MpermutMax {MpermutMax}

The Maximum Moving Cross-Correlation Method

Description

This method is a permutation method. It is used to test for significant correlations between the variables of both stationary and non-stationary multivariate time series. This method extended the Maximum Cross-Correlation method of Change et al. (2018) to account for non-stationary high-dimensional time series. Notice that the following library is needed to be installed before using the mpermutMax function: library(roll)

Usage

```
mpermutMax(x,w,l)
```

Arguments

x
    a T-by-m data matrix, where the rows are "T" time points, and the columns are "m" variables

w
    window width (i.e. window length)

l
    number of lagged series

Value

The mpermutMax function produces a list that consists of the following elements:

NoGroups
    returns the number of multivariate subgroups (i.e. subgroups with two components series or more)

Nos_of_Members
    returns the number of members (i.e. dimension) in each subgroup listed in NoGroups

Groups
    returns the indices of components in each of the subgroups listed in NoGroups

maxcorr
    returns a total of $m(m-1)/2$ values, which are the maximum moving cross-correlation statistics in decreasing order

corrRatio
    returns the ratios of the consecutive values listed in maxcorr

NoConnectedPairs
    returns the number of connected pairs

Xpre
    returns the the prewhitened data

Note

See the example below.

Author(s)

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References

Alshammri, F. and Pan, J. (2020). Generalized Principal Component Analysis for Non-Stationary Vector Time Series. Manuscript submitted for publication. Chang, J., Guo, B., and Yao, Q. (2018). Principal component analysis for second-order stationary vector time series. The Annals of Statistics, 46(5):2094-2124.

Examples

```
##This is Example 2 of Alshammri and Pan (2020).
##The data matrix X is a non-stationary time series with m=5 and T=1000.
m=5;T=1000
##Generate x_t
X=mat.or.vec(m,T)
u=arima.sim(list(order=c(1,1,3),ar=0.75,ma=c(1.5,0.5,0.2)),n=T+1,sd=1)
for(i in 1:2) X[i,]=u[i+1:T]
v=arima.sim(list(order=c(2,1,3),ar=c(-0.5,-0.4),ma=c(-1.2,-2.75,0.5)),n=T+1,sd=1)
for(i in 3:4) X[i,]=v[(i-1):(T+i-2)]
w=arima.sim(list(order=c(2,0,4),ar=c(-0.9,-0.45),ma=c(-1.1,-0.8,-0.6,-1.3)),n=T,sd=1)
X[5,]=w[1:T]
A=matrix(runif(m*m, -5, 5), ncol=m)
YY=A%*%X
YY=t(YY)
YY=ts(YY)
##here we have YY is the used data matrix (i.e. x=YY), the window size is 100, and we use 5 lags in the calculation of mw
FF=GTSPCA(YY,100,5)
##extract the transform segmented series X
X=FF$X
##On the transformed series "X", use the maximum moving cross-correlation method over 20 lags with a window of size 100:
S=mpermutMax(X,100,20)
S$Groups
```

[Package *MpermutMax* version 0.1.0 [Index](#)]