Package ‘GuessCompx’

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Type Package

Title Empirically Estimates Algorithm Complexity

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Author Marc Agenis <marc.agenis@gmail.com> and Neeraj Bokde <neerajdhanraj@gmail.com>

Maintainer Marc Agenis <marc.agenis@gmail.com>

Description
Make an empirical guess on the time and memory complexities of an algorithm or a function. Tests multiple, increasing size random samples of your data and tries to fit various complexity functions $o(n)$, $o(n^2)$, $o(\log(n))$, etc. Based on best fit, it predicts the full computation time on your whole dataset. Results are plotted with 'ggplot2'.

BugReports https://github.com/agenis/GuessCompx/issues

URL https://github.com/agenis/GuessCompx

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Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Imports dplyr, reshape2, ggplot2, lubridate, boot

Suggests knitr, rmarkdown

VignetteBuilder knitr

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CompEst Complexity Estimation and Prediction

Description

Main function for the complexity estimation of an algorithm

Usage

CompEst(d, f, random.sampling = FALSE, max.time = 30, 
start.size = NULL, replicates = 4, strata = NULL, 
power.factor = 2, alpha.value = 0.005, plot.result = TRUE)

Arguments

d the data.frame, vector or matrix on which the algorithm is to be tested

f a user-defined function that runs the algorithm, taking d as first argument. No return value is needed.

random.sampling boolean; if TRUE a random sample is taken at each step, if FALSE the first N observations are taken at each step. Choosing a random sampling is relevant with the use of replicates to help the discrimination power for complexity functions.

max.time maximum time in seconds allowed for each step of the analysis. The function will stop once this time limit has been reached. Default is 30 seconds. There is no such limitation regarding memory.

start.size the size in rows of the first sample to run the algorithm. Default is ‘floor(log2(nrow(d)))’. If strata is not NULL, we recommend to enter a multiple of the number of categories.

replicates the number of replicated runs of the algorithm for a specific sample size. Allows to better discriminate the complexity functions. Default is 2.

strata a string, name of the categorical column of d that must be used for stratified sampling. A fixed proportion of the categories will be sampled, always keeping at least one observation per category.

power.factor the common ratio of the geometric progression of the sample sizes. Default is 2, and will make sample sizes double every step. Decimal numbers are allowed.

alpha.value the alpha risk of the test whether the model is significantly different from a constant relation. Default is 0.005.

plot.result boolean indicative if a summary plot of all the complexity functions is to be displayed
Details

The fit of a complexity function is one among: constant, linear, quadratic, cubic, logarithmic, square.root, n.log(n). Model comparison is achieved using Leave-One-Out error minimisation of the MSE (see `boot::cv.glm` doc). Note that when a CONSTANT relationship is predicted, it might simply mean that the max.time value is too low to show any tendency. For time series, the sampling removes the ts attribute to the input vector, so the user's function shall include again this ts() if a frequency is needed; also remind to avoid random sampling for it will break the series.

Value

A list with the best complexity function and the computation time on the whole dataset, for both time and memory complexity (Windows) and time complexity only (all other OS).

Examples

# Dummy function that mimics a constant time complexity and
# N.log(N) memory complexity:

f1 = function(df){
  Sys.sleep(rnorm(1, 0.1, 0.02))
  v = rnorm(n = nrow(df)*log(nrow(df)))*(runif(1, 1e3, 1.1e3)))
}

time_series = compEst(d = mtcars, f = f1, replicates=2, start.size=2, max.time = 1)

# Raises an alert for TIME complexity.
# Sometimes confuses MEMORY complexity with linear:
print(time_series)

# Real dist function analysis (everything is quadratic here):

f2 = dist
d = ggplot2::diamonds[, 5:8]
CompEst(d = d, f = f2, replicates = 1, max.time = 1)

# For time series functions, your 'f' argument may include ts()
# to avoid loosing this ts attribute at sampling
# It is also recommended to set 'start.size' argument to 3 periods at least.
f = function(d) arima(ts(d, freq = 12), order=c(1,0,1), seasonal = c(0,1,1))
d = ggplot2::txhousing$sales
# Should return a linear trend for TIME:
CompEst(d, f, start.size = 9, random.sampling = FALSE)
Arguments

to.model A data.frame produced by the CompEst() function, comprised of the following columns: size, time, memory, NlogN_X

use a string indicatif if the function deals "time" or "memory" data

Value

a list with all the fitted complexity model.

Description

_Plot function for the results of algorithms complexity

Usage

CompEstPlot(to.plot, element_title = list("", ""), use = "time")

Arguments

to.plot a dataset produced by CompEst() function

element_title a string that will be added to the subtitle of the plot

use a string indicatif if the function deals "time" or "memory" data

Value

a ggplot object

Description

_Prediction function for the computation time of a whole dataset

Usage

CompEstPred(model.list, benchmark, N, use = "time")
Arguments

- `model.list`: A list containing the fitted complexity functions, produced by CompEst()
- `benchmark`: A vector of LOO errors of complexity functions, produced by CompEst()
- `N`: number of rows of the whole dataset, produced by CompEst()
- `use`: a string indicative if the function deals "time" or "memory" data

Value

A string of the predicted time for the whole dataset

Description

Sample a random proportion of the data, keeping at least one observation

Usage

```r
GroupedSampleFracAtLeastOneSample(d_subset, prop, is.random = TRUE)
```

Arguments

- `d_subset`: A data.frame from which a small sample is to be returned
- `prop`: A number between 0 and 1, being the desired sampling fraction.
- `is.random`: a boolean. If TRUE, a random sample is drawn, else it takes the head() of the data

Details

This function is designed to allow its use with group splitting or do.by methods.

Value

A random sample from the data, of proportion prop, but always returning at least one observation even if prop is too low.
rhead  

Random Head

Description
Small Random Sample from a vector or data.frame

Usage
rhead(data, rows = 7, is.random = TRUE)

Arguments
- data: A vector or data.frame from which a small sample is to be returned
- rows: A positive integer, representing the number of lines or elements to print, default is 7.
- is.random: a boolean. If TRUE, a random sample is drawn, else it takes the head() of the data

Details
If the rows parameter is greater than the actual number of rows/elements of the data, the returned value is the initial dataset after shuffling

Value
A random sample without replacement taken from the data, in the same format than the input.

Examples
set.seed(1234)
rhead(mtcars)
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