Package 'hNMF'

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Title Hierarchical Non-Negative Matrix Factorization

Version 1.0

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Description Hierarchical and single-level non-negative matrix factorization. Several NMF algorithms are available.

Depends R (>= 3.3.0)

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Encoding UTF-8

LazyData true

Imports NMF, oro.nifti, tcltk, nnls, rasterImage, stats, graphics, grDevices, MASS

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Suggests testthat

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R topics documented:

HALSacc *Accelerated hierarchical alternating least squares NMF. For a reference to the method, see N. Gillis, Nonnegative matrix factorization: complexity, algorithms and applications [Section 4.2, Algo. 6], PhD thesis, Université catholique de Louvain, February 2011.*

Description

Accelerated hierarchical alternating least squares NMF. For a reference to the method, see N. Gillis, Nonnegative matrix factorization: complexity, algorithms and applications [Section 4.2, Algo. 6], PhD thesis, Université catholique de Louvain, February 2011.

Usage

```
HALSacc(X, nmfMod, alpha = 1, maxiter = 1000, checkDivergence = FALSE)
```

Arguments

X	Input data matrix, each column represents one observation and the rows correspond to the different features
nmfMod	Valid NMF model, containing initialized factor matrices (in accordance with the NMF package definition)
alpha	Nonnegative parameter of the accelerated method
maxiter	Maximum number of iterations
checkDivergence	currently not in use, to be implemented

Value

Resulting NMF model (in accordance with the NMF package definition)

Author(s)

nsauwen

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hNMF *Hierarchical non-negative matrix factorization.*

Description

Hierarchical non-negative matrix factorization.

Usage

```
hNMF(nmfInput, nmfMethod = "HALSacc")
```

Arguments

nmfInput	List with NMF input attributes
nmfMethod	String referring to the NMF algorithm to be used.

Value

Resulting NMF model (in accordance with NMF package definition)

Author(s)

Nicolas Sauwen

Examples

```
# create nmfInput object
X <- matrix(runif(10*20), 10,20)
bgImageTensor <- array(0,dim=dim(X))
selectVect <- array(1,dim=dim(X))
nmfInput <- NULL
nmfInput$numRows <- nrow(X)
nmfInput$numCols <- ncol(X)
nmfInput$numSlices <- 1
nmfInput$bgImageTensor <- bgImageTensor
nmfInput$selectVect <- selectVect

# run NMF with default algorithm, 5 runs with random initialization
NMFresult1 <- oneLevelNMF(X, rank=2, nruns=5)

# run NMF with specified algorithm and with initialized sources
W0 <- initializeSPA(X,3)
NMFresult2 <- oneLevelNMF(X, rank=3, method="HALSacc", initData = W0)
```

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imoverlay *Overlay a mask or a color scaled image on top of a background image*

Description

Overlay a mask or a color scaled image on top of a background image

Usage

```
imoverlay(image, overlay, selectVect = NULL, color = c(0, 1, 0))
```

Arguments

image	A matrix, background image
overlay	A matrix, serving as the overlay mask or figure
selectVect	A matrix (binary values), specifying which matrix elements are to be overlaid
color	3-element vector, defining the RGB color to be used in case the overlay is a mask

Author(s)

Nicolas Sauwen

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initializeNMF *Initialize NMF model with initial spectral data*

Description

Initialize NMF model with initial spectral data

Usage

```
initializeNMF(X, initData = NULL)
```

Arguments

X	input matrix
initData	source or abundance matrix with initial values

---

initializeSPA *The successive projection algorithm, a useful method for initializing the NMF source matrix*

Description

The successive projection algorithm, a useful method for initializing the NMF source matrix

Usage

```
initializeSPA(data, nSources)
```

Arguments

data	Input data matrix. The columns correspond to the data points, each row represents one feature
nSources	Number of sources to be obtained

Value

Matrix with initialized sources as its columns

Author(s)

Nicolas Sauwen

Examples

```
# random data
X <- matrix(runif(10*20), 10,20)

# Create initial source matrix for 3 sources
W0 <- initializeSPA(X,3)
```

`oneLevelNMF` *Perform Non-Negative Matrix factorization*

Description

Perform Non-Negative Matrix factorization

Usage

```
oneLevelNMF(X, rank, initData = NULL, method = "PGNMF", nruns = 10,
  checkDivergence = TRUE)
```

