

# Package ‘SQLDataFrame’

June 27, 2025

**Title** Representation of SQL tables in DataFrame metaphor

**Version** 1.23.0

**Description** Implements bindings for SQL tables that are compatible with Bioconductor S4 data structures, namely the DataFrame and DelayedArray. This allows SQL-derived data to be easily used inside other Bioconductor objects (e.g., SummarizedExperiments) while keeping everything on disk.

**License** LGPL (>= 3); File LICENSE

**Depends** DelayedArray, S4Vectors

**Imports** stats, utils, methods, BiocGenerics, RSQLite, duckdb, DBI

**Suggests** knitr, rmarkdown, BiocStyle, testthat

**biocViews** DataRepresentation, Infrastructure, Software

**VignetteBuilder** knitr

**URL** <https://github.com/Bioconductor/SQLDataFrame>

**BugReports** <https://github.com/Bioconductor/SQLDataFrame/issues>

**RoxygenNote** 7.2.3

**Encoding** UTF-8

**git\_url** <https://git.bioconductor.org/packages/SQLDataFrame>

**git\_branch** devel

**git\_last\_commit** f23bd64

**git\_last\_commit\_date** 2025-04-15

**Repository** Bioconductor 3.22

**Date/Publication** 2025-06-26

**Author** Qian Liu [aut, cre] (ORCID: <<https://orcid.org/0000-0003-1456-5099>>),  
Aaron Lun [aut],  
Martin Morgan [aut]

**Maintainer** Qian Liu <Qian.Liu@RoswellPark.org>

## Contents

|                                  |   |
|----------------------------------|---|
| acquireConn . . . . .            | 2 |
| SQLColumnSeed . . . . .          | 3 |
| SQLDataFrame . . . . .           | 4 |
| SQLiteColumnSeed-class . . . . . | 6 |

**Index****8**


---

|             |                                        |
|-------------|----------------------------------------|
| acquireConn | <i>Acquire the SQL file connection</i> |
|-------------|----------------------------------------|

---

**Description**

Acquire a (possibly cached) SQL file connection given it's path.

**Usage**

```
acquireConn(path, dbtype = NULL)
```

```
releaseConn(path)
```

**Arguments**

|        |                                                                                                        |
|--------|--------------------------------------------------------------------------------------------------------|
| path   | String containing a path to a SQL file.                                                                |
| dbtype | String containing the SQL database type (case insensitive). Supported types are "SQLite" and "DuckDB". |

**Details**

acquireConn will cache the DBIConnection object in the current R session to avoid repeated initialization. This improves efficiency for repeated calls, e.g., when creating a [DataFrame](#) with multiple columns from the same SQL table. The cached DBIConnection for any given path can be deleted by calling releaseConn for the same path.

**Value**

For acquireConn, a DBIConnection with backends of SQLite or DuckDB, which are identical to that returned by DBI::dbConnect(RSQLite::SQLite(), path) or DBI::dbConnect(duckdb::duckdb(), path).

For releaseConn, any existing DBIConnection for the path is disconnected and cleared from cache, and NULL is invisibly returned. If path=NULL, all cached connections are removed.

**Author(s)**

Qian Liu

**Examples**

```
#####
## SQLite
#####

## Mocking up a file
tf <- tempfile()
on.exit(unlink(tf))
con <- DBI::dbConnect(RSQLite::SQLite(), tf)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)
```

```
## Acquire or release connection
con <- acquireConn(tf, dbtype = "SQLite")
acquireConn(tf, dbtype = "SQLite") # just re-uses the cache
releaseConn(tf) # clears the cache

#####
## DuckDB
#####

tf1 <- tempfile()
on.exit(unlist(tf1))
con <- DBI::dbConnect(duckdb::duckdb(), tf1)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)
con <- acquireConn(tf1, dbtype = "DuckDB")
releaseConn(tf1)
```

SQLColumnSeed

*Column of a SQL table***Description**

Represent a column of a SQL table as a 1-dimensional [DelayedArray](#). This allows us to use SQL data inside [DataFrames](#) without loading them into memory.

