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` *Maps Each Column or Row Index of a Linked Matrix to the Column or Row Index of Its Corresponding Node*

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

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

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

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 *Returns the Column or Row Indexes at Which Each Node Starts and Ends*

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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