Package ‘mcStats’

February 26, 2020

Title Visualize Results of Statistical Hypothesis Tests
Version 0.1.2
Maintainer Michael Czekanski <mczekanski@middlebury.edu>
Description Provides functionality to produce graphs of sampling distributions of test statistics from a variety of common statistical tests. With only a few keystrokes, the user can conduct a hypothesis test and visualize the test statistic and corresponding p-value through the shading of its sampling distribution. Initially created for statistics at Middlebury College.
Depends R (>= 3.4.0)
License GPL-3
Encoding UTF-8
LazyData true
RoxygenNote 7.0.2
Imports dplyr, ggplot2, ggthemes, gridExtra, magrittr, rlang, stats, tidyr
Suggests testthat
NeedsCompilation no
Author Michael Czekanski [aut, cre], Alex Lyford [aut]
Repository CRAN
Date/Publication 2020-02-26 06:50:02 UTC

R topics documented:

- bootstrap .................................................... 2
- hello ....................................................... 3
- labelBootResults ........................................... 3
- labelPDFDis ................................................ 4
- mcDChiSq .................................................... 4
- mcDF ........................................................ 5
- mcDNorm ...................................................... 5
- mcDT ......................................................... 6
Description

Bootstrap using given data and statistic

Usage

```
bootstrap(fun, data, h0, nreps, conf.level = 0.95, verbose = 1)
```

Arguments

- `fun`: function to calculate on each sample. This can be a user-defined function that takes in data as a vector and returns a statistic.
- `data`: data to use for bootstrapping. Should be a representative sample.
- `h0`: null hypothesis value.
- `nreps`: number of times to bootstrap.
- `conf.level`: confidence value.
- `verbose`: default is 1 which will create a graph. To turn this off use verbose = 0.

Value

results from boostrapping. A vector of length @param nreps containing each statistic calculated.

Examples

```
x <- rnorm(100)
bootstrap(mean, x, 0.5, 1000, verbose = 0)
bootstrap(mean, x, 0.5, 1000)
```
**hello**

Print "hello world!"

**Description**

print "hello world!"

**Usage**

hello()

**Examples**

hello()

---

**labelBootResults**

*Label Bootstrapped Results*

**Description**

labels bootstrapped results. We use this to create colored histograms.

**Usage**

labelBootResults(results, lBound, uBound)

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>results</td>
<td>a vector, data from bootstrapping</td>
</tr>
<tr>
<td>lBound</td>
<td>lower bound of confidence interval</td>
</tr>
<tr>
<td>uBound</td>
<td>upper bound of confidence interval</td>
</tr>
</tbody>
</table>

**Value**

vector of labels corresponding to result values

**Examples**

```r
x <- rnorm(100)
labelBootResults(x, -1, 1)
```
### labelPDFDis

**Label discrete PDF**

**Description**

labels a discrete pdf

**Usage**

`labelPDFDis(x, obsVal, expVal)`

**Arguments**

- `x` : x value
- `obsVal` : observed event
- `expVal` : expected value

**Value**

vector of labels for x value in relation to observed event

**Examples**

`labelPDFDis(0:10, 3, 5)`

### mcDChiSq

**Density of Chi-Square distribution**

**Description**

Density of Chi-Square distribution

**Usage**

`mcDChiSq(x, degFree, ...)`

**Arguments**

- `x` : x value
- `degFree` : degrees of freedom
- `...` : optional additional parameters which are ignored

**Value**

density of given Chi-Square dist. at x
mcDF

Density of F-distribution

Description
Density of F-distribution

Usage
mcDF(x, degFree1, degFree2, ...)

Arguments
x x value
degFree1 degrees of freedom 1
degFree2 degrees of freedom 2
... optional additional parameters which are ignored

Value
density of given F-dist. at x

mcDNorm

dnorm but with more arguments

Description
compute density of normal distribution while allowing for more arguments which are ignored

Usage
mcDNorm(x, mean = 0, sd = 1, log = FALSE, ...)

Arguments
x x value
mean mean of normal distribution
sd std. dev. of normal distribution
log logical; if TRUE probabilities are given as log(p). See stats::dnorm
... extra parameters which are ignored

Value
density of normal distribution
mcDT \hspace{1cm} Density of t-distribution

Description
Density of t-distribution

Usage
mcDT(x, degFree, ...)

Arguments
\begin{itemize}
\item x \hspace{1cm} x value
\item degFree \hspace{1cm} degrees of freedom
\item ... \hspace{1cm} optional additional parameters which are ignored
\end{itemize}

Value
density of given t-dist. at x

shadePDFCts \hspace{1cm} Used to shade in a PDF

Description
Returns density with extreme event region having NAs

Usage
shadePDFCts(x, fun, testStat, ...)

Arguments
\begin{itemize}
\item x \hspace{1cm} x value
\item fun \hspace{1cm} density function to use
\item testStat \hspace{1cm} test statistic value
\item ... \hspace{1cm} optional parameters passed to density function
\end{itemize}

Value
density if outside of extreme event region
showANOVA

Show results of ANOVA

Description
Visualization of distributional results of ANOVA. Please see aov for more information on parameters

Usage
showANOVA(formula, data = NULL, verbose = 1, ...)

