

Package ‘DelayedMatrixStats’

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Type Package

Title Functions that Apply to Rows and Columns of 'DelayedMatrix' Objects

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Description A port of the 'matrixStats' API for use with DelayedMatrix objects from the 'DelayedArray' package. High-performing functions operating on rows and columns of DelayedMatrix objects, e.g. col / rowMedians(), col / rowRanks(), and col / rowSds(). Functions optimized per data type and for subsetted calculations such that both memory usage and processing time is minimized.

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colAlls,DelayedMatrix-method

Check if all elements in a row (column) of a matrix-like object are equal to a value

Description

Check if all elements in a row (column) of a matrix-like object are equal to a value.

Usage

```
## S4 method for signature 'DelayedMatrix'
colAlls(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
colAnys(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowAlls(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowAnys(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| value | The value to search for. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type [matrix](#), [array](#), [table](#), or [numeric](#) call `matrixStats::rowAlls` / `matrixStats::colAlls`.

Value

Returns a [logical vector](#) of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowAlls()` and `matrixStats::colAlls()` which are used when the input is a [matrix](#) or [numeric vector](#).
- For checks if *any* element is equal to a value, see `rowAnys()`.
- `base::all()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'SolidRleArraySeed' seed
dm_Rle <- RleArray(Rle(c(rep(1L, 5),
                        as.integer((0:4) ^ 2),
                        seq(-5L, -1L, 1L))),
                  dim = c(5, 3))

colAlls(dm_matrix, value = 1)
colAnys(dm_matrix, value = 2)
rowAlls(dm_Rle, value = 1)
rowAnys(dm_Rle, value = 2)
```

colAnyNAs,DelayedMatrix-method

Check if any elements in a row (column) of a matrix-like object is missing

Description

Check if any elements in a row (column) of a matrix-like object is missing.

Usage

```
## S4 method for signature 'DelayedMatrix'
colAnyNAs(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowAnyNAs(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type [matrix](#), [array](#), [table](#), or [numeric](#) call `matrixStats::rowAnyNAs / matrixStats::colAnyNAs`.

Value

Returns a [logical vector](#) of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowAnyNAs()` and `matrixStats::colAnyNAs()` which are used when the input is a [matrix](#) or [numeric](#) vector.
- For checks if any element is equal to a value, see [rowAnys\(\)](#).
- `base::is.na()` and `base::any()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'HDF5ArraySeed' seed
# NOTE: Requires that the HDF5Array package is installed
library(HDF5Array)
dm_HDF5 <- writeHDF5Array(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))
```

```
dm_matrix[dm_matrix > 3] <- NA
colAnyNAs(dm_matrix)
dm_HDF5[dm_HDF5 > 3] <- NA
rowAnyNAs(dm_HDF5)
```

colAvsPerRowSet,DelayedMatrix-method

Calculates for each row (column) a summary statistic for equally sized subsets of columns (rows)

Description

Calculates for each row (column) a summary statistic for equally sized subsets of columns (rows).

Usage

```
## S4 method for signature 'DelayedMatrix'
colAvsPerRowSet(
  X,
  W = NULL,
  cols = NULL,
  S,
  FUN = colMeans,
  ...,
  force_block_processing = FALSE,
  na.rm = NA,
  tFUN = FALSE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowAvsPerColSet(
  X,
  W = NULL,
  rows = NULL,
  S,
  FUN = rowMeans,
  ...,
  force_block_processing = FALSE,
  na.rm = NA,
  tFUN = FALSE
)
```

Arguments

X A NxM [DelayedMatrix](#).

W An optional numeric NxM matrix of weights.

| | |
|------------------------|---|
| S | An integer KxJ matrix that specifying the J subsets. Each column hold K column (row) indices for the corresponding subset. The range of values is [1, M] ([1,N]). |
| FUN | A row-by-row (column-by-column) summary statistic function. It is applied to each column (row) subset of X that is specified by S. |
| ... | Additional arguments passed to specific methods. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| na.rm | (logical) Argument passed to FUN() as <code>na.rm = na.rm</code> . If NA (default), then <code>na.rm = TRUE</code> is used if X or S holds missing values, otherwise <code>na.rm = FALSE</code> . |
| tFUN | If TRUE, X is transposed before it is passed to FUN. |
| rows, cols | A vector indicating the subset (and/or columns) to operate over. If <code>NULL</code> , no subsetting is done. |

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowAvsPerColSet` / `matrixStats::colAvsPerRowSet`.

Value

Returns a numeric JxN (MxJ) matrix.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowAvsPerColSet()` and `matrixStats::colAvsPerRowSet()` which are used when the input is a matrix or numeric vector.

