Package 'ccTensor'

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Type Package

Title CUR/CX Tensor Decomposition

Version 1.0.2

Date 2021-08-02

Depends R (>= 4.1.0)

Imports methods, fields, MASS, igraph, rTensor

Suggests testthat, nnTensor

Description CUR/CX decomposition factorizes a matrix into two factor matrices and Multidimensional CX Decomposition factorizes a tensor into a core tensor and some factor matrices. See the reference section of GitHub README.md <https://github.com/rikenbit/ccTensor>, for details of the methods.

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URL https://github.com/rikenbit/ccTensor

NeedsCompilation no

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Details

The DESCRIPTION file:

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Title:	CUR/CX Tensor Decomposition
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License:	Artistic-2.0
URL:	https://github.com/rikenbit/ccTensor
Author:	Koki Tsuyuzaki [aut, cre], Itoshi Nikaido [aut]
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Author(s)

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Maintainer: NA

References

Michael W. Mahoney, et. al., (2009). CUR matrix decompositions for improved data analysis. *PNAS*

Petros Drineas et.al., (2008). Relative-error CUR Matrix Decompositions. *SIAM J. Matrix Anal. Appl.*

Maria F. K. B. et. al. (2019). Multidimensional CX Decomposition of Tensors. *WCNPS*

See Also

CX,CUR,MultiCX

Examples

```
ls("package:ccTensor")
```

CUR *CUR Matrix Decomposition*

Description

The input data is assumed to be a matrix. CUR decomposes the matrix to three low-dimensional factor matices. C and R are not estimated values but the actual column and row vectors sampled from the matrix.

Usage

```
CUR(A, c.rank=NULL, r.rank=NULL, thr=0.9,
  c.method=c("best.match", "random", "exact.num.random", "top.scores"),
  u.method=c("invCR", "invW"),
  r.method=c("best.match", "random", "exact.num.random", "top.scores"))
```

Arguments

A	The input matrix which has N-rows and M-columns.
c.rank	The number of low-dimension of C (J1 < N,M). If this argument is not specified or specified as NULL, the low-dimension is estimated based on the cumulative singular value (Default: NULL).
r.rank	The number of low-dimension of R (J2 < N,M). If this argument is not specified or specified as NULL, the low-dimension is estimated based on the cumulative singular value (Default: NULL).
thr	The threshold to determine the low-dimension J1 and J2. The value must be range 0 to 1 (Default: 0.9).
c.method	The column sampling algorithm (Default: best.match).
u.method	The algorithm to calculate U (Default: invCR).
r.method	The row sampling algorithm (Default: best.match).

Value

C: A N-rows and J1-columns matrix contains the sampled column vectors from the input matrix A. U: A J1-rows and J2-columns matrix. R: A J2-rows and M-columns matrix contains the sampled row vectors from the input matrix A. indC: The sampled column indices. indC: The sampled row indices. RecError : The reconstruction error between data matrix and reconstructed matrix from C and X.

Author(s)

Koki Tsuyuzaki

References

Michael W. Mahoney, et. al., (2009). CUR matrix decompositions for improved data analysis. *PNAS*

Examples

```
library("ccTensor")
library("nnTensor")
# Test data
matdata <- toyModel(model = "NMF")
# Simple usage
out <- CUR(matdata, c.rank=3, r.rank=4)
```

CX *CX Matrix Decomposition*

Description

The input data is assumed to be a matrix. CX decomposes the matrix to two low-dimensional factor matices. C is not an estimated values but the actual column vectors sampled from the matrix.

Usage

```
CX(A, rank=NULL, thr=0.9,
  c.method=c("best.match", "random", "exact.num.random", "top.scores"))
```

Arguments

A	The input matrix which has N-rows and M-columns.
rank	The number of low-dimension (J < N,M). If this argument is not specified or specified as NULL, the low-dimension is estimated based on the cumulative singular value (Default: NULL).
thr	The threshold to determine the low-dimension J. The value must be range 0 to 1 (Default: 0.9).
c.method	The column sampling algorithm (Default: best.match).

Value

C: A N-rows and J-columns matrix contains the sampled column vectors from the input matrix A. X: A J-rows and M-columns matrix. indC: The sampled column indices. RecError : The reconstruction error between data matrix and reconstructed matrix from C and X.

Author(s)

Koki Tsuyuzaki

References

Petros Drineas et.al., (2008). Relative-error CUR Matrix Decompositions. *SIAM J. Matrix Anal. Appl.*

Examples

```
library("ccTensor")
library("nnTensor")
# Test data
matdata <- toyModel(model = "NMF")
# Simple usage
out <- CX(matdata, rank=5)
```

`MultiCX` *MultiCX Tensor Decomposition*

Description

The input data is assumed to be a tensor. MultiCX decomposes the tensor into a core tensor and some factor matrices. The factor matrices are not estimated values but the actual column vectors sampled from the unfolded matrix in each mode.

Usage

```
MultiCX(Y, rank=NULL, modes=1:3, thr=0.9,
  c.method=c("best.match", "random", "exact.num.random", "top.scores"))
```

Arguments

`Y`	The input tensor (e.g. N times M times L).
`rank`	The number of low-dimension of factor matrices (e.g. J1, J2, and J3). If this argument is not specified or specified as NULL, the low-dimension is estimated based on the cumulative singular value (Default: NULL).
`modes`	The vector of the modes on whih to perform the decomposition (Default: 1:3 <all modes>).
`thr`	The threshold to determine the low-dimension of factor matrices. The value must be range 0 to 1 (Default: 0.9).
`c.method`	The column sampling algorithm (Default: best.match).

Value

U: Core tensor (e.g. J1 times J2 times J3). C: Factor matrices (e.g. C_1: ????????) RecError : The reconstruction error between data tensor and reconstructed tensor from C and X.

Author(s)

Koki Tsuyuzaki

References

Maria F. K. B. et. al. (2019). Multidimensional CX Decomposition of Tensors. *WCNPS*

Examples

```
library("ccTensor")
library("nnTensor")
# Test data
tensdata <- toyModel(model = "CP")
# Simple usage
out <- MultiCX(tensdata, rank=c(3,4,5))
```

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