
matrix_decomposition Documentation

Release 0.1

Joscha Reimer

Jul 19, 2018

Contents:

1	Matrix decompositions	1
1.1	LL decomposition	1
1.2	LDL decomposition	2
1.3	LDL decomposition compressed	3
1.4	base decomposition	5
2	Changelog	7
2.1	v0.1	7
3	Indices and tables	9

Matrix decompositions

Several matrix decompositions are supported. They are available in *matrix.decompositions*:

1.1 LL decomposition

class `matrix.decompositions.LL-Decomposition` (*L*, *p=None*)

Bases: `matrix.decompositions.DecompositionBase`

A matrix decomposition where LL^H is the decomposed (permuted) matrix.

L is a lower triangle matrix with ones on the diagonal. This decomposition is also called Cholesky decomposition.

Parameters

- **L** (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix *L* of the decomposition.
- **p** (`numpy.ndarray`) – The permutation vector used for the decomposition. This decomposition is of $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ where *A* is a matrix. optional, default: no permutation

L

`numpy.matrix` or `scipy.sparse.spmatrix` – The matrix *L* of the decomposition.

P

`scipy.sparse.dok_matrix` – The permutation matrix. $P @ A @ P.H$ is the matrix *A* permuted by the permutation of the decomposition

composed_matrix

`numpy.matrix` or `scipy.sparse.spmatrix` – The composed matrix represented by this decomposition.

is_permuted

`bool` – Whether this is a decomposition with permutation.

is_sparse

`bool` – Whether this is a sparse decomposition.

n

`int` – The dimension of the squared decomposed matrix.

p

`numpy.ndarray` – The permutation vector. $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ is the matrix A permuted by the permutation of the decomposition

p_inverse

`numpy.ndarray` – The permutation vector that undoes the permutation.

permute_matrix(A)

Permute a matrix by the permutation of the decomposition.

Parameters A (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be permuted.

Returns The matrix A permuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

unpermute_matrix(A)

Unpermute a matrix permuted by the permutation of the decomposition.

Parameters A (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be unpermuted.

Returns The matrix A unpermuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

1.2 LDL decomposition

class `matrix.decompositions.LDL_Decomposition`($L, d, p=None$)

Bases: `matrix.decompositions.DecompositionBase`

A matrix decomposition where LDL^H is the decomposed (permuted) matrix.

L is a lower triangle matrix with ones on the diagonal. D is a diagonal matrix. Only the diagonal values of D are stored.

Parameters

- **L** (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix L of the decomposition.
- **d** (`numpy.ndarray`) – The vector of the diagonal components of D of the decomposition.
- **p** (`numpy.ndarray`) – The permutation vector used for the decomposition. This decomposition is of $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ where A is a matrix. optional, default: no permutation

D

`scipy.sparse.dia_matrix` – The permutation matrix.

L

`numpy.matrix` or `scipy.sparse.spmatrix` – The matrix L of the decomposition.

LD

`numpy.matrix` or `scipy.sparse.spmatrix` – A matrix whose diagonal values are the diagonal values of D and whose off-diagonal values are those of L .

P

`scipy.sparse.dok_matrix` – The permutation matrix. $P @ A @ P.H$ is the matrix A permuted by the permutation of the decomposition

composed_matrix

`numpy.matrix` or `scipy.sparse.spmatrix` – The composed matrix represented by this decomposition.

d

`numpy.ndarray` – The diagonal vector of the matrix D of the decomposition.

is_permuted

`bool` – Whether this is a decomposition with permutation.

is_sparse

`bool` – Whether this is a sparse decomposition.

n

`int` – The dimension of the squared decomposed matrix.

P

`numpy.ndarray` – The permutation vector. $A[p[:, np.newaxis], p[np.newaxis, :]]$ is the matrix A permuted by the permutation of the decomposition

p_inverse

`numpy.ndarray` – The permutation vector that undoes the permutation.

permute_matrix(A)

Permute a matrix by the permutation of the decomposition.