Examples

```
# A DelayedMatrix with a 'DataFrame' seed
dm_DF <- DelayedArray(S4Vectors::DataFrame(C1 = rep(1L, 5),
                                           C2 = as.integer((0:4) ^ 2),
                                           C3 = seq(-5L, -1L, 1L)))
colAvsPerRowSet(dm_DF, S = matrix(1:2, ncol = 2))

rowAvsPerColSet(dm_DF, S = matrix(1:2, ncol = 1))
```

colCollapse,DelayedMatrix-method

Extract one cell from each row (column) of a matrix-like object

Description

Extract one cell from each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colCollapse(
  x,
  idxs,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowCollapse(
  x,
  idxs,
  rows = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|---|
| x | A NxK DelayedMatrix . |
| idxs | An index vector with the position to extract. It is recycled to match the number of rows (column) |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowCollapse` / `matrixStats::colCollapse`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowCollapse()` and `matrixStats::colCollapse()` which are used when the input is a `matrix` or `numeric vector`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))
# A DelayedMatrix with a 'HDF5ArraySeed' seed
# NOTE: Requires that the HDF5Array package is installed
library(HDF5Array)
dm_HDF5 <- writeHDF5Array(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))

# Extract the 4th row as a vector
# NOTE: An ordinary vector is returned regardless of the backend of
#       the DelayedMatrix object
colCollapse(dm_matrix, 4)
colCollapse(dm_HDF5, 4)

# Extract the 2nd column as a vector
# NOTE: An ordinary vector is returned regardless of the backend of
#       the DelayedMatrix object
rowCollapse(dm_matrix, 2)
rowCollapse(dm_HDF5, 2)
```

 colCounts,DelayedMatrix-method

Count how often an element in a row (column) of a matrix-like object is equal to a value

Description

Count how often an element in a row (column) of a matrix-like object is equal to a value.

Usage

```
## S4 method for signature 'DelayedMatrix'
colCounts(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowCounts(
  x,
  rows = NULL,
  cols = NULL,
  value = TRUE,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| value | The value to search for. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads |

one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.

... Additional arguments passed to specific methods.

`useNames` If `TRUE` (default), names attributes of result are set. Else if `FALSE`, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowCounts` / `matrixStats::colCounts`.

Value

Returns a `integer vector` of length `N` (`K`).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowCounts()` and `matrixStats::colCounts()` which are used when the input is a matrix or numeric vector.
- For checks if any element is equal to a value, see `rowAnys()`. To check if all elements are equal, see `rowAlls()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'DataFrame' seed
dm_DF <- DelayedArray(S4Vectors::DataFrame(C1 = rep(1L, 5),
                                           C2 = as.integer((0:4) ^ 2),
                                           C3 = seq(-5L, -1L, 1L)))

colCounts(dm_matrix, value = 1)
# Only count those in the first 4 rows
colCounts(dm_matrix, rows = 1:4, value = 1)

rowCounts(dm_DF, value = 5)
# Only count those in the odd-numbered rows of the 2nd column
rowCounts(dm_DF, rows = seq(1, nrow(dm_DF), 2), cols = 2, value = 5)
```

`colCummaxs,DelayedMatrix-method`

Calculates the cumulative maxima for each row (column) of a matrix-like object

Description

Calculates the cumulative maxima for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'  
colCummaxs(  
  x,  
  rows = NULL,  
  cols = NULL,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)
```

```
## S4 method for signature 'DelayedMatrix'  
colCummins(  
  x,  
  rows = NULL,  
  cols = NULL,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)
```

```
## S4 method for signature 'DelayedMatrix'  
colCumprods(  
  x,  
  rows = NULL,  
  cols = NULL,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)
```

```
## S4 method for signature 'DelayedMatrix'  
colCumsums(  
  x,  
  rows = NULL,  
  cols = NULL,  
  force_block_processing = FALSE,
```

```

    ...,
    useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowCummaxs(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowCummins(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowCumprods(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowCumsums(
  x,
  rows = NULL,
  cols = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

`x` A $N \times K$ [DelayedMatrix](#).

`rows, cols` A [vector](#) indicating the subset of rows (and/or columns) to operate over. If

`NULL`, no subsetting is done.
`force_block_processing` `FALSE` (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to `TRUE` (typically not advised). The block-processing strategy loads one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.
`...` Additional arguments passed to specific methods.
`useNames` If `TRUE` (default), names attributes of result are set. Else if `FALSE`, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowCummaxs` / `matrixStats::colCummaxs`.

Value

Returns a `numeric matrix` with the same dimensions as `x`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowCummaxs()` and `matrixStats::colCummaxs()` which are used when the input is a `matrix` or `numeric vector`.
- For single maximum estimates, see `rowMaxs()`.
- `base::cummax()`.

Examples

```

# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))

# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                           as.integer((0:4) ^ 2),
                                           seq(-5L, -1L, 1L)),
                                         ncol = 3))

colCummaxs(dm_matrix)

colCummins(dm_matrix)

colCumprods(dm_matrix)

```

```

colCumsums(dm_matrix)

# Only use rows 2-4
rowCummaxs(dm_Matrix, rows = 2:4)

# Only use rows 2-4
rowCummins(dm_Matrix, rows = 2:4)

# Only use rows 2-4
rowCumprods(dm_Matrix, rows = 2:4)

# Only use rows 2-4
rowCumsums(dm_Matrix, rows = 2:4)

```

colDiffs,DelayedMatrix-method

Calculates the difference between each element of a row (column) of a matrix-like object

Description

Calculates the difference between each element of a row (column) of a matrix-like object.

Usage

```

## S4 method for signature 'DelayedMatrix'
colDiffs(
  x,
  rows = NULL,
  cols = NULL,
  lag = 1L,
  differences = 1L,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowDiffs(
  x,
  rows = NULL,
  cols = NULL,
  lag = 1L,
  differences = 1L,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|------------------------|---|
| x | A $N \times K$ <code>DelayedMatrix</code> . |
| rows, cols | A <code>vector</code> indicating the subset of rows (and/or columns) to operate over. If <code>NULL</code> , no subsetting is done. |
| lag | An integer specifying the lag. |
| differences | An integer specifying the order of difference. |
| force_block_processing | <code>FALSE</code> (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to <code>TRUE</code> (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If <code>TRUE</code> (default), names attributes of result are set. Else if <code>FALSE</code> , no naming support is done. |

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowDiffs` / `matrixStats::colDiffs`.

