

Package ‘TileDBArray’

October 24, 2025

Version 1.19.1

Date 2025-06-19

Title Using TileDB as a DelayedArray Backend

Description Implements a DelayedArray backend for reading and writing dense or sparse arrays in the TileDB format. The resulting TileDBArrays are compatible with all Bioconductor pipelines that can accept DelayedArray instances.

License MIT + file LICENSE

Depends SparseArray (>= 1.5.20), DelayedArray (>= 0.31.7)

Imports methods, tiledb, S4Vectors

Suggests knitr, Matrix, rmarkdown, BiocStyle, BiocParallel, testthat

biocViews DataRepresentation, Infrastructure, Software

VignetteBuilder knitr

BugReports <https://github.com/LTLA/TileDBArray>

URL <https://github.com/LTLA/TileDBArray>

RoxygenNote 7.3.2

Encoding UTF-8

git_url <https://git.bioconductor.org/packages/TileDBArray>

git_branch devel

git_last_commit 5a6552a

git_last_commit_date 2025-06-19

Repository Bioconductor 3.23

Date/Publication 2025-10-24

Author Aaron Lun [aut, cre],
Genentech, Inc. [cph]

Maintainer Aaron Lun <infinite.monkeys.with.keyboards@gmail.com>

Contents

TileDBArray	2
TileDBArray-globals	3
TileDBArray-pkg	5
TileDBRealizationSink	5
Index	8

TileDBArray	<i>Delayed TileDB arrays</i>
-------------	------------------------------

Description

The TileDBArray class provides a [DelayedArray](#) backend for TileDB arrays (sparse and dense).

Constructing a TileDBArray

TileDBArray(x, attr) returns a TileDBArray object given:

- x, a string containing a URI to a TileDB backend, most typically a path to a directory.
- attr, a string specifying the attribute to represent in the array. Defaults to the first attribute.

Alternatively, x can be a TileDBArraySeed object, in which case attr is ignored.

TileDBArraySeed(x, attr) returns a TileDBArraySeed with the same arguments as described for TileDBArray. If x is already a TileDBArraySeed, it is returned directly without further modification.

[DelayedArray](#)(x) returns a TileDBArray object given x, a TileDBArraySeed.

In all cases, two-dimensional arrays will automatically generate a TileDBMatrix, a subclass of the TileDBArray.

Available operations

[extract_array](#)(x, index) will return an ordinary array containing values from the TileDBArraySeed x, subsetting to the indices specified in index. The latter should be a list of length equal to the number of dimensions in x, where each entry is an integer vector or NULL (in which case the entirety of the dimension is used).

[extract_sparse_array](#)(x, index) will return a [COO_SparseArray](#) representing the subset of x corresponding to the indices in index. The latter should be a list of the same structure as described for [extract_array](#).

[type](#)(x) will return a string containing the type of the TileDBArraySeed object x. Currently, only "integer", "logical" and "double"-precision is supported.

[is_sparse](#)(x) will return a logical scalar indicating whether the TileDBArraySeed x uses a sparse format in the TileDB backend.

[path](#)(x) will return a string containing the path to the TileDB backend directory.

`chunkdim(x)` will return an integer vector containing the tile extent in each dimension. This will be used as the chunk dimensions in methods like `chunkGrid`.

All of the operations described above are also equally applicable to `TileDBArray` objects, as their methods simply delegate to those of the `TileDBArraySeed`.

All operations supported by `DelayedArray` objects are also available for `TileDBArray` objects.

Author(s)

Aaron Lun

Examples

```
data <- matrix(rpois(10000, 5), nrow=100, ncol=100)
B <- as(data, "TileDBArray")
B

# Apply typical DelayedArray operations:
as.matrix(B[1:10,1:10])
B %*% runif(ncol(B))

# This also works for sparse arrays:
sdata <- Matrix::rsparsematrix(nrow=100, ncol=100, density=0.1)
C <- as(sdata, "TileDBArray")
C
```

TileDBArray-globals *TileDBArray global options*

Description

Global options for writing `TileDBArray` backends, intended for parameters that cannot be automatically derived from the data.

Usage

```
getTileDBPath()

setTileDBPath(path = NULL)

getTileDBAttr()

setTileDBAttr(attr = NULL)

getTileDBDimType()

setTileDBDimType(dimtype = NULL)
```

```

getTileDBExtent()

setTileDBExtent(extent = NULL)

getTileDBContext()

setTileDBContext(context = NULL)

getTileDBCellOrder()

setTileDBCellOrder(cellorder = NULL)

getTileDBTileOrder()

setTileDBTileOrder(tileorder = NULL)

getTileDBCcapacity()

setTileDBCcapacity(capacity = NULL)

```

Arguments

<code>path</code>	String containing a path to a TileDB backend.
<code>attr</code>	String containing the name of a TileDB attribute.
<code>dimtype</code>	String specifying the TileDB datatype to use for the dimensions.
<code>extent</code>	Integer scalar specifying the tile extent for all dimensions. Alternatively, an integer vector of length equal to the number of dimensions, specifying a different extent for each dimension in the array to be created.
<code>context</code>	A TileDB context object, see tiledb_ctx for an example.
<code>cellorder</code>	String specifying the desired cell order.
<code>tileorder</code>	String specifying the desired tile order.
<code>capacity</code>	Integer scalar specifying the data tile capacity for sparse arrays.

