12, 5-point Likert type ordinal data. Modeled on the
basis of a standard normal data-generating process. Likert scales reflect 20

Usage

data(lik_data)

Format

An object of class "data.frame"

References

This data set was artificially created for the ResIN package.

Examples

data(lik_data)
head(lik_data)
ResIN

Description

Performs Response Item-Network analysis (ResIN)

Usage

ResIN(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  poly_ncor = 2,
  remove_negative = TRUE,
  EBICglasso = FALSE,
  EBIClasso_arglist = NULL,
  node_covars = NULL,
  node_costats = NULL,
  network_stats = FALSE,
  cluster = TRUE,
  seed = 42
)

Arguments

df
  A data-frame object containing the raw data.

node_vars
  An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).

cor_method
  Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".

weights
  An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.

method_wCorr
  If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.

poly_ncor
  How many CPU cores should be used to estimate polychoric correlation matrix? Only used if cor_method = "polychoric".
remove_negative
Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.

EBICglasso
Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

EBICglasso_arglist
An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE.

node_covars
An optional character string selecting quantitative covariates that can be used to enhance ResIN analysis. Typically, these covariates provide grouped summary statistics for item response nodes. (E.g.: What is the average age or income level of respondents who selected a particular item response?) Variable names specified here should match existing columns in df.

node_costats
If any node_covars are selected, what summary statistics should be estimated from them? Argument should be a character vector of the same length of node_covars and call a base-R function. (E.g. "mean", "median", "sd"). The first element in node_costats specifies the summary statistic extracted from the first element in node_covars, and so on.

network_stats
Should common network structuration and centralization metrics be extracted? Calls qgraph::centrality_auto and DirectedClustering::ClustF to the ResIN graph object to extract network average betweenness, closeness, strength centrality (mean) and centralization scores (sd). Also estimates network expected influence, average path length, and global clustering coefficients.

cluster
Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in plotting_frame.

seed
Random seed for force-directed algorithm.

Value
A list object containing the ResIN adjacency matrix (adj_matrix), a numeric vector detailing which item responses belong to which item (same_items), a ggplot-ready edge-list type dataframe (ggplot_frame), a node-level dataframe (plotting_frame), a vector with the optional graph structuration (graph_structuration) and centralization (graph_centralization) statistics, as well as the dummy-coded item-response dataframe (df_dummies).

Examples

```r
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)
library(ggplot2)

# Apply the ResIN function to toy Likert data:
output <- ResIN(lik_data, cor_method = "spearman", network_stats = TRUE)
```
# Create a basic outcome plot with ggplot
output$ggplot_frame <- output$ggplot_frame[order(output$ggplot_frame$Strength, decreasing = FALSE), ]
ResIN_plot <- ggplot2::ggplot(output$ggplot_frame)+
  geom_curve(data = output$ggplot_frame, aes(x = from.x, xend = to.x, y = from.y, 
    yend = to.y, linewidth = weight, 
    color = Strength), curvature = 0.2)+
  geom_point(aes(x = from.x, y = from.y, shape = as.factor(cluster)), size = 8)+
  geom_point(aes(x = to.x, y = to.y), size = 8)+
  geom_text(data = output$ggplot_frame, aes(x = from.x, y = from.y, label = from), 
    size = 3, color = "white")+
  geom_text(data = output$ggplot_frame, aes(x = to.x, y = to.y, label = to), 
    size = 3, color = "white")+
  ggtitle("ResIN example plot")+
  theme_dark()+
  theme(axis.text.x = element_blank(), axis.title.x = element_blank(), 
    axis.text.y = element_blank(), axis.title.y = element_blank(), 
    axis.ticks = element_blank(), panel.grid.major = element_blank(), 
    panel.grid.minor = element_blank(), legend.position = "none", 
    legend.text = element_blank(), plot.title = element_text(hjust = 0.5))
ResIN_plot

ResIN_igraph

Description

Performs Response Item-Network analysis (ResIN) and exports the results as an igraph object.

Usage

ResIN_igraph(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  igraph_arglist = NULL,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL,
  cluster = TRUE,
  seed = 42
)

Arguments

- **df**: A data-frame object containing the raw data.
- **node_vars**: An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e., the subset of attitude variables in df).
- **cor_method**: Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
- **weights**: An optional continuous vector of survey weights. Should have the same length as the number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.
- **method_wCorr**: If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.
- **remove_negative**: Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.
- **igraph_arglist**: An optional argument list feeding additional instructions to igraph. Needs to be specified as an object list containing the arguments to be passed down.
- **EBICglasso**: Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph package performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.
- **EBICglasso_arglist**: An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE.
- **cluster**: Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in plotting_frame.
- **seed**: Random seed for force-directed algorithm.

