

Package ‘LinkedMatrix’

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Title Column-Linked and Row-Linked Matrices

Description A class that links matrix-like objects (nodes) by rows or by columns while behaving similarly to a base R matrix. Very large matrices are supported if the nodes are file-backed matrices.

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BugReports <https://github.com/QuantGen/LinkedMatrix/issues>

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LinkedMatrix-package *Column-Linked and Row-Linked Matrices*

Description

A class that links matrix-like objects (nodes) by rows or by columns while behaving similarly to a base R matrix. Very large matrices are supported if the nodes are file-backed matrices.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the ColumnLinkedMatrix, RowLinkedMatrix, and LinkedMatrix classes.

as.ColumnLinkedMatrix *Converts an Object to a LinkedMatrix Object*

Description

Converts an Object to a LinkedMatrix Object.

Usage

```
as.ColumnLinkedMatrix(x, ...)
```

```
## S3 method for class 'list'
as.ColumnLinkedMatrix(x, ...)
```

```
as.RowLinkedMatrix(x, ...)
```

```
## S3 method for class 'list'
as.RowLinkedMatrix(x, ...)
```

Arguments

x An object to convert to a LinkedMatrix object.
 ... Additional arguments.

Value

A LinkedMatrix object.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the ColumnLinkedMatrix, RowLinkedMatrix, and LinkedMatrix classes.

Examples

```
m1 <- ff::ff(initdata = rnorm(50), dim = c(5, 10))
m2 <- bigmemory::big.matrix(init = rnorm(50), nrow = 5, ncol = 10)
m3 <- matrix(data = rnorm(50), nrow = 5, ncol = 10)

myList <- list(m1, m2, m3)

m <- as.ColumnLinkedMatrix(myList)
```

as.matrix.LinkedMatrix

Converts a LinkedMatrix Instance to a Matrix (if Small Enough)

Description

Converts a LinkedMatrix Instance to a Matrix (if Small Enough).

Usage

```
## S3 method for class 'LinkedMatrix'
as.matrix(x, ...)
```

Arguments

x	Either a ColumnLinkedMatrix or a RowLinkedMatrix object.
...	Additional arguments (unused).

Value

A matrix.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the ColumnLinkedMatrix, RowLinkedMatrix, and LinkedMatrix classes.

`cbind.ColumnLinkedMatrix`

Combine Matrix-Like Objects by Columns or Rows

Description

Compared to the `ColumnLinkedMatrix` and `RowLinkedMatrix` constructor functions, nested `LinkedMatrix` objects that are passed via `...` will not be treated as matrix-like objects, but their nodes will be extracted and merged with the new `ColumnLinkedMatrix` (for `cbind.ColumnLinkedMatrix`) or `RowLinkedMatrix` (for `rbind.RowLinkedMatrix`) object for a more compact representation.

Usage

```
## S3 method for class 'ColumnLinkedMatrix'  
cbind(..., deparse.level = 0L)
```

```
## S3 method for class 'RowLinkedMatrix'  
rbind(..., deparse.level = 1L)
```

Arguments

`...` Matrix-like objects to be combined by columns.
`deparse.level` Currently unused, defaults to 0.

Details

`cbind.ColumnLinkedMatrix` currently only works for `ColumnLinkedMatrix` objects, `rbind.RowLinkedMatrix` only for `RowLinkedMatrix`.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the `ColumnLinkedMatrix`, `RowLinkedMatrix`, and `LinkedMatrix` classes.

`ColumnLinkedMatrix` *Create a LinkedMatrix Object*

Description

This function constructs a new `ColumnLinkedMatrix` or `RowLinkedMatrix` object from a list of matrix-like objects.

Usage

```
ColumnLinkedMatrix(...)
```

```
RowLinkedMatrix(...)
```

Arguments

... A sequence of matrix-like objects of the same row-dimension (for ColumnLinkedMatrix) or column-dimension (for RowLinkedMatrix).

Details

A matrix-like object is one that has two dimensions and implements at least `dim` and `[]`. Each object needs to have the same number of rows (for ColumnLinkedMatrix) or columns (for RowLinkedMatrix) to be linked together. If no matrix-like objects are given, a single 1x1 node of type `matrix` filled with NA is returned. LinkedMatrix objects can be nested as long as they are conformable.

Value

Either a ColumnLinkedMatrix or a RowLinkedMatrix object.

See Also

[LinkedMatrix](#) to create an empty, prespecified LinkedMatrix object.