Value

Returns a `numeric matrix` with one column (row) less than x: $N \times (K - 1)$ or $(N - 1) \times K$.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowDiffs()` and `matrixStats::colDiffs()` which are used when the input is a matrix or numeric vector.
- `base::diff()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'HDF5ArraySeed' seed
# NOTE: Requires that the HDF5Array package is installed
library(HDF5Array)
dm_HDF5 <- writeHDF5Array(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
```

```

                                ncol = 3))

colDiffs(dm_matrix)

rowDiffs(dm_HDF5)
# In reverse column order
rowDiffs(dm_HDF5, cols = seq(ncol(dm_HDF5), 1, -1))

```

colIQRDiffs,DelayedMatrix-method

Calculates the interquartile range of the difference between each element of a row (column) of a matrix-like object

Description

Calculates the interquartile range of the difference between each element of a row (column) of a matrix-like object.

Usage

```

## S4 method for signature 'DelayedMatrix'
colIQRDiffs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  diff = 1L,
  trim = 0,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
colMadDiffs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  diff = 1L,
  trim = 0,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'

```

```
colSdDiffs(  
  x,  
  rows = NULL,  
  cols = NULL,  
  na.rm = FALSE,  
  diff = 1L,  
  trim = 0,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)  
  
## S4 method for signature 'DelayedMatrix'  
colVarDiffs(  
  x,  
  rows = NULL,  
  cols = NULL,  
  na.rm = FALSE,  
  diff = 1L,  
  trim = 0,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)  
  
## S4 method for signature 'DelayedMatrix'  
rowIQRDiffs(  
  x,  
  rows = NULL,  
  cols = NULL,  
  na.rm = FALSE,  
  diff = 1L,  
  trim = 0,  
  force_block_processing = FALSE,  
  ...,  
  useNames = TRUE  
)  
  
## S4 method for signature 'DelayedMatrix'  
rowMadDiffs(  
  x,  
  rows = NULL,  
  cols = NULL,  
  na.rm = FALSE,  
  diff = 1L,  
  trim = 0,  
  force_block_processing = FALSE,  
  ...,
```

```

    useNames = TRUE
  )

## S4 method for signature 'DelayedMatrix'
rowSdDiffs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  diff = 1L,
  trim = 0,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowVarDiffs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  diff = 1L,
  trim = 0,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|-------------------------------------|--|
| <code>x</code> | A $N \times K$ DelayedMatrix . |
| <code>rows, cols</code> | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| <code>na.rm</code> | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| <code>diff</code> | An integer specifying the order of difference. |
| <code>trim</code> | A double in $[0, 1/2]$ specifying the fraction of observations to be trimmed from each end of (sorted) <code>x</code> before estimation. |
| <code>force_block_processing</code> | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| <code>...</code> | Additional arguments passed to specific methods. |
| <code>useNames</code> | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowIQRDiffs` / `matrixStats::colIQRDiffs`.

Value

Returns a `numeric vector` of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowIQRDiffs()` and `matrixStats::colIQRDiffs()` which are used when the input is a matrix or numeric vector.
- For the direct interquartile range see also `rowIQRs`.

Examples

```
# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                         as.integer((0:4) ^ 2),
                                         seq(-5L, -1L, 1L)),
                                         ncol = 3))

# A DelayedMatrix with a 'SolidRleArraySeed' seed
dm_Rle <- RleArray(Rle(c(rep(1L, 5),
                        as.integer((0:4) ^ 2),
                        seq(-5L, -1L, 1L))),
                  dim = c(5, 3))

colIQRDiffs(dm_Matrix)

colMadDiffs(dm_Matrix)

colSdDiffs(dm_Matrix)

colVarDiffs(dm_Matrix)

# Only using rows 2-4
rowIQRDiffs(dm_Rle, rows = 2:4)

# Only using rows 2-4
rowMadDiffs(dm_Rle, rows = 2:4)

# Only using rows 2-4
rowSdDiffs(dm_Rle, rows = 2:4)

# Only using rows 2-4
rowVarDiffs(dm_Rle, rows = 2:4)
```

 colIQRs,DelayedMatrix-method

Calculates the interquartile range for each row (column) of a matrix-like object

Description

Calculates the interquartile range for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colIQRs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowIQRs(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|-------------------------------------|---|
| <code>x</code> | A <code>NxK</code> DelayedMatrix . |
| <code>rows, cols</code> | A vector indicating the subset of rows (and/or columns) to operate over. If <code>NULL</code> , no subsetting is done. |
| <code>na.rm</code> | If <code>TRUE</code> , missing values (<code>NA</code> or <code>NaN</code>) are omitted from the calculations. |
| <code>force_block_processing</code> | <code>FALSE</code> (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to <code>TRUE</code> (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| <code>...</code> | Additional arguments passed to specific methods. |

useNames If **TRUE** (default), names attributes of result are set. Else if **FALSE**, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowIQRs` / `matrixStats::colIQRs`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowIQRs()` and `matrixStats::colIQRs()` which are used when the input is a `matrix` or `numeric vector`.
- For a non-robust analog, see `rowSds()`. For a more robust version see `rowMads()`
- `stats::IQR()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                           as.integer((0:4) ^ 2),
                                           seq(-5L, -1L, 1L)),
                                           ncol = 3))

colIQRs(dm_matrix)