Value

All of the getter functions return the current global value, or a default value if the former is NULL:

- `path` defaults to a temporary file in [tempdir](#).
- `attr` defaults to "x".
- `dimtype` defaults to "INT32".
- `extent` defaults to 100L.
- `cellorder` defaults to "COL_MAJOR".
- `tileorder` defaults to "COL_MAJOR".
- `capacity` defaults to 10000L.
- `context` defaults to the value of [tiledb_ctx\(\)](#).

All setter functions change the global value and return NULL invisibly.

Author(s)

Aaron Lun

See Also[writeTileDBArray](#), where these functions are most often used.**Examples**

```
setTileDBPath("my_local_dir")
getTileDBPath()
```

TileDBArray-pkg

The TileDBArray package

Description

Implements the TileDB framework as a [DelayedArray](#) backend, with read and write functionality for both dense and sparse arrays. Currently only integer, logical and double-precision values are supported.

Author(s)

Aaron Lun

TileDBRealizationSink *Write arrays to TileDB*

Description

Write array data to a TileDB backend via **DelayedArray**'s [RealizationSink](#) machinery.

Writing a TileDBArray

```
TileDBRealizationSink(
  dim,
  dimnames=NULL,
  type="double",
  path=getTileDBPath(),
  attr=getTileDBAttr(),
  storagetype=NULL,
  dimtype=getTileDBDimType(),
```

```

    sparse=FALSE,
    extent=getTileDBExtent(),
    offset=1L,
    cellorder=getTileDBCellOrder(),
    tileorder=getTileDBTileOrder(),
    capacity=getTileDBCapacity(),
    context=getTileDBContext()
)

```

returns a `TileDBRealizationSink` object that can be used to write content to a TileDB backend. It accepts the following arguments:

- `dim`, an integer vector (usually of length 2) to specify the array dimensions.
- `dimnames`, a list of length equal to `dim`, containing character vectors with names for each dimension. Defaults to `NULL`, i.e., no `dimnames`.
- `type`, a string specifying the R data type for the newly written array. Currently only "double", "integer" and "logical" arrays are supported.
- `path`, a string containing the location of the new TileDB backend.
- `attr`, a string specifying the name of the attribute to store.
- `storagetype`, a string specifying the TileDB data type for the attribute, e.g., "UINT8", "FLOAT32". If `NULL`, this is automatically determined from `type` using [r_to_tiledb_type](#).
- `dimtype`, a string specifying the TileDB data type for the dimension.
- `sparse`, a logical scalar indicating whether the array should be stored in sparse form.
- `extent`, an integer scalar (or vector of length equal to `dim`) specifying the tile extent for each dimension. Larger values improve compression at the cost of unnecessary data extraction during reads.
- `offset`, an integer scalar (or vector of length equal to `dim`) specifying the starting offset for each dimension's domain.
- `cellorder`, a string specifying the ordering of cells within each tile.
- `tileorder`, a string specifying the ordering of tiles across the array.
- `capacity`, an integer scalar specifying the size of each data tile in the sparse case.
- `context` is the TileDB context, defaulting to the output of [tiledb_ctx\(\)](#).

`writeTileDBArray(x, sparse=is_sparse(x), ...)` writes the matrix-like object `x` to a TileDB backend, returning a [TileDBArray](#) object referring to that backend. Appropriate values for `dim`, `dimnames` and `type` are determined automatically from `x` itself. All other arguments described for `TileDBRealizationSink` can be passed into `...` to configure the representation.

Coercing to a TileDBArray

`as(x, "TileDBArray")` will coerce a matrix-like object `x` to a `TileDBArray` object.
`as(x, "TileDBArraySeed")` will coerce a matrix-like object `x` to a `TileDBArraySeed` object.
`as(x, "TileDBMatrix")` will coerce a matrix-like object `x` to a `TileDBArraySeed` object.
`as(x, "TileDBArray")` will coerce a `TileDBRealizationSink` `x` to a `TileDBArray` object.
`as(x, "TileDBArraySeed")` will coerce a `TileDBRealizationSink` `x` to a `TileDBArraySeed` object.
`as(x, "DelayedArray")` will coerce a `TileDBRealizationSink` `x` to a `TileDBArray` object.

Sink internals

`write_block(sink, viewport, block)` will write the subarray block to the TileDBRealizationSink sink at the specified viewport, returning sink upon completion. See [write_block](#) in **DelayedArray** for more details.