Arguments
- formula: formula specifying a model.
- data: data on which to perform ANOVA
- verbose: if verbose > 0 the resulting graph is printed
- ...: Arguments passed to lm. See aov for more detail

Value
output of call to aov

Examples
showANOVA(yield ~ N + P + K, npk)

showChiSq.Test

Show Chi-Square Test

Description
show results of a chi-square test visually using chisq.test

Usage
showChiSq.Test(
  x,
  y = NULL,
  p = rep(1/length(x), length(x)),
  simulate.p.value = FALSE,
  nreps = 2000,
  verbose = 1
)
showMcNemarTest

Arguments

x         a numeric vector or matrix. x and can also be factors
y         a numeric vector
p         a vector of probabilities the same length as x. Used for goodness-of-fit tests. Must
          be a valid distribution
simulate.p.value
          boolean, if TRUE use simulation to estimate p-value
nreps
          if simulate.p.value = TRUE number of simulations to complete
verbose
          level of visual output, 0 = silent

Value

results of chisq.test call

Examples

showChiSq.Test(x = c(1,2,1), y = c(1,2,2))

showMcNemarTest

Visualize results of McNemar’s Test

Description

relevant parameters are passed to mcnemar.test

Usage

showMcNemarTest(x, y = NULL, correct = TRUE, verbose = 1)

Arguments

x         two dimensional contingency table as a matrix or a factor object
y         factor object, ignored if x is a matrix
correct   logical indicating whether or not to perform continuity correction
verbose   if verbose > 0 the resulting graph is printed

Value

results of call to mcnemar.test
showMosaicPlot

Mosaic Plot

Description
Mosaic Plot

Usage
showMosaicPlot(x)

Arguments
x must be a matrix with each row and column labelled

Value
mosaic plot showing observed proportions, colored by residuals from chi-sq. test

Examples
x <- matrix(runif(9,5,100), ncol = 3, dimnames = list(c("Yes1", "No1", "Maybe1"), c("Yes2", "No2", "Maybe2")))
showMosaicPlot(x)

showOLS

Show hypothesis tests from OLS

Description
Show hypothesis tests from OLS

Usage
showOLS(formula, data, verbose = 1)

Arguments
formula forumula for regression. Passed to lm
data data for regression. Passed to lm
verbose if verbose > 0 the resulting graph is printed

Value
model object resulting from the regression
Examples

showOLS(mpg ~ cyl + disp, mtcars)

showProp.Test(x, n, p = 0.5)

Description

Show results of proportion test using \texttt{binom.test}

Usage

showProp.Test(x, n, p = 0.5)

Arguments

\begin{itemize}
  \item \texttt{x}: x value
  \item \texttt{n}: number of repetitions
  \item \texttt{p}: probability of success in one Bernoulli trial
\end{itemize}

Value

output of call to \texttt{binom.test}

Examples

showProp.Test(3, 10)

showT.Test(group1, group2 = NULL, mu = 0, paired = FALSE, verbose = 1)

Description

Runs \textit{z-test} and outputs graph for interpretation using \texttt{stats::t.test}

Usage

showT.Test(group1, group2 = NULL, mu = 0, paired = FALSE, verbose = 1)

Arguments

\begin{itemize}
  \item \texttt{group1}: continuous data to test
  \item \texttt{group2}: optional; second group to include for two sample t-test
  \item \texttt{mu}: optional: mean to test against for one-sample t-test
  \item \texttt{paired}: boolean, if TRUE perform matched pairs t-test
  \item \texttt{verbose}: default is 1 which will create a graph. To turn this off use \texttt{verbose = 0.}
\end{itemize}
showXtremeEventsCts

Value

results of call to t.test

Examples

x <- rnorm(100)
showT.Test(x, verbose = 0)
showT.Test(x)

showXtremeEventsCts  Highlight extreme events

Description

Make graph highlighting events more extreme than observed sample

Usage

showXtremeEventsCts(
  testID,
  testStat,
  densFun,
  degFree = NULL,
  degFree1 = NULL,
  degFree2 = NULL,
  xlims,
  verbose = 1,
  ...
)

Arguments

testID              name of hypothesis test
testStat            test statistic
densFun             function that computes appropriate density
degFree             degrees of freedom when only one is needed. This gets passed into densFun
degFree1            first degrees of freedom parameter when more than one is needed
degFree2            second degrees of freedom parameter when more than one is neededxlims               x limits of the graph to be used. This is passed to ggplotverbose          if verbose > 0 the resulting graph is printed...
extra arguments passed to density function

Value

results of call testFun
Examples

```r
x <- rnorm(100)
showT.Test(x, verbose = 0)
showT.Test(x)
```

Description

Show Extreme Events from a Discrete Distribution

Usage

```r
showXtremeEventsDis(testID, obsVal, expVal, xVals, probFun, ...)
```

Arguments

- `testID`: name of test being performed. This is used to title the graph
- `obsVal`: observed x value
- `expVal`: expected x value
- `xVals`: domain of x (possible values)
- `probFun`: probability mass function for the given distribution
- `...`: addition arguments passed to probFun

Value

Graph coloring events by how extreme they are under the null hypothesis

Examples

```r
showXtremeEventsDis("Prop. Test", 3, 5, 0:10, probFun = dbinom, size = 10, prob = 0.5)
```
Index

aov, 7
binom.test, 10
bootstrap, 2
chisq.test, 7, 8
hello, 3
labelBootResults, 3
labelPDFDis, 4
lm, 9
mcDChiSq, 4
mcDF, 5
mcDNorm, 5
mcDT, 6
mcnemar.test, 8
shadePDFCts, 6
showANOVA, 7
showChiSq.Test, 7
show McNemar Test, 8
showMosaicPlot, 9
showOLS, 9
show Prop. Test, 10
show T. Test, 10
show Xtreme Events Cts, 11
show Xtreme Events Dis, 12