Package ‘simTool’

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Type Package

Title Conduct Simulation Studies with a Minimal Amount of Source Code.

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Description The simTool package is designed for statistical simulations that
have two components. One component generates the data and the other one
analyzes the data. The main aims of the simTool package are the reduction
of the administrative source code (mainly loops and management code for the
results) and a simple applicability of the package that allows the user to
quickly learn how to work with the simTool package. Parallel computing is
also supported. Finally, convenient functions are provided to summarize the
simulation results.

Depends R (>= 2.14.0)

Imports plyr (>= 1.8.1), reshape (>= 0.8.5), parallel

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License GPL-3

VignetteBuilder knitr

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simTool-package

Conduct Simulation Studies with a Minimal Amount of Source Code.

Description

The simTool package is designed for statistical simulations that have two components. One component generates the data and the other one analyzes the data. The main aims of the simTool package are the reduction of the administrative source code (mainly loops and management code for the results) and a simple applicability of the package that allows the user to quickly learn how to work with the simTool package. Parallel computing is also supported. Finally, convenient functions are provided to summarize the simulation results.

Details

Package: simTool
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evalGrids is the workhorse. as.data.frame is function coercing the result object of evalGrids to a data.frame. expandGrid is only a convenient function

Author(s)

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Examples

dg = expandGrid(fun="rexp", n=c(10, 20), rate=1:2)
pg = expandGrid(proc="summary")
eg = evalGrids(dg, pg, replications=3)
as.data.frame(eg)
as.data.frame(eg, summary.fun=mean)
as.data.frame(eg, summary.fun=c(mean, sd))
Description

Converts the results contained in the object returned by `evalGrids` into a data.frame. If the results cannot be coerced automatically into a data.frame, the user can provide a function to pre-process the results (see `convert.result.fun`). Furthermore, univariate functions to summarize the results over the replications can be specified via `summary.fun`.

Usage

```r
## S3 method for class 'evalGrid'
as.data.frame(x, ..., convert.result.fun = identity,
              summary.fun = NULL, progress = FALSE)
```

Arguments

- `x` an object returned by `evalGrids`
- `...` only for S3 method consistency
- `convert.result.fun` a function that converts the result object contained in `x` into a data.frame
- `summary.fun` univariate functions to summarize the results (numeric or logical) over the replications, e.g. mean, sd. Alternatively, `summary.fun` can be one function that may return a vector.
- `progress` if TRUE a progress bar is shown in the console.

Value

a data.frame with the parameter constellations for the data generation and evaluation and the results (probably summarized).

Author(s)

Marsel Scheer

See Also

evalGrids

Examples

```r
genRegData <- function(){
data.frame(
x = 1:10,
y = rnorm(10, mean=1:10))
}

eg <- evalGrids(
  expandGrid(fun="genRegData"),
  expandGrid(proc="lm", formula=c("y ~ x", "y ~ x + I(x^2)")),
  replications=5)
```
evalGrids = function(lm.object) {
  ret = coef(summary.lm(lm.object))[, 1:2]
  data.frame(covariable = rownames(ret), ret, check.names=FALSE)
}

as.data.frame(eg, convert.result.fun=lm2df, progress=TRUE)

as.data.frame(eg, convert.result.fun=lm2df, summary.fun=c(mean, sd), progress=TRUE)

---

evalGrids

*Workhorse for simulation studies*

**Description**

Generates data according to all provided constellations in `datagrid` and applies all provided constellations in `procgrid` to them.

**Usage**

```r
evalGrids(dataGrid, procGrid = expandGrid(proc = "length"),
  replications = 1, discardGeneratedData = FALSE, progress = FALSE,
  summary.fun = NULL, ncpus = 1L, cluster = NULL,
  clusterSeed = rep(12345, 6), clusterLibraries = NULL,
  clusterGlobalObjects = NULL, fallback = NULL, envir = globalenv(), ...)
```

**Arguments**

- `datagrid` a `data.frame` where the first column is a character vector with function names. The other columns contain parameters for the functions specified in the first column. Parameters with NA are ignored.
- `procgrid` similar as `datagrid` the first column must contain function names. The other columns contain parameters for the functions specified in the first column. The data generated according to `datagrid` will always be passed to the first unspecified argument of the functions specified in the first column of `procgrid`.
- `replications` number of replications for the simulation
- `discardGeneratedData` if TRUE the generated data is deleted after all function constellations in `procgrid` have been applied. Otherwise, ALL generated data sets will be part of the returned object.
- `progress` if TRUE a progress bar is shown in the console.
- `summary.fun` univariate functions to summarize the results (numeric or logical) over the replications, e.g. mean, sd. Alternatively, `summary.fun` can be one function that may return a vector.
- `ncpus` a cluster of ncpus workers (R-processes) is created on the local machine to conduct the simulation. If ncpus equals one no cluster is created and the simulation is conducted by the current R-process.
- `cluster` a cluster generated by the `parallel` package that will be used to conduct the simulation. If `cluster` is specified, then ncpus will be ignored.
if the simulation is done in parallel manner, then the combined multiple-recursive
generator from L'Ecuyer (1999) is used to generate random numbers. Thus
clusterSeed must be a (signed) integer vector of length 6. The 6 elements of
the seed are internally regarded as 32-bit unsigned integers. Neither the first
three nor the last three should be all zero, and they are limited to less than
4294967087 and 4294944443 respectively.

a character vector specifying the packages that should be loaded by the workers.

a character vector specifying the names of R objects in the global environment
that should be exported to the global environment of every worker.

must be missing or a character specifying a file. Every time when the data genera-
tion function is changed, the results so far obtained are saved in the file specified
by fallback.

must be provided if the functions specified in dataGrid or procGrid are not
part of the global environment.

only needed to alert the user if some deprecated arguments were used.

