Package ‘familial’

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**Type**  Package

**Title**  Statistical Tests of Familial Hypotheses

**Version**  1.0.5

**Description**  Provides functionality for testing familial hypotheses. Supports testing centers belonging to the Huber family. Testing is carried out using the Bayesian bootstrap. One- and two-sample tests are supported, as are directional tests. Methods for visualizing output are provided.

**URL**  https://github.com/ryan-thompson/familial

**BugReports**  https://github.com/ryan-thompson/familial/issues

**License**  GPL-3

**Encoding**  UTF-8

**Depends**  R (>= 4.1.0)

**Imports**  parallel, ggplot2, DepthProc, matrixStats

**RoxygenNote**  7.2.3

**Suggests**  testthat, knitr, markdown, MASS

**VignetteBuilder**  knitr

**Config/testthat/edition**  3

**NeedsCompilation**  no

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**Repository**  CRAN

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bayes.boot

Description

Performs a Bayesian bootstrap for a statistic defined via a suitable function.

Usage

bayes.boot(x, fun, nboot = 1000, cluster = NULL, ...)

Arguments

x
   a numeric vector to be passed as the first argument to fun
fun
   the function to bootstrap; must accept data x and weights w (in that order), and return a data frame
nboot
   the number of bootstraps to perform
cluster
   an optional cluster for running bootstraps in parallel; must be set up using parallel::makeCluster
...
   any other arguments for fun

Value

An object of class bayes.boot; a data frame with the following columns:

boot.id
   the bootstrap iteration index
...
   any columns returned by fun

Author(s)

Ryan Thompson <ryan.thompson1@unsw.edu.au>

Examples

set.seed(123)

boot <- bayes.boot(MASS::galaxies, fun = fit.family, nboot = 100)
head(boot)
Description

Performs a one- or two-sample test for a family of centers.

Usage

center.test(
  x,
  y = NULL,
  family = "huber",
  alternative = c("two.sided", "less", "greater"),
  mu = 0,
  paired = FALSE,
  nboot = 1000,
  loss = NULL,
  cluster = NULL,
  ...
)

Arguments

x a numeric vector of data
y an optional numeric vector of data
family the family of centers; currently only allows 'huber' for Huber family
alternative the form of the alternative hypothesis; must be one of 'two.sided' (default), 'greater', or 'less'
mu the null value of the center for a one-sample test, or the null value of the center of differences for a paired two-sample test, or the null value of the difference of centers for an independent two-sample test; can be an interval
paired a logical indicating whether to treat x and y as paired
nboot the number of bootstraps to perform
loss an optional c×2 matrix of losses incurred from an incorrect decision, where c is the number of candidate choices (typically c=3: H0, H1, or indeterminate)
cluster an optional cluster for running bootstraps in parallel; must be set up using parallel::makeCluster
...
any other arguments

Details

Uses the Bayesian bootstrap to compute posterior probabilities for the hypotheses $H_0 : \mu(\lambda) = \mu_0$ for some $\lambda \in \Lambda$ vs. $H_1 : \mu(\lambda) \neq \mu_0$ for all $\lambda \in \Lambda$, where $\{\mu(\lambda) : \lambda \in \Lambda\}$ is a family of centers. The default loss matrix results in a decision whenever the posterior probability for one of the hypotheses is greater than 0.95 and otherwise is indeterminate.
Value

An object of class `center.test`; a list with the following components:

- `expected.loss` the expected loss, calculated by post-multiplying `loss` with `prob`
- `decision` the optimal decision given the expected loss
- `loss` the loss matrix
- `prob` the estimated posterior probabilities of the null and alternative
- `boot` the bootstrap output from `bayes.boot`
- `x` the `x` that was supplied
- `y` the `y` that was supplied
- `mu` the `mu` that was supplied
- `family` the family that was supplied

Author(s)

Ryan Thompson <ryan.thompson1@unsw.edu.au>

References


Examples

```r
set.seed(123)

test <- center.test(MASS::galaxies, mu = 21000, nboot = 100)
print(test)
plot(test)

cl <- parallel::makeCluster(2)
test <- center.test(MASS::galaxies, mu = 21000, nboot = 100, cluster = cl)
parallel::stopCluster(cl)
print(test)
```

Description

Fits a family of centers.
Usage

fit.family(
    x,
    w = rep(1, length(x)),
    family = "huber",
    spread.fun = weighted.mad,
    eps = .Machine$double.eps
)

Arguments

x a numeric vector of data
w a numeric vector of weights
family the location family; currently only allows ’huber’ for Huber family
spread.fun a function used for the spread of x; must accept data x and weights w (in that order), and return a numeric
eps a numerical tolerance parameter

Value

An object of class fit.family; a data frame with the following columns:

mu the fitted values
lambda the thresholding parameter

Author(s)

Ryan Thompson <ryan.thompson1@unsw.edu.au>

Examples

fit <- fit.family(MASS::galaxies)
plot(fit)

plot.center.test  Plot function for center.test object

Description

Plot the posterior distribution for the family of centers using a functional box plot.

Usage

## S3 method for class 'center.test'
plot(x, band = c(0.5, 0.75, 0.95), ninterp = 25, ...)

plot.center.test
**Arguments**

- **x**
  - an object of class `center.test`
- **band**
  - a vector of band limits for the functional box plot
- **ninterp**
  - the number of interpolation points for the functional box plot; more points lead to finer resolution of the plot at the expense of additional computation
- **...**
  - any other arguments

**Value**

A plot of the posterior distribution.

**Author(s)**

Ryan Thompson <ryan.thompson@monash.edu>

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(plot.fit.family) *Plot function for fit.family object*

**Description**

Plot a fitted family.

**Usage**

```r
## S3 method for class 'fit.family'
plot(x, y = NULL, ...)
```

**Arguments**

- **x**
  - an object of class `fit.family`
- **y**
  - an object of class `fit.family`
- **...**
  - any other arguments

**Value**

A plot of the fitted family.

**Author(s)**

Ryan Thompson <ryan.thompson@monash.edu>
**print.center.test**

*Print function for center.test object*

**Description**

Print objects of class `center.test`.

**Usage**

```r
## S3 method for class 'center.test'
print(x, ...)
```

**Arguments**

- `x`: an object of class `center.test`
- `...`: any other arguments

**Value**

The argument `x`.

**Author(s)**

Ryan Thompson <ryan.thompson@monash.edu>

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**rudirichlet**

*Uniform Dirichlet distribution*

**Description**

Random number generation for the uniform Dirichlet distribution (having all concentration parameters set to one).

**Usage**

```
rudirichlet(n, d)
```

**Arguments**

- `n`: the number of observations
- `d`: the number of dimensions

**Value**

A matrix; each row is a random draw and each column is a dimension.
Author(s)
Ryan Thompson <ryan.thompson1@unsw.edu.au>

Description
Assorted weighted statistics unavailable in base R.

Usage
weighted.median(x, w)

weighted.mad(x, w)

Arguments
x a numeric vector of data
w a numeric vector of weights

Value
A length-one numeric vector.

Author(s)
Ryan Thompson <ryan.thompson1@unsw.edu.au>
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