Package 'ParallelLogger'

March 25, 2025

Type Package

Title Support for Parallel Computation, Logging, and Function Automation

Version 3.4.1

Date 2025-03-25

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Description Support for parallel computation with progress bar, and option to stop or proceed on errors. Also provides logging to console and disk,
and the logging persists in the parallel threads. Additional functions support function call automation with delayed execution (e.g. for executing functions in
parallel).

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VignetteBuilder knitr

Depends R (>= 4.0.0)

Imports snow,
xml2,
jsonlite,
methods,
utils,
rstudioapi

Suggests sendmailR,
testthat,
shiny,
DT,
knitr,
rmarkdown,
tibble

URL https://ohdsi.github.io/ParallelLogger/, https://github.com/OHDSI/ParallelLogger

BugReports https://github.com/OHDSI/ParallelLogger/issues

NeedsCompilation no

RoxygenNote 7.3.2

Encoding UTF-8

Contents

`addDefaultConsoleLogger` *Add the default console logger*

Description

Add the default console logger

Usage

```
addDefaultConsoleLogger(name = "DEFAULT_CONSOLE_LOGGER")
```

Arguments

name	A name for the logger.

Details

Creates a logger that writes to the console using the "INFO" threshold and the layoutSimple layout.

Examples

```
logger <- addDefaultConsoleLogger()
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger(logger)
```

---

addDefaultEmailLogger *Add the default e-mail logger*

Description

Add the default e-mail logger

Usage

```
addDefaultEmailLogger(
  mailSettings,
  label = Sys.info()["nodename"],
  name = "DEFAULT_EMAIL_LOGGER",
  test = FALSE
)
```

Arguments

mailSettings	Arguments to be passed to the sendmail function in the sendmailR package (except subject and msg).
label	A label to be used in the e-mail subject to identify a run. By default the name of the computer is used.
name	A name for the logger.
test	If TRUE, a message will be displayed on the console instead of sending an e-mail.

Details

Creates a logger that writes to e-mail using the "FATAL" threshold and the layoutEmail layout. This function uses the sendmailR package. Please make sure your e-mail settings are correct by using the sendmailR package before using those settings here. ParallelLogger will not display any messages if something goes wrong when sending the e-mail.

Using GMail

To use a GMail account, make sure to enable 2-step verification on your Google account (see 'Security'). Click on 2-Step Verification, and scroll down to 'App passwords'. Here, you can create an app-specific password to be used with `ParallelLogger`. You can set `host.name = "smtp.gmail.com:587"`, and be sure to use `engine = "curl"`.

Examples

```
mailSettings <- list(
  from = "someone@gmail.com",
  to = "someone_else@gmail.com",
  engine = "curl",
  engineopts  = list(
    username = "someone@gmail.com",
    password = "Secret!"
  ),
  control = list(
    host.name = "smtp.gmail.com:587"
  )
)

# Setting test to TRUE in this example so we don't really send an e-mail:
addDefaultEmailLogger(mailSettings, "My R session", test = TRUE)
logFatal("Something bad")

unregisterLogger("DEFAULT_EMAIL_LOGGER")
```

---

addDefaultErrorReportLogger

Add the default error report logger

Description

Add the default error report logger

Usage

```
addDefaultErrorReportLogger(
  fileName = file.path(getwd(), "errorReportR.txt"),
  name = "DEFAULT_ERRORREPORT_LOGGER"
)
```

Arguments

`fileName`	The name of the file to write to.
`name`	A name for the logger.

Details

Creates a logger that writes to a file using the "FATAL" threshold and the `layoutErrorReport` layout. The file will be overwritten if it is older than 60 seconds. The user will be notified that the error report has been created, and where to find it.

addDefaultFileLogger *Add the default file logger*

Description

Add the default file logger

Usage

```
addDefaultFileLogger(fileName, name = "DEFAULT_FILE_LOGGER")
```

Arguments

fileName	The name of the file to write to.
name	A name for the logger.

Details

Creates a logger that writes to a file using the "TRACE" threshold and the layoutParallel layout. The output can be viewed with the built-in log viewer that can be started using launchLogViewer.

clearLoggers *Remove all registered loggers*

Description

Remove all registered loggers

Usage

```
clearLoggers()
```

clusterApply *Apply a function to a list using the cluster*

Description

Apply a function to a list using the cluster

Usage

```
clusterApply(cluster, x, fun, ..., stopOnError = FALSE, progressBar = TRUE)
```

Arguments

cluster	The cluster of threads to run the function.
x	The list on which the function will be applied.
fun	The function to apply. Note that the context in which the function is specifies matters (see details).
...	Additional parameters for the function.
stopOnError	Stop when one of the threads reports an error? If FALSE, all errors will be reported at the end.
progressBar	Show a progress bar?