Examples

```
# Create various matrix-like objects that correspond in dimensions
m1 <- ff::ff(initdata = rnorm(50), dim = c(5, 10))
m2 <- bigmemory::big.matrix(init = rnorm(50), nrow = 5, ncol = 10)
m3 <- matrix(data = rnorm(50), nrow = 5, ncol = 10)

# Create a ColumnLinkedMatrix object
cm <- ColumnLinkedMatrix(m1, m2, m3)

# To specify the matrix-like objects as a list, use the `do.call` function
rm <- do.call(RowLinkedMatrix, list(m1, m2, m3))
```

ColumnLinkedMatrix-class

A Class for Linking Matrices by Columns or Rows

Description

This class treats a list of matrix-like objects that are linked together by columns (ColumnLinkedMatrix) or rows (RowLinkedMatrix) and have the same number of rows similarly to a regular matrix by implementing key methods such as `[]` and `[]<=` for extracting and replacing matrix elements, `dim` to retrieve dimensions, and `dimnames` and `dimnames<=` to retrieve and set dimnames. Each list element is called a node and can be extracted or replaced using `[[` and `[[<=`. A matrix-like object is one that has two dimensions and implements at least `dim` and `[]`.

Details

Internally, this class is an S4 class that contains list. Each node can be accessed using the `[[` operator. `lapply` is also possible. `ColumnLinkedMatrix` and `RowLinkedMatrix` form a class union called `LinkedMatrix`.

Methods

- `[`
- `[<-`
- `dim`
- `dimnames`
- `dimnames<-`
- `as.matrix`
- `is.matrix`
- `length`
- `print`
- `str`
- `cbind` (for `ColumnLinkedMatrix`)
- `rbind` (for `RowLinkedMatrix`)

See Also

[ColumnLinkedMatrix](#) and [RowLinkedMatrix](#) to create a `ColumnLinkedMatrix` and `RowLinkedMatrix` objects from scratch. [as.ColumnLinkedMatrix](#) and [as.RowLinkedMatrix](#) to create a `ColumnLinkedMatrix` and `RowLinkedMatrix` objects from other objects. [LinkedMatrix](#) to create an empty, prespecified `LinkedMatrix` object. [nNodes](#) to get the number of nodes of a `LinkedMatrix` object.

Examples

```
# Create various matrix-like objects that correspond in dimensions
m1 <- ff::ff(initdata = rnorm(50), dim = c(5, 10))
m2 <- bigmemory::big.matrix(init = rnorm(50), nrow = 5, ncol = 10)
m3 <- matrix(data = rnorm(50), nrow = 5, ncol = 10)

# Link random matrices by columns
cm <- ColumnLinkedMatrix(m1, m2, m3)
dim(cm)

# Link random matrices by rows
rm <- RowLinkedMatrix(m1, m2, m3)
dim(rm)

# Get the number of nodes of each linked matrix
nNodes(cm)
nNodes(rm)

# Extract specific rows of linked matrix
```

```

cm[1, ]
cm[1:3, ]
rm[1, ]
rm[1:3, ]

# Extract specific columns of linked matrix
cm[, 1]
cm[, 1:3]
rm[, 1]
rm[, 1:3]

# Extract specific rows and columns of linked matrix
cm[1, 1]
cm[1:3, 1:3]
rm[1, 1]
rm[1:3, 1:3]

# Get a reference to one of the nodes
n <- cm[[2]]
class(n) == "big.matrix"

# LinkedMatrix objects are matrix-like and can be nested
rcm <- RowLinkedMatrix(cm, cm)

```

index	<i>Maps Each Column or Row Index of a Linked Matrix to the Column or Row Index of Its Corresponding Node</i>
-------	--

Description

If *j* for `ColumnLinkedMatrix` or *i* for `RowLinkedMatrix` is passed, it will only generate entries for the given indices. `sort`, which is set by default, determines whether *j* or *i* should be sorted before building the index.

Usage

```
index(x, ...)
```

Arguments

<i>x</i>	Either a <code>ColumnLinkedMatrix</code> or a <code>RowLinkedMatrix</code> object.
<i>...</i>	Additional arguments (see Details).

Value

A matrix.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the `ColumnLinkedMatrix`, `RowLinkedMatrix`, and `LinkedMatrix` classes.

 LinkedMatrix

Create an Empty, Prespecified LinkedMatrix Object

Description

This function creates an empty `LinkedMatrix` object of a certain size, a certain number of nodes, and certain types of nodes.