**Usage**

```
SQLColumnSeed(path, dbtype, table, column, length = NULL, type = NULL)
```

```
SQLColumnVector(x, ...)
```

**Arguments**

|        |                                                                                                                                                                                                |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| path   | String containing a path to a SQL file.                                                                                                                                                        |
| dbtype | String containing the SQL database type (case insensitive). Supported types are "SQLite" and "DuckDB".                                                                                         |
| table  | String containing the name of the table in SQL file.                                                                                                                                           |
| column | String containing the name of the column inside the table.                                                                                                                                     |
| length | Integer containing the number of rows. If NULL, this is determined by inspecting the SQL table. This should only be supplied for efficiency purposes, to avoid a file look-up on construction. |
| type   | String specifying the type of the data. If NULL, this is determined by inspecting the file. Users may specify this to avoid a look-up, or to coerce the output into a different type.          |
| x      | A SQLColumnSeed object.                                                                                                                                                                        |
| ...    | Further arguments to be passed to the SQLColumnSeed constructor. #'                                                                                                                            |

**Value**

For SQLColumnSeed: a SQLColumnSeed. For SQLColumnVector: a SQLColumnVector. #'

**Author(s)**

Qian Liu

**Examples**

```
# Mocking up a file:
tf <- tempfile()
on.exit(unlink(tf))
con <- DBI::dbConnect(RSQLite::SQLite(), tf)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)

# Creating a vector:
SQLColumnVector(tf, dbtype = "SQLite", "mtcars", column="gear")

# This happily lives inside DataFrames:
collected <- list()
for (x in colnames(mtcars)) {
  collected[[x]] <- SQLColumnVector(tf, dbtype = "SQLite", "mtcars", column=x)
}
DataFrame(collected)
#'
```

SQLDataFrame

*SQL-backed DataFrame***Description**

Create a SQL-backed [DataFrame](#), where the data are kept on disk until requested. Direct extension classes are `SQLiteDataFrame` and `DuckDBDataFrame`.

**Usage**

```
SQLDataFrame(path, dbtype = NULL, table = NULL, columns = NULL, nrows = NULL)
```

**Arguments**

|                      |                                                                                                         |
|----------------------|---------------------------------------------------------------------------------------------------------|
| <code>path</code>    | String containing a path to a SQL file.                                                                 |
| <code>dbtype</code>  | String containing the SQL database type (case insensitive). Supported types are "SQLite" and "DuckDB".  |
| <code>table</code>   | String containing the name of SQL table.                                                                |
| <code>columns</code> | Character vector containing the names of columns in a SQL table. If NULL, this is determined from path. |
| <code>nrows</code>   | Integer scalar specifying the number of rows in a SQL table. If NULL, this is determined from path.     |

## Details

The SQLDataFrame is essentially just a [DataFrame](#) of [SQLColumnVector](#) objects. It is primarily useful for indicating that the in-memory representation is consistent with the underlying SQL file (e.g., no delayed filter/mutate operations have been applied, no data has been added from other files). Thus, users can specialize code paths for a SQLDataFrame to operate directly on the underlying SQL table.

In that vein, operations on a SQLDataFrame may return another SQLDataFrame if the operation does not introduce inconsistencies with the file-backed data. For example, slicing or combining by column will return a SQLDataFrame as the contents of the retained columns are unchanged. In other cases, the SQLDataFrame will collapse to a regular [DFrame](#) of [SQLColumnVector](#) objects before applying the operation; these are still file-backed but lack the guarantee of file consistency.

## Value

A SQLDataFrame where each column is a [SQLColumnVector](#).

## Author(s)

Qian Liu

## Examples

```
## Mocking up a file:

### SQLite
tf <- tempfile()
on.exit(unlink(tf))
con <- DBI::dbConnect(RSQLite::SQLite(), tf)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)

### DuckDB
tf1 <- tempfile()
on.exit(unlist(tf1))
con <- DBI::dbConnect(duckdb::duckdb(), tf1)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)

## Creating a SQLite-backed data frame:

df <- SQLDataFrame(tf, dbtype = "SQLite", table = "mtcars")
df1 <- SQLiteDataFrame(tf, "mtcars")
identical(df, df1)

## DuckDB-backed data frame:
df2 <- SQLDataFrame(tf1, dbtype = "duckdb", table = "mtcars")
df3 <- DuckDBDataFrame(tf1, "mtcars")
identical(df2, df3)
## Extraction yields a SQLiteColumnVector:
df$carb

## Some operations preserve the SQLDataFrame:
df[,1:5]
combined <- cbind(df, df)
class(combined)
```

```
## ... but most operations collapse to a regular DFrame:
df[1:5,]
combined2 <- cbind(df, some_new_name=df[,1])
class(combined2)

df1 <- df
rownames(df1) <- paste0("row", seq_len(nrow(df1)))
class(df1)

df2 <- df
colnames(df2) <- letters[1:ncol(df2)]
class(df2)

df3 <- df
df3$carb <- mtcars$carb
class(df3)

## Utility functions
path(df)
dbtype(df)
sqltable(df)
dim(df)
names(df)

as.data.frame(df)
```

---

SQLiteColumnSeed-class

*SQL extensions*

---

## Description

Extensions of SQLDataFrame, SQLColumnVector, SQLColumnSeed with different SQL backends. Currently supporting SQLite and DuckDB, with which the definition coding can be followed for added extension of other SQL backends.