Value

A list object containing the igraph output object, a numeric vector detailing which item responses belong to which item (same_items), and optionally a matrix detailing community membership of different item nodes (clustering).

References

Examples

```r
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)

## Run the function:
ResIN_igraph <- ResIN_igraph(lik_data)

## Plot and/or investigate as you wish:
igraph::plot.igraph(ResIN_igraph$igraph_obj)
```

Description

Performs Response Item-Network analysis (ResIN) and exports the results as an qgraph object.

Usage

```r
ResIN_qgraph(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  plot_graph = TRUE,
  plot_title = "ResIN_qgraph",
  qgraph_arglist = NULL,
  EBICglasso = TRUE,
  EBICglasso_arglist = NULL,
  same_item_groups = FALSE,
  cluster = FALSE
)
```

Arguments

- **df**: A data-frame object containing the raw data.
- **node_vars**: An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
- **cor_method**: Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
weights
An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.

method_wCorr
If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.

remove_negative
Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.

plot_graph
Optionally, should qgraph generate print the network upon generation? Defaults to TRUE.

plot_title
Optionally, assign a title to the qgraph plot.

qgraph_arglist
An optional argument list feeding additional instructions to qgraph. Needs to be specified as an object list containing the arguments to be passed down.

EBICglasso
Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

EBICglasso_arglist
An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE. Needs to be specified as an object list containing the arguments to be passed down.

same_item_groups
Optionally, should the qgraph object automatically incorporate a "group" attribute that groups item response nodes by the items that repose nodes stem from?

cluster
Optional, should community detection be performed on item response network? Defaults to FALSE. If set to TRUE, performs "cluster_leading_eigen" function from the igraph package and stores results in plotting_frame.

Value
A list object containing the qgraph output object, a numeric vector detailing which item responses belong to which item (same_items), and optionally a matrix detailing community membership of different item nodes (clustering).

References

Examples
## Load the 12-item simulated Likert-type ResIN toy dataset

data(lik_data)

## Run the function:
ResIN_qgraph <- ResIN_qgraph(lik_data, same_item_groups = TRUE)

---

### Description

Generates auxiliary utensils useful for Response-Item Networks analysis.

### Usage

```r
ResIN_utils(
  df,
  node_vars = NULL,
  cor_method = "auto",
  weights = NULL,
  method_wCorr = "Polychoric",
  remove_negative = TRUE,
  EBICglasso = FALSE,
  EBICglasso_arglist = NULL
)
```

### Arguments

- **df**: A data-frame object containing the raw data.
- **node_vars**: An optional character string detailing the attitude item columns to be selected for ResIN analysis (i.e. the subset of attitude variables in df).
- **cor_method**: Which correlation method should be used? Defaults to "auto" which applies the cor_auto function from the qgraph package. Possible arguments are "auto", "pearson", "kendall", and "spearman".
- **weights**: An optional continuous vector of survey weights. Should have the same length as number of observations in df. If weights are provided, weighted correlation matrix will be estimated with the weightedCorr function from the wCorr package.
- **method_wCorr**: If weights are supplied, which method for weighted correlations should be used? Defaults to "Polychoric". See wCorr::weightedCorr for all correlation options.
- **remove_negative**: Should all negative correlations be removed? Defaults to TRUE (highly recommended). Setting to FALSE makes it impossible to estimate a force-directed network layout. Function will use igraph::layout_nicely instead.
EBICglasso Should a sparse, Gaussian-LASSO ResIN network be estimated? Defaults to FALSE. If set to TRUE, EBICglasso function from the qgraph packages performs regularization on (nearest positive-semi-definite) ResIN correlation matrix.

EBICglasso_arglist An argument list feeding additional instructions to the EBICglasso function if EBICglasso is set to TRUE.

Value A list object containing the original dataframe, (resin_df), the dummy-coded dataframe (resin_dummies), the ResIN correlation and covariance matrices (resin_cor & resin_vcov), and a numeric vector detailing which item responses belong to which item (same_items).


Examples

```r
## Load the 12-item simulated Likert-type ResIN toy dataset
data(lik_data)

## Extract the utilities
output <- ResIN_utils(lik_data)
```
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