The returned object is a list of the class evalGrid, where the fourth element is a list of lists named
simulation. simulation[i][r] contains:

data the data set that was generated by the ith constellation (i-th row) of dataGrid
in the rth replication

results a list containing nrow(procGrid) objects. The jth object is the returned value
of the function specified by the jth constellation (j-th row) of procGrid applied
to the data set contained in data

If cluster is provided by the user the function evalGrids will NOT stop the cluster. This has to be
done by the user. Conducting parallel simulations by specifying ncpus will internally create a cluster
and stop it after the simulation is done.

Author(s)
Marsel Scheer

See Also

as.data.frame.evalGrid

Examples

rng = function(data, ...) {
  ret = range(data)
  names(ret) = c("min", "max")
  ret

# call runif(n=1), runif(n=2), runif(n=3)
# and range on the three "datasets"
# generated by runif(n=1), runif(n=2), runif(n=3)
eg = evalGrids(
   expandGrid(fun="runif", n=1:3),
   expandGrid(proc="rng"),
   rep=10
)
eg

# summarizing the results in a data.frame
as.data.frame(eg)

# we now generate data for a regression
# and fit different regression models

# not that we use SD and not sd (the
# reason for this is the cast() call below)
regData = function(n, SD){
data.frame(
   x=seq(0,1,length=n),
   y=rnorm(n, sd=SD))
}
eg = evalGrids(
   expandGrid(fun="regData", n=20, SD=1:2),
   expandGrid(proc="lm", formula=c("y-x", "y-I(x^2)")),
   replications=2)

# can not be converted to data.frame, because
# an object of class "lm" can not converted to
# a data.frame
try(as.data.frame(eg))

# for the data.frame we just extract the r.squared
# from the fitted model
as.data.frame(eg, convert.result.fun=function(fit) c(rsq=summary(fit)$r.squared))

# for the data.frame we just extract the coefficients
# from the fitted model
df = as.data.frame(eg, convert.result.fun=coef)

# since we have done 2 replication we can calculate
# sum summary statistics
library("reshape")
df$replication=NULL
mdf = melt(df, id=1:7, na.rm=TRUE)
cast(mdf, ... ~ ., c(mean, length, sd))

# note if the data.frame would contain the column
# named "sd" instead of "SD" the cast will generate
evalGrids

# an error
names(df)[5] = "sd"
mdf = melt(df, id=1:7, na.rm=TRUE)
try(cast(mdf, ... ~ ., c(mean, length, sd)))

# extracting the summary of the fitted.model
as.data.frame(eg, convert.result.fun=function(x) {
  ret = coef(summary(x))
data.frame(valueName = rownames(ret), ret, check.names=FALSE)
})

# we now compare to methods for calculating quantiles
# the functions and parameters
# that generate the data
N = c(10, 50, 100)
library("plyr")
dg = rbind.fill(
  expandgrid(fun="rbeta", n=N, shape1=4, shape2=4),
  expandgrid(fun="rnorm", n=N))

# definition of the two quantile methods
emp.q = function(data, probs) c(quantile(data, probs=probs))
nor.q = function(data, probs) {
  ret = qnorm(probs, mean=mean(data), sd=sd(data))
  names(ret) = names(quantile(1, probs=probs))
  ret
}

# the functions and parameters that are applied to the generate data
pg = rbind.fill(expandGrid(proc=c("emp.q", "nor.q"), probs=c(0.01, 0.025, 0.05)))

# generate data and apply quantile methods
set.seed(1234)
eg = evalGrids(dg, pg, replication=50, progress=TRUE)

# convert the results to a data.frame
df = as.data.frame(eg)
df$replication=NULL
mdf = melt(df, id=1:8, na.rm=TRUE)

# calculate, print and plot summary statistics
require("ggplot2")
print(a <- arrange(cast(mdf, ... ~ ., c(mean, sd)), n))
ggplot(a, aes(x=fun, y=mean, color=proc)) + geom_point(size=I(3)) + facet_grid(probs ~ n)
**expandGrid**

*Creates a data.frame from All Combinations*

**Description**

Actually a wrapper for `expand.grid`, but character vectors will stay as characters.

**Usage**

`expandGrid(...)`

**Arguments**

... vectors, factors or a list containing these.

**Value**

See `expand.grid`

**Author(s)**

Marsel Scheer

**See Also**

`expand.grid`

**Examples**

```r
eexpandGrid(fun="rnorm", mean=1:4, sd=2:5)
```

**meanAndNormCI**

*A convenient function to calculate the mean and a 95% confidence interval*

**Description**

The 95% confidence interval is based on a normal approximation.

**Usage**

`meanAndNormCI(results)`

**Arguments**

results a numeric or logical vector
meanAndNormCI

Author(s)
Marsel Scheer

Examples
meanAndNormCI(rexp(10^4, rate=2))
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