Details

The function will be executed on each element of x in the threads of the cluster. If there are more elements than threads, the elements will be queued. The progress bar will show the number of elements that have been completed. It can sometimes be important to realize that the context in which a function is created is also transmitted to the worker node. If a function is defined inside another function, and that outer function is called with a large argument, that argument will be transmitted to the worker node each time the function is executed. It can therefore make sense to define the function to be called at the package level rather than inside a function, to save overhead.

Value

A list with the result of the function on each item in x.

Examples

```
fun <- function(x) {
  return (x^2)
}

cluster <- makeCluster(numberOfThreads = 3)
clusterApply(cluster, 1:10, fun)
stopCluster(cluster)
```

---

clusterRequire *Require a package in the cluster*

Description

Calls the `require` function in each node of the cluster.

Usage

```
clusterRequire(cluster, package)
```

Arguments

cluster	The cluster object.
package	The name of the package to load in all nodes.

convertJsonToSettings *Converts a JSON string to a settings object*

Description

Converts a JSON string to a settings object

Usage

```
convertJsonToSettings(json)
```

Arguments

json	A JSON string.

Details

Converts a JSON string generated using the convertSettingsToJson function to a settings object, restoring object classes and attributes.

Value

An R object as specified by the JSON.

convertSettingsToJson *Convert a settings object to a JSON string*

Description

Convert a settings object to a JSON string

Usage

```
convertSettingsToJson(object)
```

Arguments

object	R object to be converted.

Details

Convert a settings object to a JSON string, using pretty formatting and preserving object classes and attributes.

Value

A JSON string representing the R object.

createArgFunction *Create an argument function*

Description

Create an argument function

Usage

```
createArgFunction(
  functionName,
  excludeArgs = c(),
  includeArgs = NULL,
  addArgs = list(),
  rCode = c(),
  newName
)
```

Arguments

functionName	The name of the function for which we want to create an args function.
excludeArgs	Exclude these arguments from appearing in the args function.
includeArgs	Include these arguments in the args function.
addArgs	Add these arguments to the args functions. Defined as a list with format name = default.
rCode	A character vector representing the R code where the new function should be appended to.
newName	The name of the new function. If not specified, the new name will be automatically derived from the old name.

Details

This function can be used to create a function that has (almost) the same interface as the specified function, and the output of this function will be a list of argument values.

Value

A character vector with the R code including the new function.

Examples

```
createArgFunction("read.csv", addArgs = list(exposureId = "exposureId"))
```

createConsoleAppender *Create console appender*

Description

Create console appender

Usage

```
createConsoleAppender(layout = layoutSimple)
```

Arguments

layout	The layout to be used by the appender.

Details

Creates an appender that will write to the console.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

createEmailAppender *Create e-mail appender*

Description

Create e-mail appender

Usage

```
createEmailAppender(
  layout = layoutEmail,
  mailSettings,
  label = Sys.info()["nodename"],
  test = FALSE
)
```

Arguments

layout	The layout to be used by the appender.
mailSettings	Arguments to be passed to the sendmail function in the sendmailR package (except subject and msg).
label	A label to be used in the e-mail subject to identify a run. By default the name of the computer is used.
test	If TRUE, a message will be displayed on the console instead of sending an e-mail.

Details

Creates an appender that will send log events to an e-mail address using the sendmailR package. Please make sure your settings are correct by using the sendmailR package before using those settings here. ParallelLogger will not display any messages if something goes wrong when sending the e-mail.

Using GMail

To use a GMail account, make sure to enable 2-step verification on your Google account (see 'Security'). Click on 2-Step Verification, and scroll down to 'App passwords'. Here, you can create an app-specific password to be used with ParallelLogger. You can set host.name = "smtp.gmail.com:587", and be sure to use engine = "curl".

Examples

```
mailSettings <- list(
  from = "someone@gmail.com",
  to = "someone_else@gmail.com",
  engine = "curl",
  engineopts  = list(
    username = "someone@gmail.com",
    password = "Secret!"
  ),
  control = list(
    host.name = "smtp.gmail.com:587"
  )
)
# Setting test to TRUE in this example so we don't really send an e-mail:
appender <- createEmailAppender(
  layout = layoutEmail,
  mailSettings = mailSettings,
  label = "My R session",
  test = TRUE
)

logger <- createLogger(name = "EMAIL", threshold = "FATAL", appenders = list(appender))
registerLogger(logger)

logFatal("Something bad")

unregisterLogger("EMAIL")
```

createFileAppender *Create file appender*

Description

Create file appender

Usage

```
createFileAppender(
  layout = layoutParallel,
  fileName,
  overwrite = FALSE,
  expirationTime = 60
)
```

Arguments

layout	The layout to be used by the appender.
fileName	The name of the file to write to.
overwrite	Overwrite the file if it is older than the expiration time?
expirationTime	Expiration time in seconds

Details

Creates an appender that will write to a file.

createLogger *Create a logger*

Description

Create a logger

Usage

```
createLogger(
  name = "SIMPLE",
  threshold = "INFO",
  appenders = list(createConsoleAppender())
)
```

Arguments

name	A name for the logger.
threshold	The threshold to be used for reporting.
appenders	A list of one or more appenders as created for example using the createConsoleAppender or createFileAppender function.