# Only using rows 2-4
rowIQRs(dm_matrix, rows = 2:4)
```

Description

Accurately calculates the logarithm of the sum of exponentials for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colLogSumExps(
  lx,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowLogSumExps(
  lx,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|-------------------------------------|---|
| <code>lx</code> | A $N \times K$ DelayedMatrix . Typically, <code>lx</code> are $\log(x)$ values. |
| <code>rows, cols</code> | A vector indicating the subset (and/or columns) to operate over. If NULL , no subsetting is done. |
| <code>na.rm</code> | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| <code>force_block_processing</code> | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| <code>...</code> | Additional arguments passed to specific methods. |
| <code>useNames</code> | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for `x` of type **matrix**, **array**, **table**, or **numeric** call `matrixStats::rowLogSumExps` / `matrixStats::colLogSumExps`.

Value

Returns a [numeric vector](#) of length N (K).

Author(s)

Peter Hickey

See Also

- [matrixStats::rowLogSumExps\(\)](#) and [matrixStats::colLogSumExps\(\)](#) which are used when the input is a matrix or numeric vector.
- [rowSums2\(\)](#)

Examples

```
x <- DelayedArray(matrix(runif(10), ncol = 2))
colLogSumExps(log(x))
rowLogSumExps(log(x))
```

colMads,DelayedMatrix-method

Calculates the median absolute deviation for each row (column) of a matrix-like object

Description

Calculates the median absolute deviation for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colMads(
  x,
  rows = NULL,
  cols = NULL,
  center = NULL,
  constant = 1.4826,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
colSds(
  x,
  rows = NULL,
```

```

    cols = NULL,
    na.rm = FALSE,
    center = NULL,
    force_block_processing = FALSE,
    ...,
    useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowMads(
  x,
  rows = NULL,
  cols = NULL,
  center = NULL,
  constant = 1.4826,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowSds(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  center = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| center | (optional) the center, defaults to the row means |
| constant | A scale factor. See <code>stats::mad()</code> for details. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |

... Additional arguments passed to specific methods.

useNames If **TRUE** (default), names attributes of result are set. Else if **FALSE**, no naming support is done.

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowMads / matrixStats::colMads`.

Value

Returns a `numeric vector` of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowMads()` and `matrixStats::colMads()` which are used when the input is a `matrix` or `numeric vector`.
- For mean estimates, see `rowMeans2()` and `rowMeans()`.
- For non-robust standard deviation estimates, see `rowSds()`.

Examples

```
# A DelayedMatrix with a 'data.frame' seed
dm_df <- DelayedArray(data.frame(C1 = rep(1L, 5),
                                C2 = as.integer((0:4) ^ 2),
                                C3 = seq(-5L, -1L, 1L)))

# A DelayedMatrix with a 'DataFrame' seed
dm_DF <- DelayedArray(S4Vectors::DataFrame(C1 = rep(1L, 5),
                                           C2 = as.integer((0:4) ^ 2),
                                           C3 = seq(-5L, -1L, 1L)))

colMads(dm_df)

colSds(dm_df)

rowMads(dm_DF)

rowSds(dm_DF)
```

 colMeans2,DelayedMatrix-method

Calculates the mean for each row (column) of a matrix-like object

Description

Calculates the mean for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colMeans2(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'Matrix'
colMeans2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)

## S4 method for signature 'SolidRleArraySeed'
colMeans2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)

## S4 method for signature 'DelayedMatrix'
rowMeans2(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'Matrix'
rowMeans2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)
```

Arguments

| | |
|------------|---|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |

na.rm If **TRUE**, missing values (**NA** or **NaN**) are omitted from the calculations.

force_block_processing **FALSE** (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to **TRUE** (typically not advised). The block-processing strategy loads one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.

... Additional arguments passed to specific methods.

useNames If **TRUE** (default), names attributes of result are set. Else if **FALSE**, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowMeans2 / matrixStats::colMeans2`.

Value

Returns a **numeric vector** of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowMeans2()` and `matrixStats::colMeans2()` which are used when the input is a `matrix` or `numeric vector`.
- See also `rowMeans()` for the corresponding function in base R.
- For variance estimates, see `rowVars()`.
- See also the base R version `base::rowMeans()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'SolidRleArraySeed' seed
dm_Rle <- RleArray(Rle(c(rep(1L, 5),
                        as.integer((0:4) ^ 2),
                        seq(-5L, -1L, 1L))),
                  dim = c(5, 3))

colMeans2(dm_matrix)

# NOTE: Temporarily use verbose output to demonstrate which method is
#       which method is being used
```

```

options(DelayedMatrixStats.verbose = TRUE)
# By default, this uses a seed-aware method for a DelayedMatrix with a
# 'SolidRleArraySeed' seed
rowMeans2(dm_Rle)
# Alternatively, can use the block-processing strategy
rowMeans2(dm_Rle, force_block_processing = TRUE)
options(DelayedMatrixStats.verbose = FALSE)

```

colMedians,DelayedMatrix-method

Calculates the median for each row (column) of a matrix-like object

Description

Calculates the median for each row (column) of a matrix-like object.

Usage

```

## S4 method for signature 'DelayedMatrix'
colMedians(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowMedians(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|------------|---|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |

| | |
|------------------------|---|
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE, no naming support is done. |

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowMedians` / `matrixStats::colMedians`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowMedians()` and `matrixStats::colMedians()` which are used when the input is a `matrix` or `numeric vector`.
- For mean estimates, see `rowMeans2()` and `rowMeans()`.

