Package ‘familial’

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Type Package
Title Statistical Tests of Familial Hypotheses
Version 1.0.3
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.

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Author Ryan Thompson [aut, cre] (<https://orcid.org/0000-0002-9002-0448>)
Maintainer Ryan Thompson <ryan.thompson@monash.edu>
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R topics documented:

bayes.boot .................................................. 2
center.test .................................................. 3
fit.family .................................................... 4
plot.center.test ............................................ 5
Bayesian bootstrap

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.thompson@monash.edu>

Examples
set.seed(123)

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

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.thompson@monash.edu>

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)
```

---

**Fit family**

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.thompson@monash.edu>

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, ...)
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
## 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>

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.
**Description**

Assorted weighted statistics unavailable in base R.

**Usage**

```r
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.thompson@monash.edu>
Index

bayes.boot, 2
center.test, 3
fit.family, 4
plot.center.test, 5
plot.fit.family, 6
print.center.test, 7
rudirichlet, 7
weighted, 8