Package ‘pompom’

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Type Package

Title Person-Oriented Method and Perturbation on the Model

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Description An implementation of a hybrid method of person-oriented method and perturbation on the model. Pompom is the initials of the two methods. The hybrid method will provide a multivariate intraindividual variability metric (iRAM). The person-oriented method used in this package refers to uSEM (unified structural equation modeling, see Kim et al., 2007, Gates et al., 2010 and Gates et al., 2012 for details). Perturbation on the model was conducted according to impulse response analysis introduced in Lutkepohl (2007).


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LazyData true

RoxygenNote 7.1.1

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Imports lavaan (>= 0.5-23.1097), ggplot2 (>= 2.2.1), reshape2 (>= 1.4.2), qgraph, utils

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Description

Bootstrapped iRAM (including replications of iRAM and corresponding time profiles) for the bivariate time-series (simts2node)

Usage

bootstrap_iRAM_2node

Format

An object of class list of length 5.

Details

Data bootstrapped from the estimated three-node network structure with 200 replications.
Examples

```r
bootstrap_iRAM_3node$mean # mean of bootstrapped iRAM
bootstrap_iRAM_3node$upper # Upper bound of confidence interval of bootstrapped iRAM
bootstrap_iRAM_3node$lower # lower bound of confidence interval of bootstrapped iRAM
bootstrap_iRAM_3node$time.profile.data # time profiles generated from the bootstrapped beta matrices
bootstrap_iRAM_3node$recovery.time.reps # iRAMs generated from the bootstrapped beta matrices
```

### Description

Bootstrapped iRAM (including replications of iRAM and corresponding time profiles) for the 3-variate time-series (simts)

### Usage

```r
bootstrap_iRAM_3node
```

### Format

An object of class `list` of length 5.

### Details

Data bootstrapped from the estimated three-node network structure with 200 replications.

### Examples

```r
bootstrap_iRAM_3node$mean # mean of bootstrapped iRAM
bootstrap_iRAM_3node$upper # Upper bound of confidence interval of bootstrapped iRAM
bootstrap_iRAM_3node$lower # lower bound of confidence interval of bootstrapped iRAM
bootstrap_iRAM_3node$time.profile.data # time profiles generated from the bootstrapped beta matrices
bootstrap_iRAM_3node$recovery.time.reps # iRAMs generated from the bootstrapped beta matrices
```
iRAM

Generate iRAM (impulse response analysis metric) from model fit.

Usage

iRAM(
  model.fit,  
  beta,        
  var.number,  
  lag.order = 1,
  threshold = 0.01, 
  boot = FALSE,
  replication = 200,
  steps = 100
)

Arguments

model.fit    model fit object generated by lavaan
beta         beta matrix for a point estimate
var.number   number of variables in the time series
lag.order    lag order of the model to be fit
threshold    threshold of calculation of recovery time (duration of perturbation), default value is 0.01
boot         to bootstrap, default value is FALSE
replication  number of replication of bootstrap, default value is 200
steps        number of steps of impulse response analysis, default value is 100

Value

iRAM matrix. Rows represent where the orthogonal impulse was given, and columns represent the response. Dimension is var.number by var.number.

References

Examples

```r
boot.iRAM <- iRAM(model.fit = usecmmodelfit,
    beta = NULL,
    var.number = 3,
    lag.order = 1,
    threshold = 0.01,
    boot = TRUE,
    replication = 200,
    steps = 100
)
boot.iRAM$mean
```

**iRAM_equilibrium**  
Generate iRAM (impulse response analysis metric) in the equilibrium form.

**Description**  
Generate iRAM (impulse response analysis metric) in the equilibrium form.

**Usage**  
iRAM_equilibrium(beta.matrix, var.number, lag.order)

**Arguments**  
- **beta.matrix**: beta matrix for a point estimate
- **var.number**: number of variables in the time series
- **lag.order**: lag order of the model to be fit

**Value**  
a list of equilibria. First numeric number in the variable name indicate where the impulse was given, and the second numeric number indicate the response, e.g., e12 indicates equilibrium of node 2 when node 1 is given an impulse.

**Examples**

```r
iRAM_evalue <- iRAM_equilibrium(beta.matrix = true_beta_3node,
    var.number = 3,
    lag.order = 1)
```
model_summary

Description

Provide model summary.

Usage

model_summary(model.fit, var.number, lag.order)

Arguments

model.fit model fit object generated by lavaan
var.number number of variables in the time-series
lag.order lag order of model

Details

Model fit criteria: 3 out of 4 rule, meaning 3 out of 4 criteria should be satisfied, including CFI and TLI should be greater than 0.95, RMSEA and SRMR should be less than 0.08.