Examples

```
# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                         as.integer((0:4) ^ 2),
                                         seq(-5L, -1L, 1L)),
                                         ncol = 3))

colMedians(dm_Matrix)

rowMedians(dm_Matrix)
```

 colOrderStats,DelayedMatrix-method

Calculates an order statistic for each row (column) of a matrix-like object

Description

Calculates an order statistic for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colOrderStats(
  x,
  rows = NULL,
  cols = NULL,
  which,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowOrderStats(
  x,
  rows = NULL,
  cols = NULL,
  which,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|---|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| which | An integer index in [1,K] ([1,N]) indicating which order statistic to be returned |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |

useNames If **TRUE** (default), names attributes of result are set. Else if **FALSE**, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowOrderStats` / `matrixStats::colOrderStats`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowOrderStats()` and `matrixStats::colOrderStats()` which are used when the input is a `matrix` or `numeric vector`.

Examples

```
# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                           as.integer((0:4) ^ 2),
                                           seq(-5L, -1L, 1L)),
                                           ncol = 3))

# Only using columns 2-3
colOrderStats(dm_Matrix, cols = 2:3, which = 1)

# Different algorithms, specified by `which`, may give different results
rowOrderStats(dm_Matrix, which = 1)
rowOrderStats(dm_Matrix, which = 2)
```

colProds,DelayedMatrix-method

Calculates the product for each row (column) of a matrix-like object

Description

Calculates the product for each row (column) of a matrix-like object.

Usage

```

## S4 method for signature 'DelayedMatrix'
colProds(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  method = c("direct", "expSumLog"),
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'SolidRleArraySeed'
colProds(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  method = c("direct", "expSumLog"),
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowProds(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  method = c("direct", "expSumLog"),
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|------------------------|---|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| method | A character vector of length one that specifies the how the product is calculated. Note, that this is not a generic argument and not all implementation have to provide it. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if avail- |

able). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.

... Additional arguments passed to specific methods.

useNames If TRUE (default), names attributes of result are set. Else if FALSE, no naming support is done.

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowProds / matrixStats::colProds`.

Value

Returns a `numeric vector` of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowProds()` and `matrixStats::colProds()` which are used when the input is a `matrix` or `numeric vector`.
- For sums across rows (columns), see `rowSums2()` (`colSums2()`)
- `base::prod()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))

# A DelayedMatrix with a 'HDF5ArraySeed' seed
# NOTE: Requires that the HDF5Array package is installed
library(HDF5Array)
dm_HDF5 <- writeHDF5Array(matrix(c(rep(1L, 5),
                                  as.integer((0:4) ^ 2),
                                  seq(-5L, -1L, 1L)),
                                ncol = 3))

colProds(dm_matrix)

rowProds(dm_matrix)
```

 colQuantiles,DelayedMatrix-method

Calculates quantiles for each row (column) of a matrix-like object

Description

Calculates quantiles for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colQuantiles(
  x,
  rows = NULL,
  cols = NULL,
  probs = seq(from = 0, to = 1, by = 0.25),
  na.rm = FALSE,
  type = 7L,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE,
  drop = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowQuantiles(
  x,
  rows = NULL,
  cols = NULL,
  probs = seq(from = 0, to = 1, by = 0.25),
  na.rm = FALSE,
  type = 7L,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE,
  drop = TRUE
)
```

Arguments

| | |
|-------------------------|---|
| <code>x</code> | A $N \times K$ DelayedMatrix . |
| <code>rows, cols</code> | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| <code>probs</code> | A numeric vector of J probabilities in $[0, 1]$. |
| <code>na.rm</code> | If TRUE , missing values (NA or NaN) are omitted from the calculations. |

| | |
|------------------------|---|
| type | An integer specifying the type of estimator. See <code>stats::quantile()</code> for more details. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE, no naming support is done. |
| drop | If TRUE a vector is returned if $J == 1$. |

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowQuantiles` / `matrixStats::colQuantiles`.

Value

a `numeric` $N \times J$ ($K \times J$) `matrix`, where N (K) is the number of rows (columns) for which the J values are calculated.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowQuantiles()` and `matrixStats::colQuantiles()` which are used when the input is a matrix or numeric vector.
- `stats::quantile`

Examples

```
# A DelayedMatrix with a 'data.frame' seed
dm_df <- DelayedArray(data.frame(C1 = rep(1L, 5),
                                C2 = as.integer((0:4) ^ 2),
                                C3 = seq(-5L, -1L, 1L)))