Parameters **A** (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be permuted.

Returns The matrix A permuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

unpermute_matrix(A)

Unpermute a matrix permuted by the permutation of the decomposition.

Parameters **A** (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be unpermuted.

Returns The matrix A unpermuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

1.3 LDL decomposition compressed

class `matrix.decompositions.LDL_DecompositionCompressed(LD, p=None)`

Bases: `matrix.decompositions.DecompositionBase`

A matrix decomposition where LDL^H is the decomposed (permuted) matrix.

L is a lower triangle matrix with ones on the diagonal. D is a diagonal matrix. L and D are stored in one matrix whose diagonal values are the diagonal values of D and whose off-diagonal values are those of L .

Parameters

- **LD** (*numpy.ndarray* or *scipy.sparse.spmatrix*) – A matrix whose diagonal values are the diagonal values of *D* and whose off-diagonal values are those of *L*.
- **p** (*numpy.ndarray*) – The permutation vector used for the decomposition. This decomposition is of $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ where *A* is a matrix. optional, default: no permutation

D
scipy.sparse.dia_matrix – The permutation matrix.

L
numpy.matrix or *scipy.sparse.spmatrix* – The matrix *L* of the decomposition.

LD
numpy.matrix or *scipy.sparse.spmatrix* – A matrix whose diagonal values are the diagonal values of *D* and whose off-diagonal values are those of *L*.

P
scipy.sparse.dok_matrix – The permutation matrix. $P @ A @ P.H$ is the matrix *A* permuted by the permutation of the decomposition

composed_matrix
numpy.matrix or *scipy.sparse.spmatrix* – The composed matrix represented by this decomposition.

d
numpy.ndarray – The diagonal vector of the matrix *D* of the decomposition.

is_permuted
bool – Whether this is a decomposition with permutation.

is_sparse
bool – Whether this is a sparse decomposition.

n
int – The dimension of the squared decomposed matrix.

p
numpy.ndarray – The permutation vector. $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ is the matrix *A* permuted by the permutation of the decomposition

p_inverse
numpy.ndarray – The permutation vector that undoes the permutation.

permute_matrix (*A*)
Permute a matrix by the permutation of the decomposition.

Parameters **A** (*numpy.ndarray* or *scipy.sparse.spmatrix*) – The matrix that should be permuted.

Returns The matrix *A* permuted by the permutation of the decomposition.

Return type *numpy.ndarray* or *scipy.sparse.spmatrix*

unpermute_matrix (*A*)
Unpermute a matrix permuted by the permutation of the decomposition.

Parameters **A** (*numpy.ndarray* or *scipy.sparse.spmatrix*) – The matrix that should be unpermuted.

Returns The matrix *A* unpermuted by the permutation of the decomposition.

Return type *numpy.ndarray* or *scipy.sparse.spmatrix*

1.4 base decomposition

class `matrix.decompositions.DecompositionBase` (*p=None*)

Bases: `object`

A matrix decomposition.

This class is a base class for matrix decompositions.

Parameters *p* (`numpy.ndarray`) – The permutation vector used for the decomposition. This decomposition is of $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ where A is a matrix. optional, default: no permutation

P

`scipy.sparse.dok_matrix` – The permutation matrix. $P @ A @ P.H$ is the matrix A permuted by the permutation of the decomposition

composed_matrix

`numpy.matrix` or `scipy.sparse.spmatrix` – The composed matrix represented by this decomposition.

is_permuted

`bool` – Whether this is a decomposition with permutation.

is_sparse

`bool` – Whether this is a sparse decomposition.

n

`int` – The dimension of the squared decomposed matrix.

P

`numpy.ndarray` – The permutation vector. $A[p[:, \text{np.newaxis}], p[\text{np.newaxis}, :]]$ is the matrix A permuted by the permutation of the decomposition

p_inverse

`numpy.ndarray` – The permutation vector that undoes the permutation.

permute_matrix (*A*)

Permute a matrix by the permutation of the decomposition.