Details

Creates a logger that will log messages to its appenders. The logger will only log messages at a level equal to or higher than its threshold. For example, if the threshold is "INFO" then messages marked "INFO" will be logged, but messages marked "TRACE" will not. The order of levels is "TRACE", "DEBUG", "INFO", "WARN", "ERROR, "and FATAL".

Value

An object of type `Logger`, to be used with the `registerLogger` function.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

---

excludeFromList *Exclude variables from a list of objects of the same type*

Description

Exclude variables from a list of objects of the same type

Usage

```
excludeFromList(x, exclude)
```

Arguments

`x`	A list of objects of the same type.
`exclude`	A character vector of names of variables to exclude.

---

getLoggers *Get all registered loggers*

Description

Get all registered loggers

Usage

```
getLoggers()
```

Value

Returns all registered loggers.

getPhysicalMemory *Get the total amount of physical memory*

Description

Get the total amount of physical memory

Usage

```
getPhysicalMemory()
```

Value

The number of GB of RAM. Returns NA if the function failed. One GB is 1,000,000,000 bytes.

Examples

```
getPhysicalMemory()
```

getThreadNumber *Return the number of the current thread*

Description

Return the number of the current thread

Usage

```
getThreadNumber()
```

Value

Returns the number of the current thread. Returns 0 if this is the main thread.

launchLogViewer *Launch the log viewer Shiny app*

Description

Launch the log viewer Shiny app

Usage

```
launchLogViewer(logFileName)
```

Arguments

logFileName	Name of the log file to view.

Details

Launches a Shiny app that allows the user to view a log file created using the default file logger. Use addDefaultFileLogger to start the default file logger.

Examples

```
# Create a log file:
logFile <- file.path(tempdir(), "log.txt")
addDefaultFileLogger(logFile)
logInfo("Hello world")

# Launch the log file viewer (only if in interactive mode):
if (interactive()) {
  launchLogViewer(logFile)
}

# Delete the log file:
unlink(logFile)
```

---

layoutEmail *Logging layout for e-mail*

Description

A layout function to be used with an e-mail appender. This layout creates a short summary e-mail message on the event, including stack trace.

Usage

```
layoutEmail(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

---

layoutErrorReport *Logging layout for error report*

Description

A layout function to be used with an appender. This layout creates a more elaborate error message, for sharing with the developer. If an error occurs in the main thread a summary of the system info will be included.

Usage

```
layoutErrorReport(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

---

layoutParallel *Logging layout for parallel computing*

Description

A layout function to be used with an appender. This layout adds the time, thread, level, package name, and function name to the message.

Usage

```
layoutParallel(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

---

layoutSimple *Simple logging layout*

Description

A layout function to be used with an appender. This layout simply includes the message itself.

Usage

```
layoutSimple(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

layoutStackTrace *Logging layout with stack trace*

Description

A layout function to be used with an appender. This layout adds the stack trace to the message.

Usage

```
layoutStackTrace(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

layoutTimestamp *Logging layout with timestamp*

Description

A layout function to be used with an appender. This layout adds the time to the message.

Usage

```
layoutTimestamp(level, message)
```

Arguments

level	The level of the message (e.g. "INFO")
message	The message to layout.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

loadSettingsFromJson *Load a settings object from a JSON file*

Description

Load a settings object from a JSON file

Usage

```
loadSettingsFromJson(fileName)
```

Arguments

fileName	Name of the JSON file to load.

Details

Load a settings object from a JSON file, restoring object classes and attributes.

Value

An R object as specified by the JSON.

logDebug *Log a message at the DEBUG level*

Description

Log a message at the DEBUG level

Usage

```
logDebug(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers.

logError *Log a message at the ERROR level*

Description

Log a message at the ERROR level

Usage

```
logError(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers.

logFatal *Log a message at the FATAL level*

Description

Log a message at the FATAL level

Usage

```
logFatal(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers. This function is be automatically called when an error occurs, and should not be called directly. Use `stop()` instead.

logInfo *Log a message at the INFO level*

Description

Log a message at the INFO level

Usage

```
logInfo(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers. This is equivalent to calling R's native `message()` function.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

logTrace *Log a message at the TRACE level*

Description

Log a message at the TRACE level

Usage

```
logTrace(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

---

logWarn *Log a message at the WARN level*

Description

Log a message at the WARN level

Usage

```
logWarn(...)
```

Arguments

...	Zero or more objects which can be coerced to character (and which are pasted together with no separator).