# colnames, if present, are preserved as rownames on output
colQuantiles(dm_df)

# Input has no rownames so output has no rownames
rowQuantiles(dm_df)
```

colRanks,DelayedMatrix-method

Calculates the rank of the elements for each row (column) of a matrix-like object

Description

Calculates the rank of the elements for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colRanks(
  x,
  rows = NULL,
  cols = NULL,
  ties.method = c("max", "average", "first", "last", "random", "max", "min", "dense"),
  preserveShape = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowRanks(
  x,
  rows = NULL,
  cols = NULL,
  ties.method = c("max", "average", "first", "last", "random", "max", "min", "dense"),
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|---------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| ties.method | A character string specifying how ties are treated. Note that the default specifies fewer options than the original matrixStats package. |
| preserveShape | If TRUE the output matrix has the same shape as the input x. Note, that this is not a generic argument and not all implementation of this function have to provide it. |

| | |
|------------------------|---|
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If <code>TRUE</code> (default), names attributes of result are set. Else if <code>FALSE</code> , no naming support is done. |

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowRanks / matrixStats::colRanks`.

The `matrixStats::rowRanks()` function can handle a lot of different values for the `ties.method` argument. Users of the generic function should however only rely on `max` and `average` because the other ones are not guaranteed to be implemented:

`max` for values with identical values the maximum rank is returned

`average` for values with identical values the average of the ranks they cover is returned. Note, that in this case the return value is of type `numeric`.

Value

A `matrix` of type `integer` is returned, unless `ties.method = "average"` when it is of type `numeric`.

The `rowRanks()` function always returns an `NxK matrix`, where `N` (`K`) is the number of rows (columns) whose ranks are calculated.

The `colRanks()` function returns an `NxK matrix`, if `preserveShape = TRUE`, otherwise a `KxN matrix`.

Any `names` of `x` are ignored and absent in the result.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowRanks()` and `matrixStats::colRanks()` which are used when the input is a `matrix` or `numeric` vector.
- `base::rank`

Examples

```
# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                           as.integer((0:4) ^ 2),
                                           seq(-5L, -1L, 1L)),
                                           ncol = 3))
```

```
colRanks(dm_Matrix)
rowRanks(dm_Matrix)
```

```
colSums2,DelayedMatrix-method
```

Calculates the sum for each row (column) of a matrix-like object

Description

Calculates the sum for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colSums2(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'Matrix'
colSums2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)

## S4 method for signature 'SolidRleArraySeed'
colSums2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)

## S4 method for signature 'DelayedMatrix'
rowSums2(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'Matrix'
rowSums2(x, rows = NULL, cols = NULL, na.rm = FALSE, ..., useNames = TRUE)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type [matrix](#), [array](#), [table](#), or [numeric](#) call `matrixStats::rowSums2 / matrixStats::colSums2`.

Value

Returns a [numeric vector](#) of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowSums2()` and `matrixStats::colSums2()` which are used when the input is a [matrix](#) or [numeric vector](#).
- For mean estimates, see `rowMeans2()` and `rowMeans()`.
- `base::sum()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                           as.integer((0:4) ^ 2),
                                           seq(-5L, -1L, 1L)),
                                           ncol = 3))
```

```
colSums2(dm_matrix)

# NOTE: Temporarily use verbose output to demonstrate which method is
#       which method is being used
options(DelayedMatrixStats.verbose = TRUE)
# By default, this uses a seed-aware method for a DelayedMatrix with a
# 'SolidRleArraySeed' seed
rowSums2(dm_Matrix)
# Alternatively, can use the block-processing strategy
rowSums2(dm_Matrix, force_block_processing = TRUE)
options(DelayedMatrixStats.verbose = FALSE)
```

colTabulates,DelayedMatrix-method

Tabulates the values in a matrix-like object by row (column)

Description

Tabulates the values in a matrix-like object by row (column).

Usage

```
## S4 method for signature 'DelayedMatrix'
colTabulates(
  x,
  rows = NULL,
  cols = NULL,
  values = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowTabulates(
  x,
  rows = NULL,
  cols = NULL,
  values = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

x A NxK [DelayedMatrix](#).

| | |
|------------------------|--|
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| values | the values to search for. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type [matrix](#), [array](#), [table](#), or [numeric](#) call `matrixStats::rowTabulates` / `matrixStats::colTabulates`.

Value

a [numeric](#) $N \times J$ ($K \times J$) [matrix](#), where N (K) is the number of rows (columns) for which the J values are calculated.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowTabulates()` and `matrixStats::colTabulates()` which are used when the input is a [matrix](#) or [numeric vector](#).
- `base::table()`

Examples

```
# A DelayedMatrix with a 'DataFrame' seed
dm_DF <- DelayedArray(S4Vectors::DataFrame(C1 = rep(1L, 5),
                                           C2 = as.integer((0:4) ^ 2),
                                           C3 = seq(-5L, -1L, 1L)))

colTabulates(dm_DF)

rowTabulates(dm_DF)
```

 colVars,DelayedMatrix-method

Calculates the variance for each row (column) of a matrix-like object

Description

Calculates the variance for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colVars(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  center = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowVars(
  x,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  center = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| center | (optional) the center, defaults to the row means. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |

... Additional arguments passed to specific methods.

useNames If **TRUE** (default), names attributes of result are set. Else if **FALSE**, no naming support is done.

Details

The S4 methods for x of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowVars / matrixStats::colVars`.

Value

Returns a `numeric vector` of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowVars()` and `matrixStats::colVars()` which are used when the input is a `matrix` or `numeric vector`.
- For mean estimates, see `rowMeans2()` and `rowMeans()`.
- For standard deviation estimates, see `rowSds()`.
- `stats::var()`.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))

# A DelayedMatrix with a 'HDF5ArraySeed' seed
# NOTE: Requires that the HDF5Array package is installed
library(HDF5Array)
dm_HDF5 <- writeHDF5Array(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                              ncol = 3))

colVars(dm_matrix)

rowVars(dm_matrix)
```

 colWeightedMads,DelayedMatrix-method

Calculates the weighted median absolute deviation for each row (column) of a matrix-like object

