Package ‘graphicalVAR’

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Title Graphical VAR for Experience Sampling Data
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Description Estimates within and between time point interactions in experience sampling data, using the Graphical VAR model in combination with LASSO and EBIC.
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Estimate the graphical VAR model.

Description

Estimates the graphical VAR (Wild et al., 2010) model through LASSO estimation coupled with extended Bayesian information criterion for choosing the optimal tuning parameters. The estimation procedure is outlined by Rothman, Levina and Zhu (2010) and is further described by Abegaz and Wit (2013). The procedure here is based on the work done in the R package SparseTSCGM (Abegaz and Wit, 2014).

Usage

```r
graphicalVAR(data, nlambda = 50, verbose = TRUE, gamma = 0.5, lambda_beta, lambda_kappa, maxit.in = 100, maxit.out = 100)
```

Arguments

- **data**: A matrix or data frame containing repeated measures (rows) on a set of variables (columns). Must not contain missing data.
- **nlambda**: The number of both lambda parameters to test. Defaults to 50, which results in 2500 models to evaluate.
- **verbose**: Logical, should a progress bar be printed to the console?
- **gamma**: The EBIC hyper-parameter. Set to 0 to use regular BIC.
- **lambda_beta**: An optional vector of lambda_beta values to test.
- **lambda_kappa**: An optional vector of lambda_kappa values to test.
- **maxit.in**: Maximum number of iterations in the inner loop (computing beta).
- **maxit.out**: Maximum number of iterations in the outer loop

Details

Let $y_t$ denote the vector of responses of a subject on a set of items on time point $t$. The graphical VAR model, using only one lag, is defined as follows:

$$y_t = \text{Beta} \cdot y_{t-1} + \text{epsilon}_t$$

In which $\text{epsilon}_t$ is a vector of error and is independent between time points but not within time points. Within time points, the error is normally distributed with mean vector 0 and precision matrix (inverse covariance matrix) Kappa. The Beta matrix encodes the between time point interactions and the Kappa matrix encodes the within time point interactions. We aim to find a sparse solution for both Beta and Kappa, and do so by applying the LASSO algorithm as detailed by Rothman, Levina and Zhu (2010). The LASSO algorithm uses two tuning parameters, lambda_beta controlling the sparsity in Beta and lambda_kappa controlling the sparsity in Kappa. We estimate the model under a (by default) 50 by 50 grid of tuning parameters and choose the tuning parameters that optimize the extended Bayesian Information Criterion (EBIC; Chen and Chen, 2008).
After estimation, the Beta and Kappa matrices can be standardized as described by Wild et al. (2010). The Kappa matrix can be standardized to partial contemporaneous correlations (PCC) as follows:

\[ PCC(y_{i,t}, y_{j,t}) = -\frac{\kappa_{ij}}{\sqrt{\kappa_{ii} \kappa_{jj}}} \]

Similarly, the beta matrix can be standardized to partial directed correlations (PDC):

\[ PDC(y_{i,t-1}, y_{j,t}) = \frac{\beta_{ji}}{\sqrt{\sigma_{jj} \kappa_{ii}}} + \beta_{ji}^2 \]

In which sigma is the inverse of kappa. Note that this process transposes the beta matrix. This is done because in representing a directed network it is typical to let rows indicate the node of origin and columns the node of destination.

Value

A `graphicalVAR` object, which is a list containing:

- `pcc` The partial contemporaneous correlation network
- `pdc` The partial directed correlation network
- `beta` The estimated beta matrix
- `kappa` The estimated kappa matrix
- `ebic` The optimal EBIC
- `path` Results of all tested tuning parameters
- `labels` A vector containing the node labels

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References


Examples

# Real matrices:
Kappa <- diag(1,3,3)
Beta <- diag(0.4,3,3)
Beta[1,3] <- -0.5

# Simulate data:
Data <- graphicalVARsim(100,Beta,Kappa)

# Estimate model:
Res <- graphicalVAR(Data, gamma = 0, nLambda = 20)

# Plot results:
plot(Res)

# Compare results:
Beta
Res$beta

Kappa
Res$kappa

graphicalVARsim Simulates data from the graphical VAR model

Description

Simulates data from the graphical VAR model, see graphicalVAR for details.

Usage

graphicalVARsim(nTime, beta, kappa, init = 0, intercepts = 0, warmup = 100)

Arguments

nTime Number of time points to sample
beta The Beta matrix to use
kappa The Kappa matrix to use
init Initial values
intercepts Intercepts to use
warmup The amount of samples to use as warmup (not returned)

Value

A matrix containing the simulated data.
plot.graphicalVAR

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**Description**

Sends the estimated PCC and PDC networks to *qgraph*.

**Usage**

```r
## S3 method for class 'graphicalVAR'
plot(x, include = c("PCC", "PDC"), repulsion = 1,
     horizontal = TRUE, titles = TRUE, sameLayout = TRUE, ...)
```

**Arguments**

- `x`: A `graphicalVAR` object
- `include`: A vector of at most two containing "PCC" and "PDC" indicating which networks should be plotted and in what order.
- `repulsion`: The repulsion argument used in *qgraph*
- `horizontal`: Logical, should the networks be plotted horizontal or vertical?
- `titles`: Logical, should titles be added to the plots?
- `sameLayout`: Logical, should both networks be plotted in the same layout?
- `...`: Arguments sent to *qgraph*

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print.graphicalVAR

**S3 methods for graphicalVAR objects.**

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**Description**

Prints a short overview of the results of *graphicalVAR*.

**Usage**

```r
## S3 method for class 'graphicalVAR'
print(x, ...)  
## S3 method for class 'graphicalVAR'
summary(object, ...)  
```
Arguments

x               A graphicalVAR object
object          A graphicalVAR object
...             Not used.

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