Value

beta matrix estimates
matrix of standard error of beta
matrix of psi estimates
fit statistics CFI
fit statistics TLI
fit statistics RMSEA
fit statistics SRMR
Examples

```r
mdl <- model_summary(model.fit = usemmodelfit,
  var.number = 3,
  lag.order = 1)
mdl$beta
mdl$beta.se
mdl$psi
mdl$cfi
mdl$tli
mdl$rmsea
mdl$srmr
```

Description

Parse the beta from model fit object

Usage

```r
parse_beta(var.number, model.fit, lag.order, matrix = F)
```

Arguments

- `var.number`: number of variables in the time series
- `model.fit`: model fit object generated by lavaan
- `lag.order`: lag order of the model to be fit
- `matrix`: output beta in matrix format or estimates format, default value is FALSE (as estimates)

Value

beta

Examples

```r
data(usemmodelfit)
beta.matrix <- parse_beta(var.number = 3,
  model.fit = usemmodelfit,
  lag.order = 1,
  matrix = TRUE)
```
plot_integrated_time_profile

Plot the time profiles in the integrated form

Usage

plot_integrated_time_profile(beta.matrix, var.number, lag.order = 1)

Arguments

- beta.matrix: matrix of temporal relations, containing both lag-1 and contemporaneous
- var.number: number of variables in the time series
- lag.order: lag order of the model to be fit

Examples

plot_integrated_time_profile(beta.matrix = true_beta_3node, var.number = 3, lag.order = 1)

plot_iRAM_dist

Plot distribution of recovery time based on bootstrapped version of iRAM

Usage

plot_iRAM_dist(recovery.time.reps)
plot_network_graph

Arguments

recovery.time.reps
    bootstrapped version of recovery time

Examples

plot_iRAM_dist(bootstrap_iRAM_3node$recovery.time.reps)

plot_network_graph(beta, var.number)

Arguments

beta         matrix of temporal relations, containing both lag-1 and contemporaneous
var.number   number of variables in the time series

Examples

plot_network_graph(beta = true_beta_3node,
                   var.number = 3)
### plot_time_profile

Plot time profiles given a time-series generated by impulse response analysis

#### Usage

```r
plot_time_profile(time.series.data, var.number, threshold = 0.01, xupper = 20)
```

#### Arguments

- **time.series.data**: data of impulse response in long format
- **var.number**: number of variables in the time-series
- **threshold**: threshold of asymptote of equilibrium
- **xupper**: upper limit of x-axis

#### Examples

```r
plot_time_profile(time.series.data = bootstrap_iRAM_2node$time.profile.data, 
                  var.number = 2, 
                  threshold = .01, 
                  xupper = 20)
```

### simts_2node

Simulated bivariate time-series data

#### Usage

```r
simts_2node
```

#### Format

An object of class `data.frame` with 200 rows and 2 columns.
**Details**

Data simulated from a given three-node network structure with 200 measurements. Network structure is shown in the dataset true.beta. Process noise has mean of 0 and SD .1.

**Examples**

```r
data(simts_2node)
```

---

**Description**

Simulated 3-variate time-series data

**Usage**

`simts_3node`

**Format**

An object of class `data.frame` with 100 rows and 3 columns.

**Details**

Data simulated from a given three-node network structure with 200 measurements. Network structure is shown in the dataset true.beta. Process noise has mean of 0 and SD .1.

**Examples**

```r
data(simts_3node)
```
true_beta_2node

Description

The true beta matrix (4 by 4) used in simulation.

Usage

true_beta_2node

Format

An object of class matrix (inherits from array) with 4 rows and 4 columns.

Details

true_beta_2node <- matrix(c(0,0,0,0, 0,0,0,0, 0.2,-.4,0,-0.25, 0,0.3,-0.2,0), nrow = 4, ncol = 4, byrow = TRUE)

Examples

true_beta_2node

true_beta_3node

The true beta matrix (4 by 4) used in simulation.

Description

The true beta matrix (6 by 6) used in simulation.

Usage

true_beta_3node

Format

An object of class matrix (inherits from array) with 6 rows and 6 columns.

Details

true_beta_3node <- matrix(c(0,0,0,0,0,0, 0,0,0,0,0,0, 0,0,0,0,0,0, 0.2,0,0.25,0,0,0.6, 0,0.3,0,-0.2,0,-0.6, 0,-0.2,0.3,0,0,0), nrow = 6, ncol = 6, byrow = TRUE)
uSEM

Examples

true_beta_3node

uSEM

Fit a multivariate time series with uSEM (unified Structural Equation Model).

Usage

uSEM(var.number, data, lag.order = 1, verbose = FALSE, trim = FALSE)

Arguments

var.number  number of variables in the time series
data  time series data, must be in long format
lag.order  lag order of the model to be fit, default value is 1. Note: Higher order (greater than 1) might not run.
verbose  print intermediate model fit (iterations), default value is FALSE
trim  to trim the insignificant betas (just one step, not iterative), default value is FALSE

Details

The purpose of uSEM is to quantify the temporal relations (both contemporaneous and lag-1) between variables. Model specification and estimation can be found in the references.

Value

model fit object generated by lavaan
References


Examples

```r
model.fit <- uSEM(var.number = 3, 
  data = simts_3node, 
  lag.order = 1, 
  verbose = FALSE, 
  trim = FALSE)
model.fit
```

usemmodelfit

Model fit based on simulated time-series by uSEM.

Description

Model fit based on simulated time-series by uSEM.

Usage

usemmodelfit

Format

An object of class lavaan of length 1.

Examples

```r
data(usemmodelfit)
```
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