Package 'TrendTM'

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Type Package

Title Trend of High-Dimensional Time Series Matrix Estimation

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Description Matrix factorization for multivariate time series with both low rank and temporal structures. The procedure is the one proposed by Alquier, P. and Marie, N. Matrix factorization for multivariate time series analysis. Electronic journal of statistics, 13(2), 4346-4366 (2019).

Depends R (>= 3.5.0)

License GPL-3

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LazyData true

RoxygenNote 7.2.3

Imports softImpute, capushe, fda

NeedsCompilation no

Repository CRAN

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R topics documented:

Data_Series   *Example of data*

Description

A simulated matrix with a low rank k and with temporal structure based on independent Gaussian.

Usage

```
data(Data_Series)
```

Format

A matrix with 30 rows (30 times series) and 100 columns (size of each temporal series).

Examples

```
library(TrendTM)
data(Data_Series)
head(Data_Series)
TrendTM(Data_Series,k_max=3)
```

FM_kt   *It performs the factorization for a fixed rank k and a temporal structure*
                               with a fixed tau

Description

It performs the factorization for a fixed rank k and a temporal structure with a fixed tau

Usage

```
FM_kt(
  Data_Series,
  k = 2,
  tau = floor(n/2),
  struct_temp = "none",
  type_soft = "als"
)
```

Arguments

Data_Series	the data matrix with d rows and n columns containing the d temporal series with size n.
k	the fixed rank of X. Default is 2.
tau	the fixed value for tau . Default is `floor(n/2)`.
struct_temp	a name indicating the temporal structure. Could be `none`, `periodic` or `smooth`. Default is `none`.
type_soft	the option `type` of the function softImpute. Default is `als`.

Value

A list containing

- `M_est` the estimation of M.
- `U_est` the component U of the decomposition of `M_est`.
- `V_est` the component V of the decomposition of `M_est`.
- `contrast` the Frobenius norm of X-M_est.

OurSlope	*It performs the slope heuristic for the selection of a penalty constant*

Description

It performs the slope heuristic for the selection of a penalty constant

Usage

```
OurSlope(contrast, grille, penalty)
```

Arguments

contrast	the Frobenius norm of X-M_est for all the value of the grid `grille`
grille	the ordered grid of potential values for the penalty constant
penalty	the penalty calculated for each value of the grid `grille`

Value

`Model_Selected` the selected parameter

TrendTM   *Matrix Factorization for Multivariate Time Series Analysis*

Description

It is the main function. It performs the factorization for a selected rank and a temporal structure with a selected tau if the selection is requested otherwise it is fixed

Usage

```
TrendTM(
  Data_Series,
  k_select = FALSE,
  k_max = 20,
  struct_temp = "none",
  tau_select = FALSE,
  tau_max = floor(n/2),
  type_soft = "als"
)
```

Arguments

Data_Series	the data matrix with d rows and n columns containing the d temporal series with size n.
k_select	a boolean indicating if the rank of the matrix Data_Series will be selected. Default is FALSE.
k_max	the fixed rank of Data_Series if k_select=FALSE. The maximal value of the rank if k_select=TRUE (must be lower than the minimum between d and n). Default is 20.
struct_temp	a name indicating the temporal structure. Could be none, periodic or smooth. Default is none.
tau_select	a boolean indicating if the parameter tau will be selected. This can be possible only when struct_temp=smooth. Default is FALSE.
tau_max	the fixed value for tau if tau_select=FALSE. The maximal value of tau if tau_select=TRUE (must be lower than n). Default is floor(n/2).
type_soft	the option type of the function softImpute. Default is als.

Details

The penalty constant(s) is(are) calibrated using the slope heuristic from package capushe. We adapt this heuristic as follows: the final dimension is the one correspind to the majority of the selected dimension for the considered different penalties.

Value

A list containing

- `k_est` the selected rank if `k_select==TRUE` or `k_max` if `k_select==FALSE`.

- `tau_est` the selected tau if `tau_select==TRUE` or `tau_max` if `tau_select==FALSE`.

- `U_est` the component U of the decomposition of the final estimator `M_est`.

- `V_est` the component V of the decomposition of the final estimator `M_est`.

- `M_est` the estimation of M.

- `contrast` the Frobenius norm of Data_Series-M_est. This is a value when `k_select==FALSE` and `tau_select==FALSE`, a vector when `k_select==TRUE` or `tau_select==TRUE`, and a matrix when `k_select==TRUE` and `tau_select==TRUE` with `k_max` rows and `tau_max` columns.

Examples

```
data(Data_Series)
result <- TrendTM(Data_Series, k_max = 3)
```

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