Usage

```
LinkedMatrix(nrow, ncol, nNodes, linkedBy, nodeInitializer, ...)
```

Arguments

<code>nrow</code>	The number of rows of the whole matrix.
<code>ncol</code>	The number of columns of the whole matrix.
<code>nNodes</code>	The number of nodes.
<code>linkedBy</code>	Whether the matrix is linked by columns or rows.
<code>nodeInitializer</code>	The name of a function or a function (<code>nodeIndex, nrow, ncol, ...</code>) where <code>nodeIndex</code> is the index of the node, <code>nrow</code> is a partition of the total number of rows, <code>ncol</code> is a partition of the total number of columns, and <code>...</code> are additional parameters passed into the function. The function is expected to return a matrix-like object of dimensions <code>nrow</code> and <code>ncol</code> . Pre-defined node initializers include <code>matrixNodeInitializer</code> to initialize matrices and <code>ffNodeInitializer</code> to initialize <code>ff</code> objects.
<code>...</code>	Additional arguments passed into the <code>nodeInitializer</code> function.

Value

A `ColumnLinkedMatrix` object if `linkedBy` is columns or a `RowLinkedMatrix` object if `linkedBy` is rows.

See Also

[ColumnLinkedMatrix](#) and [RowLinkedMatrix](#) to create `ColumnLinkedMatrix` and `RowLinkedMatrix` objects from a list of matrix-like objects.

Examples

```
# Create an empty 15x10 RowLinkedMatrix with 3 matrix nodes
m1 <- LinkedMatrix(nrow = 15, ncol = 10, nNodes = 3, linkedBy = "rows",
                  nodeInitializer = "matrixNodeInitializer")

dim(m1)
nNodes(m1)
all(sapply(m1, inherits, "matrix"))

# Create an empty 15x10 RowLinkedMatrix with 3 ff nodes
m2 <- LinkedMatrix(nrow = 15, ncol = 10, nNodes = 3, linkedBy = "rows",
                  nodeInitializer = "ffNodeInitializer", vmode = "byte")

dim(m2)
nNodes(m2)
all(sapply(m2, inherits, "ff_matrix"))

# Create an empty 15x10 RowLinkedMatrix with 3 big.matrix nodes
m3 <- LinkedMatrix(nrow = 15, ncol = 10, nNodes = 3, linkedBy = "rows",
                  nodeInitializer = function(nodeIndex, nrow, ncol, ...) {
                    bigmemory::big.matrix(nrow = nrow, ncol = ncol)
                  })

dim(m3)
nNodes(m3)
all(sapply(m3, inherits, "big.matrix"))
```

LinkedMatrix-class *A Class Union of ColumnLinkedMatrix and RowLinkedMatrix*

Description

This class is abstract and no objects can be created from it. It can be used to check whether an object is either of type `ColumnLinkedMatrix` or of type `RowLinkedMatrix` using `is(x, "LinkedMatrix")` and to assign methods for both `ColumnLinkedMatrix` and `RowLinkedMatrix` classes, e.g. `show`.

Methods

- `length`
- `as.matrix`
- `show`
- `initialize`

See Also

[ColumnLinkedMatrix-class](#) and [RowLinkedMatrix-class](#) for implementations of column-linked and row-linked matrices.

Examples

```
# Create an example RowLinkedMatrix from various matrix-like objects that
# correspond in dimensions
m <- RowLinkedMatrix(
  ff::ff(initdata = rnorm(50), dim = c(5, 10)),
  bigmemory::big.matrix(init = rnorm(50), nrow = 5, ncol = 10),
  matrix(data = rnorm(50), nrow = 5, ncol = 10)
)

# Test if m is an object of either type ColumnLinkedMatrix or RowLinkedMatrix
if (is(m, "LinkedMatrix")) {
  message("m is a LinkedMatrix")
}
```

nNodes	<i>Returns the Number of Nodes</i>
--------	------------------------------------

Description

Returns the number of nodes.

Usage

```
nNodes(x)
```

Arguments

x Either a ColumnLinkedMatrix or a RowLinkedMatrix object.

Value

The number of nodes.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the ColumnLinkedMatrix, RowLinkedMatrix, and LinkedMatrix classes.

Examples

```
# Create an example RowLinkedMatrix from various matrix-like objects that
# correspond in dimensions
m <- RowLinkedMatrix(
  ff::ff(initdata = rnorm(50), dim = c(5, 10)),
  bigmemory::big.matrix(init = rnorm(50), nrow = 5, ncol = 10),
  matrix(data = rnorm(50), nrow = 5, ncol = 10)
)

# Get the number of nodes of the RowLinkedMatrix
nNodes(m)
```

nodes	<i>Returns the Column or Row Indexes at Which Each Node Starts and Ends</i>
-------	---

Description

Returns the column or row indexes at which each node starts and ends.

Usage

nodes(x)

Arguments

x Either a `ColumnLinkedMatrix` or a `RowLinkedMatrix` object.

Value

A matrix.

See Also

[ColumnLinkedMatrix-class](#), [RowLinkedMatrix-class](#), and [LinkedMatrix-class](#) for more information on the `ColumnLinkedMatrix`, `RowLinkedMatrix`, and `LinkedMatrix` classes.

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