## Arguments

|        |                                                                                                                                                                                                |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| path   | String containing a path to a SQL file.                                                                                                                                                        |
| table  | String containing the name of the table in SQL file.                                                                                                                                           |
| column | String containing the name of the column inside the table.                                                                                                                                     |
| length | Integer containing the number of rows. If NULL, this is determined by inspecting the SQL table. This should only be supplied for efficiency purposes, to avoid a file look-up on construction. |
| type   | String specifying the type of the data. If NULL, this is determined by inspecting the file. Users may specify this to avoid a look-up, or to coerce the output into a different type.          |

**Examples**

```
## Mocking up a file:

### SQLite
tf <- tempfile()
on.exit(unlink(tf))
con <- DBI::dbConnect(RSQLite::SQLite(), tf)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)

### DuckDB
tf1 <- tempfile()
on.exit(unlist(tf1))
con <- DBI::dbConnect(duckdb::duckdb(), tf1)
DBI::dbWriteTable(con, "mtcars", mtcars)
DBI::dbDisconnect(con)

## Constructor of xxColumnSeed and xxColumnVector

sd <- SQLiteColumnSeed(tf, "mtcars", "gear")
scv <- SQLiteColumnVector(sd)
scv1 <- SQLiteColumnVector(tf, "mtcars", "gear")
identical(scv, scv1)

DuckDBColumnSeed(tf1, "mtcars", "mpg")
DuckDBColumnVector(tf1, "mtcars", "mpg")

## Constructor of xxDataFrame

SQLiteDataFrame(tf, "mtcars")
DuckDBDataFrame(tf1, "mtcars")
```

# Index

`[[`, `SQLDataFrame`-method (`SQLDataFrame`), [4](#)  
`[[<-`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`acquireConn`, [2](#)

`as.data.frame`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`cbind`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`cbind.SQLDataFrame` (`SQLDataFrame`), [4](#)

`coerce`, `SQLDataFrame`, `DFrame`-method  
(`SQLDataFrame`), [4](#)

`DataFrame`, [2–5](#)

`DelayedArray`, [3](#)

`DelayedArray`, `DuckDBColumnSeed`-method  
(`SQLiteColumnSeed`-class), [6](#)

`DelayedArray`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)

`DelayedArray`, `SQLiteColumnSeed`-method  
(`SQLiteColumnSeed`-class), [6](#)

`DFrame`, [5](#)

`dim`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)

`DuckDBColumnSeed`-class  
(`SQLiteColumnSeed`-class), [6](#)

`DuckDBColumnVector`-class  
(`SQLiteColumnSeed`-class), [6](#)

`DuckDBDataFrame`-class  
(`SQLiteColumnSeed`-class), [6](#)

`extract_array`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)

`extractCOLS`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`extractROWS`, `SQLDataFrame`, `ANY`-method  
(`SQLDataFrame`), [4](#)

`length`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`names`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`names<-`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`ncol`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`normalizeSingleBracketReplacementValue`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`nrow`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`path`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)

`path`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`releaseConn` (`acquireConn`), [2](#)

`replaceCOLS`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`replaceROWS`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`rownames`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`rownames<-`, `SQLDataFrame`-method  
(`SQLDataFrame`), [4](#)

`SQLColumnSeed`, [3](#)

`SQLColumnSeed`-class (`SQLColumnSeed`), [3](#)

`SQLColumnVector`, [5](#)

`SQLColumnVector` (`SQLColumnSeed`), [3](#)

`SQLColumnVector`-class (`SQLColumnSeed`), [3](#)

`SQLDataFrame`, [4](#)

`SQLDataFrame`-class (`SQLDataFrame`), [4](#)

`SQLiteColumnSeed`-class, [6](#)

`SQLiteColumnVector`-class  
(`SQLiteColumnSeed`-class), [6](#)

`SQLiteDataFrame`-class  
(`SQLiteColumnSeed`-class), [6](#)

`sqltable`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)

`type`, `SQLColumnSeed`-method  
(`SQLColumnSeed`), [3](#)