Description

Calculates the weighted median absolute deviation for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colWeightedMads(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  constant = 1.4826,
  center = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowWeightedMads(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  constant = 1.4826,
  center = NULL,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------|---|
| x | A NxK DelayedMatrix . |
| w | A numeric vector of length K (N) that specifies by how much each element is weighted. |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |

| | |
|------------------------|---|
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| constant | A scale factor. See <code>stats::mad()</code> for details. |
| center | (optional) the center, defaults to the row means |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary <code>base::array</code> . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowWeightedMads` / `matrixStats::colWeightedMads`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowWeightedMads()` and `matrixStats::colWeightedMads()` which are used when the input is a `matrix` or `numeric vector`.
- See also `rowMads` for the corresponding unweighted function.

Examples

```
# A DelayedMatrix with a 'matrix' seed
dm_matrix <- DelayedArray(matrix(c(rep(1L, 5),
                                as.integer((0:4) ^ 2),
                                seq(-5L, -1L, 1L)),
                                ncol = 3))

colWeightedMads(dm_matrix, w = 1:5)

rowWeightedMads(dm_matrix, w = 3:1)
```

colWeightedMeans,DelayedMatrix-method

Calculates the weighted mean for each row (column) of a matrix-like object

Description

Calculates the weighted mean for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colWeightedMeans(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```
## S4 method for signature 'DelayedMatrix'
rowWeightedMeans(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| w | A numeric vector of length K (N) that specifies by how much each element is weighted. |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by |

setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.

... Additional arguments passed to specific methods.

`useNames` If `TRUE` (default), names attributes of result are set. Else if `FALSE`, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowWeightedMeans` / `matrixStats::colWeightedMeans`.

Value

Returns a `numeric vector` of length `N (K)`.

Author(s)

Peter Hickey

See Also

- `matrixStats::rowWeightedMeans()` and `matrixStats::colWeightedMeans()` which are used when the input is a `matrix` or `numeric vector`.
- See also `rowMeans2` for the corresponding unweighted function.

Examples

```
# A DelayedMatrix with a 'Matrix' seed
dm_Matrix <- DelayedArray(Matrix::Matrix(c(rep(1L, 5),
                                         as.integer((0:4) ^ 2),
                                         seq(-5L, -1L, 1L)),
                                         ncol = 3))

colWeightedMeans(dm_Matrix)
# Specifying weights inversely proportional to rowwise variances
colWeightedMeans(dm_Matrix, w = 1 / rowVars(dm_Matrix))
rowWeightedMeans(dm_Matrix, w = 1:3)
```

colWeightedMedians,DelayedMatrix-method

Calculates the weighted median for each row (column) of a matrix-like object

Description

Calculates the weighted median for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colWeightedMedians(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowWeightedMedians(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| w | A numeric vector of length K (N) that specifies by how much each element is weighted. |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads one or more (depending on <code>\link[DelayedArray]{getAutoBlockSize}()</code>) columns (<code>colFoo()</code>) or rows (<code>rowFoo()</code>) into memory as an ordinary base::array . |
| ... | Additional arguments passed to specific methods. |
| useNames | If TRUE (default), names attributes of result are set. Else if FALSE , no naming support is done. |

Details

The S4 methods for x of type [matrix](#), [array](#), [table](#), or [numeric](#) call `matrixStats::rowWeightedMedians` / `matrixStats::colWeightedMedians`.

Value

Returns a [numeric vector](#) of length N (K).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowWeightedMedians()` and `matrixStats::colWeightedMedians()` which are used when the input is a matrix or numeric vector.
- See also [rowMedians](#) for the corresponding unweighted function.

Examples

```
# A DelayedMatrix with a 'SolidRleArraySeed' seed
dm_Rle <- RleArray(Rle(c(rep(1L, 5),
                        as.integer((0:4) ^ 2),
                        seq(-5L, -1L, 1L))),
                  dim = c(5, 3))

# Specifying weights inversely proportional to rowwise MADs
colWeightedMedians(dm_Rle, w = 1 / rowMads(dm_Rle))
```

colWeightedSds,DelayedMatrix-method

Calculates the weighted standard deviation for each row (column) of a matrix-like object

Description

Calculates the weighted standard deviation for each row (column) of a matrix-like object.

Usage

```
## S4 method for signature 'DelayedMatrix'
colWeightedSds(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)
```

```

## S4 method for signature 'DelayedMatrix'
colWeightedVars(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowWeightedSds(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

## S4 method for signature 'DelayedMatrix'
rowWeightedVars(
  x,
  w = NULL,
  rows = NULL,
  cols = NULL,
  na.rm = FALSE,
  force_block_processing = FALSE,
  ...,
  useNames = TRUE
)

```

Arguments

| | |
|------------------------|--|
| x | A NxK DelayedMatrix . |
| w | A numeric vector of length K (N) that specifies by how much each element is weighted. |
| rows, cols | A vector indicating the subset of rows (and/or columns) to operate over. If NULL , no subsetting is done. |
| na.rm | If TRUE , missing values (NA or NaN) are omitted from the calculations. |
| force_block_processing | FALSE (the default) means that a seed-aware, optimised method is used (if available). This can be overridden to use the general block-processing strategy by setting this to TRUE (typically not advised). The block-processing strategy loads |

one or more (depending on `\link[DelayedArray]{getAutoBlockSize}()`) columns (`colFoo()`) or rows (`rowFoo()`) into memory as an ordinary `base::array`.