Parameters *A* (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be permuted.

Returns The matrix A permuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

unpermute_matrix (*A*)

Unpermute a matrix permuted by the permutation of the decomposition.

Parameters *A* (`numpy.ndarray` or `scipy.sparse.spmatrix`) – The matrix that should be unpermuted.

Returns The matrix A unpermuted by the permutation of the decomposition.

Return type `numpy.ndarray` or `scipy.sparse.spmatrix`

CHAPTER 2

Changelog

2.1 v0.1

- several decompositons types added (LL, LDL, LDL compressed)
- permutation capabilities added

CHAPTER 3

Indices and tables

- `genindex`
- `modindex`
- `search`

C

composed_matrix (matrix.decompositions.DecompositionBase attribute), 5

composed_matrix (matrix.decompositions.LDL_Decomposition attribute), 3

composed_matrix (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

composed_matrix (matrix.decompositions.LL_Decomposition attribute), 1

D

D (matrix.decompositions.LDL_Decomposition attribute), 2

d (matrix.decompositions.LDL_Decomposition attribute), 3

D (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

d (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

DecompositionBase (class in matrix.decompositions), 5

I

is_permuted (matrix.decompositions.DecompositionBase attribute), 5

is_permuted (matrix.decompositions.LDL_Decomposition attribute), 3

is_permuted (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

is_permuted (matrix.decompositions.LL_Decomposition attribute), 1

is_sparse (matrix.decompositions.DecompositionBase attribute), 5

is_sparse (matrix.decompositions.LDL_Decomposition attribute), 3

is_sparse (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

is_sparse (matrix.decompositions.LL_Decomposition attribute), 1

L

L (matrix.decompositions.LDL_Decomposition attribute), 2

L (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

L (matrix.decompositions.LL_Decomposition attribute), 1

LD (matrix.decompositions.LDL_Decomposition attribute), 2

LD (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

LDL_Decomposition (class in matrix.decompositions), 2

LDL_DecompositionCompressed (class in matrix.decompositions), 3

LL_Decomposition (class in matrix.decompositions), 1

N

n (matrix.decompositions.DecompositionBase attribute), 5

n (matrix.decompositions.LDL_Decomposition attribute), 3

n (matrix.decompositions.LDL_DecompositionCompressed attribute), 4

n (matrix.decompositions.LL_Decomposition attribute), 2

P

P (matrix.decompositions.DecompositionBase attribute), 5

p (matrix.decompositions.DecompositionBase attribute), 5

P (matrix.decompositions.LDL_Decomposition attribute), 3

p (matrix.decompositions.LDL_Decomposition attribute), 3

P (matrix.decompositions.LDL_DecompositionCompressed
attribute), 4

p (matrix.decompositions.LDL_DecompositionCompressed
attribute), 4

P (matrix.decompositions.LL_Decomposition attribute),
1

p (matrix.decompositions.LL_Decomposition attribute),
2

p_inverse (matrix.decompositions.DecompositionBase
attribute), 5

p_inverse (matrix.decompositions.LDL_Decomposition
attribute), 3

p_inverse (matrix.decompositions.LDL_DecompositionCompressed
attribute), 4

p_inverse (matrix.decompositions.LL_Decomposition at-
tribute), 2

permute_matrix() (matrix.decompositions.DecompositionBase
method), 5

permute_matrix() (matrix.decompositions.LDL_Decomposition
method), 3

permute_matrix() (matrix.decompositions.LDL_DecompositionCompressed
method), 4

permute_matrix() (matrix.decompositions.LL_Decomposition
method), 2

U

unpermute_matrix() (ma-
trix.decompositions.DecompositionBase
method), 5

unpermute_matrix() (ma-
trix.decompositions.LDL_Decomposition
method), 3

unpermute_matrix() (ma-
trix.decompositions.LDL_DecompositionCompressed
method), 4

unpermute_matrix() (ma-
trix.decompositions.LL_Decomposition
method), 2