Details

Log a message at the specified level. The message will be sent to all the registered loggers. This function is automatically called when a warning is thrown, and should not be called directly. Use `warning()` instead.

---

makeCluster *Create a cluster of nodes for parallel computation*

Description

Create a cluster of nodes for parallel computation

Usage

```
makeCluster(
  numberOfThreads,
  singleThreadToMain = TRUE,
  setAndromedaTempFolder = TRUE,
  setAndromedaMemoryLimit = TRUE
)
```

Arguments

numberOfThreads
: Number of parallel threads.

singleThreadToMain
: If numberOfThreads is 1, should we fall back to running the process in the main thread?

setAndromedaTempFolder
: When TRUE, the andromedaTempFolder option will be copied to each thread.

setAndromedaMemoryLimit
: When TRUE, the andromedaMemoryLimit option will be set in each thread to be either the global andromedaMemoryLimit / numberOfThreads or 75 percent of the system memory / number of threads.

Value

An object representing the cluster.

Examples

```
fun <- function(x) {
  return (x^2)
}

cluster <- makeCluster(numberOfThreads = 3)
clusterApply(cluster, 1:10, fun)
stopCluster(cluster)
```

---

matchInList *In a list of object of the same type, find those that match the input*

Description

In a list of object of the same type, find those that match the input

Usage

```
matchInList(x, toMatch)
```

Arguments

x	A list of objects of the same type.
toMatch	The object to match.

Details

Typically, toMatch will contain a subset of the variables that are in the objects in the list. Any object matching all variables in toMatch will be included in the result.

Value

A list of objects that match the toMatch object.

Examples

```
x <- list(
  a = list(name = "John", age = 25, gender = "M"),
  b = list(name = "Mary", age = 24, gender = "F")
)

matchInList(x, list(name = "Mary"))

# $a
# $a$name
# [1] "John"
#
# $a$age
# [1] 25
#
#
# $b
# $b$name
# [1] "Mary"
#
# $b$age
# [1] 24
```

`registerLogger` *Register a logger*

Description

Register a logger

Usage

```
registerLogger(logger)
```

Arguments

`logger`	An object of type `Logger` as created using the `createLogger` function.

Details

Registers a logger as created using the `createLogger` function to the logging system.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

saveSettingsToJson *Save a settings object as JSON file*

Description

Save a settings object as JSON file

Usage

```
saveSettingsToJson(object, fileName)
```

Arguments

object	R object to be saved.
fileName	File name where the object should be saved.

Details

Save a setting object as a JSON file, using pretty formatting and preserving object classes and attributes.

selectFromList *Select variables from a list of objects of the same type*

Description

Select variables from a list of objects of the same type

Usage

```
selectFromList(x, select)
```

Arguments

x	A list of objects of the same type.
select	A character vector of names of variables to select.

Examples

```
x <- list(
  a = list(name = "John", age = 25, gender = "M"),
  b = list(name = "Mary", age = 24, gender = "F")
)
selectFromList(x, c("name", "age"))

# $a
# $a$name
# [1] "John"
#
# $a$age
```

```
# [1] 25
#
#
# $b
# $b$name
# [1] "Mary"
#
# $b$age
# [1] 24
```

`stopCluster` *Stop the cluster*

Description

Stop the cluster

Usage

```
stopCluster(cluster)
```

Arguments

`cluster`	The cluster to stop

Examples

```
fun <- function(x) {
  return (x^2)
}

cluster <- makeCluster(numberOfThreads = 3)
clusterApply(cluster, 1:10, fun)
stopCluster(cluster)
```

`unregisterLogger` *Unregister a logger*

Description

Unregister a logger

Usage

```
unregisterLogger(x, silent = FALSE)
```

Arguments

`x`	Can either be an integer (e.g. 2 to remove the second logger), the name of the logger, or the logger object itself.
`silent`	If TRUE, no warning will be issued if the logger is not found.

Details

Unregisters a logger from the logging system.

Value

Returns TRUE if the logger was removed.

Examples

```
appender <- createConsoleAppender(layout = layoutTimestamp)

logger <- createLogger(name = "SIMPLE",
                       threshold = "INFO",
                       appenders = list(appender))
registerLogger(logger)
logTrace("This event is below the threshold (INFO)")
logInfo("Hello world")
unregisterLogger("SIMPLE")
```

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