... Additional arguments passed to specific methods.

`useNames` If `TRUE` (default), names attributes of result are set. Else if `FALSE`, no naming support is done.

Details

The S4 methods for `x` of type `matrix`, `array`, `table`, or `numeric` call `matrixStats::rowWeightedSds` / `matrixStats::colWeightedSds`.

Value

Returns a `numeric vector` of length `N` (`K`).

Author(s)

Peter Hickey

See Also

- `matrixStats::rowWeightedSds()` and `matrixStats::colWeightedSds()` which are used when the input is a `matrix` or `numeric vector`.
- See also `rowSds` for the corresponding unweighted function.

Examples

```
# A DelayedMatrix with a 'SolidRleArraySeed' seed
dm_Rle <- RleArray(Rle(c(rep(1L, 5),
                        as.integer((0:4) ^ 2),
                        seq(-5L, -1L, 1L))),
                  dim = c(5, 3))

colWeightedSds(dm_Rle, w = 1 / rowMeans2(dm_Rle))

# Specifying weights inversely proportional to rowwise means
colWeightedVars(dm_Rle, w = 1 / rowMeans2(dm_Rle))

# Specifying weights inversely proportional to columnwise means
rowWeightedSds(dm_Rle, w = 1 / colMeans2(dm_Rle))

# Specifying weights inversely proportional to columnwise means
rowWeightedVars(dm_Rle, w = 1 / colMeans2(dm_Rle))
```

DelayedMatrixStats *DelayedMatrixStats: Functions that apply to rows and columns of DelayedMatrix objects.*

Description

DelayedMatrixStats is a part of the **matrixStats** API to work with *DelayedMatrix* objects from the **DelayedArray** package. High-performing functions operating on rows and columns of *DelayedMatrix* objects, e.g. `colMedians()` / `rowMedians()`, `colRanks()` / `rowRanks()`, and `colSds()` / `rowSds()`. Functions optimized per data type and for subsetted calculations such that both memory usage and processing time is minimized.

Author(s)

Maintainer: Peter Hickey <peter.hickey@gmail.com> ([ORCID](#))

Other contributors:

- Hervé Pagès <hpages.on.github@gmail.com> [contributor]
- Aaron Lun <infinite.monkeys.with.keyboards@gmail.com> [contributor]

See Also

Useful links:

- <https://github.com/PeteHaitch/DelayedMatrixStats>
- Report bugs at <https://github.com/PeteHaitch/DelayedMatrixStats/issues>

from_DelayedArray_to_simple_seed_class
Coerce DelayedArray to its 'simple seed' form

Description

Coerce DelayedArray to its 'simple seed' form

Usage

```
from_DelayedArray_to_simple_seed_class(x, drop = FALSE, do_transpose = TRUE)
```

Arguments

| | |
|--------------|--|
| x | A DelayedArray |
| drop | If TRUE the result is coerced to the lowest possible dimension |
| do_transpose | Should transposed input be physically transposed? |

Details

Like `DelayedArray:::from_DelayedArray_to_array` but returning an object of the same class as `seedClass(x)` instead of an *array*. In doing so, all delayed operations are realised (including subsetting).

Value

An object of the same class as `seedClass(x)`.

Note

Can be more efficient to leave the transpose implicit (`do_transpose = FALSE`) and switch from a `row*()` method to a `col*()` method (or vice versa).

Only works on [DelayedArray](#) objects with 'simple seeds'

reexports

Objects exported from other packages

Description

These objects are imported from other packages. Follow the links below to see their documentation.

DelayedArray [colMaxs](#), [colMins](#), [colRanges](#), [rowMaxs](#), [rowMins](#), [rowRanges](#)

subset_by_Nindex

subset_by_Nindex

Description

`subset_by_Nindex()` is an internal generic function not aimed to be used directly by the user. It is basically an S4 generic for `DelayedArray:::subset_by_Nindex`.

Usage

```
subset_by_Nindex(x, Nindex)
```

Arguments

| | |
|---------------------|---|
| <code>x</code> | An array-like object. |
| <code>Nindex</code> | An unnamed list of subscripts as positive integer vectors, one vector per dimension in <code>x</code> . Empty and missing subscripts (represented by <code>integer(0)</code> and <code>NULL</code> list elements, respectively) are allowed. The subscripts can contain duplicated indices. They cannot contain NAs or non-positive values. |

Details

subset_by_Nindex(x, Nindex) conceptually performs the operation $x[Nindex[1], \dots, Nindex[length(Nindex)]]$. subset_by_Nindex() methods need to support empty and missing subscripts, e.g., subset_by_Nindex(x, list(NULL, integer(0))) must return an $M \times 0$ object of class class(x) and subset_by_Nindex(x, list(integer(0), integer(0))) a 0×0 object of class class(x).

Also, subscripts are allowed to contain duplicate indices so things like subset_by_Nindex(x, list(c(1:3, 3:1), 2L)) need to be supported.

Value

A object of class class(x) of the appropriate type (e.g., integer, double, etc.). For example, if x is a [data.frame](#) representing an $M \times N$ matrix of integers, subset_by_Nindex(x, list(NULL, 2L)) must return its 2nd column as a [data.frame](#) with M rows and 1 column of type integer.

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