Arguments

`X`	input matrix. Each column represents one observation and the rows correspond to the different features
`rank`	number of NMF components to be found
`initData`	either of the NMF factor matrices, with initial values
`method`	name of the NMF method to be used. "PGNMF" (default) and "HALSacc" are available by default. Any method from the NMF package can also be specified
`nruns`	number of NMF runs. It is recommended to run the NMF analyses multiple times when random seeding is used, to avoid a suboptimal solution
`checkDivergence`	Boolean indicating whether divergence checking should be performed

Value

Scaled NMF model (in accordance with the NMF package definition)

Author(s)

Nicolas Sauwen

Examples

```
# random data
X <- matrix(runif(10*20), 10,20)

# run NMF with default algorithm, 5 runs with random initialization
NMFresult1 <- oneLevelNMF(X, rank=2, nruns=5)

# run NMF with specified algorithm and with initialized sources
W0 <- initializeSPA(X,3)
NMFresult2 <- oneLevelNMF(X, rank=3, method="HALSacc", initData = W0)
```

PGNMF — *NMF by alternating non-negative least squares using projected gradients. For a reference to the method, see C.-J. Lin, "Projected Gradient Methods for Non-negative Matrix Factorization", Neural computation 19.10 (2007): 2756-2779.*

Description

NMF by alternating non-negative least squares using projected gradients. For a reference to the method, see C.-J. Lin, "Projected Gradient Methods for Non-negative Matrix Factorization", Neural computation 19.10 (2007): 2756-2779.

Usage

```
PGNMF(X, nmfMod, tol = 1e-05, maxIter = 500, timeLimit = 300,
  checkDivergence = TRUE)
```

Arguments

X	Input data matrix, each column represents one data point and the rows correspond to the different features
nmfMod	Valid NMF model, containing initialized factor matrices (in accordance with the NMF package definition)
tol	Tolerance for a relative stopping condition
maxIter	Maximum number of iterations
timeLimit	Limit of time duration NMF analysis
checkDivergence	Boolean indicating whether divergence checking should be performed Default is TRUE, but it should be set to FALSE when using random initialization

Value

Resulting NMF model (in accordance with the NMF package definition)

Author(s)

nsauwen

`preProcesInputData` *Condition input data matrix properly for NMF*

Description

Condition input data matrix properly for NMF

Usage

```
preProcesInputData(X)
```

Arguments

`X`	input matrix

Value

matrix with non-zero elements

`residualNMF` *Computation of relative NMF residual per observation*

Description

Computation of relative NMF residual per observation

Usage

```
residualNMF(X, nmfFit)
```

Arguments

`X`	Input data matrix, each column represents one observation
`nmfFit`	NMF model fitted to the input data in X

Value

Relative residual per observation, returned as a vector

Author(s)

nsauwen

`scaleNMFResult` *Apply fixed scaling to NMF model matrices by normalizing the basis vectors*

Description

Apply fixed scaling to NMF model matrices by normalizing the basis vectors

Usage

```
scaleNMFResult(NMFResult)
```

Arguments

`NMFResult`	Fitted NMF model

Value

NMFResult Rescaled NMF model

Author(s)

Nicolas Sauwen

`semiNMF` *Semi-NMF based on multiplicative update rules. Reference: C. Ding, T. Li, and M.I. Jordan, "Convex and semi-nonnegative matrix factorizations", IEEE Transations on Pattern Analysis and Machine Intelligence, vol. 32, no. 1, pp. 45-55, 2010.*

Description

Semi-NMF based on multiplicative update rules. Reference: C. Ding, T. Li, and M.I. Jordan, "Convex and semi-nonnegative matrix factorizations", IEEE Transations on Pattern Analysis and Machine Intelligence, vol. 32, no. 1, pp. 45-55, 2010.

Usage

```
semiNMF(X, nmfMod, maxiter = 2000, checkDivergence = FALSE)
```

Arguments

X	Input data matrix, each column represents one observation and the rows correspond to the different features
nmfMod	Valid NMF model, containing initialized factor matrices (in accordance with the NMF package definition)
maxiter	Maximum number of iterations
checkDivergence	currently not in use, to be implemented

Value

Resulting NMF model (in accordance with the NMF package definition)

Author(s)

nsauwen

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