Package 'SparseChol'

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Type Package

Title Sparse Matrix C++ Classes Including Sparse Cholesky LDL
Decomposition of Symmetric Matrices

Version 0.3.2

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Description 'C++' classes for sparse matrix methods including implementation of sparse LDL decomposition of symmetric matrices and solvers described by Timothy A. Davis (2016)
<https://fossies.org/linux/SuiteSparse/LDL/Doc/ldl_userguide.pdf>. Provides a set of C++ classes for basic sparse
matrix specification and linear algebra, and a class to implement sparse LDL decomposition and solvers. See <https://github.com/samuel-watson/SparseChol>
for details.

License GPL (>= 2)

Imports Rcpp (>= 1.0.7)

LinkingTo Rcpp (>= 1.0.7), RcppEigen

RoxygenNote 7.2.3

NeedsCompilation yes

Author Sam Watson [aut, cre],
Timothy A. Davis [aut, ctb]

URL https://github.com/samuel-watson/SparseChol

BugReports https://github.com/samuel-watson/SparseChol/issues

Suggests testthat

Biarch true

Depends R (>= 3.4.0), Matrix (>= 1.3-4)

SystemRequirements GNU make

Encoding UTF-8

Maintainer Sam Watson <S.I.Watson@bham.ac.uk>

Repository CRAN

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Maintainer

Sam Watson <S.I.Watson@bham.ac.uk>

Author(s)

Sam Watson [aut, cre], Timothy A. Davis [aut, ctb]

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amd_order   *AMD ordering*

Description

AMD ordering

Usage

```
amd_order(mat)
```

Arguments

mat   A matrix

Details

Generates the approximate minimum degree ordering of the matrix for use in efficient Cholesky decomposition of PAP^T.

Value

A list with the permutation vector and it's inverse.

---

dense_to_sparse   *Generate sparse matrix representation of a matrix*

Description

Generate sparse matrix representation of a matrix

Usage

```
dense_to_sparse(mat)
```

Arguments

mat   A matrix

Value

A list with the matrix in compressed row storage format.

Examples

```
M <- diag(10)
#put a few random values in
M[lower.tri(M)][seq(1,45,by=5)] <- c(0.1,0.5,0.9,0.6,0.8,0.9,0.2,0.3,0.1)
M[upper.tri(M)][seq(1,45,by=5)] <- c(0.1,0.5,0.9,0.6,0.8,0.9,0.2,0.3,0.1)
L <- dense_to_sparse(M)
```

LDL_Cholesky   *Generate LDL decomposition from Matrix class 'dsCMatrix'*

Description

Generates the Cholesky decomposition L as A == LL^T from a sparse matrix

Usage

```
LDL_Cholesky(mat)
```

Arguments

mat   A matrix of class 'dsCMatrix'

Value

A list of matrices L and D

LL_Cholesky   *Generate Cholesky decomposition from Matrix class 'dsCMatrix'*

Description

Generates the Cholesky decomposition L as A == LL^T from a sparse matrix

Usage

```
LL_Cholesky(mat)
```

Arguments

mat   A matrix of class 'dsCMatrix'

Value

A matrix of class 'ddiMatrix'

---

sparse_chol   *Sparse Cholesky decomposition*

Description

Sparse Cholesky decomposition

Usage

```
sparse_chol(mat)
```

Arguments

mat   A matrix

Details

Generates the LDL decomposition of a symmetric, sparse matrix using the method described by Timothy Davis (see references). This function accepts a standard matrix, converts to sparse format, generates the LDL decomposition and returns the Cholesky decomposition LD^0.5.

Value

A lower-triangular matrix.

Examples

```
M <- diag(10)
#put a few random values in
M[lower.tri(M)][seq(1,45,by=5)] <- c(0.1,0.5,0.9,0.6,0.8,0.9,0.2,0.3,0.1)
M[upper.tri(M)][seq(1,45,by=5)] <- c(0.1,0.5,0.9,0.6,0.8,0.9,0.2,0.3,0.1)
L <- sparse_chol(M)
```

---

sparse_chol_crs   *Sparse Cholesky decomposition with sparse representation*

Description

Sparse Cholesky decomposition with sparse representation

Usage

```
sparse_chol_crs(n, Ap, Ai, Ax)
```

Arguments

n	Integer specifying the dimension of the matrix
Ap	numeric (integer valued) vector of pointers, one for each column (or row), to the initial (zero-based) index of elements in the column (or row).
Ai	Integer vector specifying the row positions of the non-zero values of the matrix
Ax	values of the non-zero matrix entries

Details

Generates the LDL decomposition of a symmetric, sparse matrix using the method described by Timothy Davis (see references). Required input is a matrix in sparse format from the matrix package, see sparseMatrix, or the package function dense_to_sparse. To instead use a matrix directly, see sparse_chol.

Value

A list with elements n, Ai, Ap, Ax (corresponding to above arguments) for matrix L, and element D, which contains the diagonal values of matrix D.

Examples

```
n <- 10
Ap <- c(0, 1, 2, 3, 4, 6, 7, 9, 11, 15, 19)
Ai <- c(1, 2, 3, 4, 2,5, 6, 5,7, 5,8, 1,5,8,9, 2,5,7,10)
Ax <- c(1.7, 1., 1.5, 1.1, .02,2.6, 1.2, .16,1.3, .09,1.6,
          .13,.52,.11,1.4, .01,.53,.56,3.1)
out <-sparse_chol_crs(n,Ap,Ai,Ax)
sparse_L(out)
sparse_D(out)
```

---

sparse_D	*Generate matrix D from 'sparse_chol' output*

Description

Generates the D matrix of the LDL decomposition from the output of the 'sparse_chol' function

Usage

```
sparse_D(mat)
```

Arguments

mat	List returned by 'sparse_chol'

Value

A matrix of class 'ddiMatrix'

sparse_L	*Generate matrix L from 'sparse_chol' output*

Description

Generates the L matrix of the LDL decomposition from the output of the 'sparse_chol' function

Usage

```
sparse_L(mat)
```

Arguments

mat   List returned by 'sparse_chol'

Value

A matrix of class 'dsCMatrix'

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