`type(x)` will return a string specifying the type of the TileDBRealizationSink x.

Examples

```
X <- matrix(rnorm(100000), ncol=200)
path <- tempfile()
out <- writeTileDBArray(X, path=path)

# Works for integer matrices.
Xi <- matrix(rpois(100000, 2), ncol=200)
pathi <- tempfile()
outi <- writeTileDBArray(Xi, path=pathi)

# Works for logical matrices.
Xl <- matrix(rpois(100000, 0.5) > 0, ncol=200)
pathl <- tempfile()
outl <- writeTileDBArray(Xl, path=pathl)

# Works for sparse numeric matrices.
Y <- Matrix::rsparsematrix(1000, 1000, density=0.01)
path2 <- tempfile()
out2 <- writeTileDBArray(Y, path=path2)

# And for sparse logical matrices.
path2l <- tempfile()
out2l <- writeTileDBArray(Y > 0, path=path2l)

# Works for dimnames.
rownames(X) <- sprintf("GENE_%i", seq_len(nrow(X)))
path3 <- tempfile()
out3 <- writeTileDBArray(X, path=path3)
```

Index

chunkdim, [3](#)
chunkdim, TileDBArraySeed-method
(TileDBArray), [2](#)
chunkGrid, [3](#)
coerce, ANY, TileDBArray-method
(TileDBRealizationSink), [5](#)
coerce, ANY, TileDBMatrix-method
(TileDBRealizationSink), [5](#)
coerce, ANY, TileDBRealizationSink-method
(TileDBRealizationSink), [5](#)
coerce, TileDBRealizationSink, DelayedArray-method
(TileDBRealizationSink), [5](#)
coerce, TileDBRealizationSink, TileDBArray-method
(TileDBRealizationSink), [5](#)
coerce, TileDBRealizationSink, TileDBMatrix-method
(TileDBRealizationSink), [5](#)
COO_SparseArray, [2](#)

DelayedArray, [2](#), [3](#), [5](#)
DelayedArray, TileDBArraySeed-method
(TileDBArray), [2](#)

extract_array, [2](#)
extract_array, TileDBArraySeed-method
(TileDBArray), [2](#)
extract_sparse_array, [2](#)
extract_sparse_array, TileDBArraySeed-method
(TileDBArray), [2](#)

getTileDBAttr (TileDBArray-globals), [3](#)
getTileDBCcapacity
(TileDBArray-globals), [3](#)
getTileDBCcellOrder
(TileDBArray-globals), [3](#)
getTileDBContext (TileDBArray-globals),
[3](#)
getTileDBDimType (TileDBArray-globals),
[3](#)
getTileDBExtent (TileDBArray-globals), [3](#)
getTileDBPath (TileDBArray-globals), [3](#)

getTileDBTileOrder
(TileDBArray-globals), [3](#)

is_sparse, [2](#)
is_sparse, TileDBArraySeed-method
(TileDBArray), [2](#)

matrixClass, TileDBArray-method
(TileDBArray), [2](#)

path, [2](#)
path, TileDBArraySeed-method
(TileDBArray), [2](#)

r_to_tiledb_type, [6](#)
RealizationSink, [5](#)

setTileDBAttr (TileDBArray-globals), [3](#)
setTileDBCcapacity
(TileDBArray-globals), [3](#)
setTileDBCcellOrder
(TileDBArray-globals), [3](#)
setTileDBContext (TileDBArray-globals),
[3](#)
setTileDBDimType (TileDBArray-globals),
[3](#)
setTileDBExtent (TileDBArray-globals), [3](#)
setTileDBPath (TileDBArray-globals), [3](#)
setTileDBTileOrder
(TileDBArray-globals), [3](#)
show, TileDBArraySeed-method
(TileDBArray), [2](#)

tempdir, [4](#)
tiledb_ctx, [4](#), [6](#)
TileDBArray, [2](#), [6](#)
TileDBArray-class (TileDBArray), [2](#)
TileDBArray-globals, [3](#)
TileDBArray-pkg, [5](#)
TileDBArraySeed (TileDBArray), [2](#)
TileDBArraySeed-class (TileDBArray), [2](#)

TileDBMatrix(TileDBArray), [2](#)
TileDBMatrix-class(TileDBArray), [2](#)
TileDBRealizationSink, [5](#)
TileDBRealizationSink-class
 (TileDBRealizationSink), [5](#)
type, [2](#)
type,TileDBArraySeed-method
 (TileDBArray), [2](#)
type,TileDBRealizationSink-method
 (TileDBRealizationSink), [5](#)

write_block, [7](#)
write_block,TileDBRealizationSink-method
 (TileDBRealizationSink), [5](#)
writeTileDBArray, [5](#)
writeTileDBArray
 (TileDBRealizationSink), [5](#)