Package ‘MOM’

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Type Package

Title Estimation and Testing of Hypothesis

Version 0.1.0

Description A collection of functions to do some statistical inferences. On estimation, it has the function to get the method of moments estimates,
the sampling interval. In terms of testing it has function of doing most powerful test.

Imports actuar, VGAM

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Contents

`beta_est` *Method of Moments Estimation of Beta distribution*

Description

function to get the method of moment estimate(s) of beta distribution

Usage

```
beta_est(
  data,
  unknown = c("shape1", "shape2", "both"),
  shape1 = NULL,
  shape2 = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

`data`	A numeric vector.
`unknown`	A character string specifying which parameter is (are) unknown to the user.
`shape1, shape2`	Non-negative parameters of the Beta distribution.
`plot`	logical which controls whether the histogram of the data along with the density curve of the theoretical beta distribution with the estimated parameters.
`curvecol`	color of the theoretical density curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is beta distribution

Examples

```
beta_est(rbeta(1000,shape1=2,shape2=1),unknown="shape2",shape1=2)#shape1 is known
beta_est(rbeta(1000,shape1=2,shape2=1),unknown="shape1",shape2=1)#shape2 is known
beta_est(rbeta(1000,shape1=2,shape2=1),unknown="both")#both will be estimated
```

binom_est *Method of Moments Estimation of Binomial distribution*

Description

function to get the method of moment estimate(s) of binomial distribution

Usage

```
binom_est(
  data,
  size.known = FALSE,
  size = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

data	A numeric vector.
size.known	logical indicating whether the size of the binomial distribution is known or not.
size	integer valued parameter of binomial distribution.
plot	logical which controls whether the barplot of the data along with the probability curve of the theoretical binomial distribution with the estimated parameters.
curvecol	color of the theoretical probability curve
...	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is binomial distribution

Examples

```
binom_est(rbinom(1000,size=5,prob=0.2),size.known=TRUE,size=5)#no of trials known
binom_est(rbinom(1000,size=10,prob=0.6))
```

chisq_est — *Method of Moments Estimation of Chi-Square distribution*

Description

function to get the method of moment estimate(s) of chi-square distribution

Usage

```
chisq_est(data, plot = TRUE, curvecol = "red", ...)
```

Arguments

data	A numeric vector.
plot	logical which controls whether the histogram of the data along with the density curve of the theoretical chi square distribution with the estimated parameters.
curvecol	color of the theoretical density curve
...	additional plotting parameters

Value

the estimated degree of freedom by the method of moments of the data assuming the underlying distribution is chi square distribution

Examples

```
chisq_est(rchisq(1000,df=3))
```

exp_est — *Method of Moments Estimation of Exponential Distribution*

Description

function to get the method of moment estimate of exponential distribution

Usage

```
exp_est(data, plot = TRUE, curvecol = "red", ...)
```

Arguments

data	An object of numeric vector.
plot	logical which controls whether the histogram of the data along with the density curve of the theoretical exponential distribution with the estimated parameters.
curvecol	color of the theoretical density curve
...	additional plotting parameters

Value

the estimated positive rate parameter by the method of moments of the data assuming the underlying distribution is exponential distribution

Examples

```
exp_est(rexp(1000,rate=0.1))
```

---

gamma_est *Method of Moments Estimation of Gamma distribution*

Description

function to get the method of moment estimate(s) of gamma distribution

Usage

```
gamma_est(
  data,
  unknown = c("shape", "scale", "both"),
  shape = NULL,
  scale = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

`data`	A numeric vector.
`unknown`	A character string specifying which parameter is (are) unknown to the user.
`shape, scale`	positive shape and scale parameters of the gamma distribution.
`plot`	logical which controls whether the histogram of the data along with the density curve of the theoretical gamma distribution with the estimated parameters.
`curvecol`	color of the theoretical density curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is gamma distribution

Examples

```
gamma_est(rgamma(1000,shape=2,scale=1),unknown="scale",shape=2)#shape is known
gamma_est(rgamma(1000,shape=2,scale=1),unknown="shape",scale=1)#scale is known
gamma_est(rgamma(1000,shape=2,scale=1),unknown="both")#both will be estimated
```

geom_est — *Method of Moments Estimation of Negative Binomial distribution*

Description

function to get the method of moment estimate(s) of negative binomial distribution

Usage

```
geom_est(data, plot = TRUE, curvecol = "red", ...)
```

Arguments

`data`	A numeric vector.
`plot`	logical which controls whether the barplot of the data along with the probability curve of the theoretical negative binomial distribution with the estimated parameters.
`curvecol`	color of the theoretical probability curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is geometric distribution

Examples

```
geom_est(rgeom(1000,prob=0.2))
```

lnorm_est — *Method of Moments Estimation of Log-Normal distribution*

Description

function to get the method of moment estimate(s) of log-normal distribution

Usage

```
lnorm_est(
  data,
  unknown = c("meanlog", "sdlog", "both"),
  meanlog = NULL,
  sdlog = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

`data`	A numeric vector.
`unknown`	A character string specifying which parameter is (are) unknown to the user.
`meanlog, sdlog`	mean and standard deviation of the distribution on the log scale.
`plot`	logical which controls whether the histogram of the data along with the density curve of the theoretical log normal distribution with the estimated parameters.
`curvecol`	color of the theoretical density curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is log normal distribution

Examples

```
lnorm_est(rlnorm(1000),unknown="meanlog",sdlog=1)#meanlog unknown, but sdlog known
lnorm_est(rlnorm(1000),unknown="sdlog",meanlog=0)#sdlog unknown, but meanlog known
lnorm_est(rlnorm(1000),unknown="both")#both will be estimated
```

`logarithmic_est` *Method of Moments Estimation of Logarithmic distribution*

Description

function to get the method of moment estimate(s) of logarithmic distribution

Usage

```
logarithmic_est(data, plot = TRUE, curvecol = "red", ...)
```

Arguments

`data`	A numeric vector.
`plot`	logical which controls whether the barplot of the data along with the probability curve of the theoretical poisson distribution with the estimated parameters.
`curvecol`	color of the theoretical probability curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is logarithmic distribution

Examples

```
require(actuar)
logarithmic_est(rlogarithmic(1000,prob=0.6))
```

`nbinom_est` *Method of Moments Estimation of Negative Binomial distribution*

Description

function to get the method of moment estimate(s) of negative binomial distribution

Usage

```
nbinom_est(
  data,
  size.known = FALSE,
  size = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

`data`	A numeric vector.
`size.known`	logical indicating whether the size of the binomial distribution is known or not.
`size`	integer valued parameter of binomial distribution.
`plot`	logical which controls whether the barplot of the data along with the probability curve of the theoretical negative binomial distribution with the estimated parameters.
`curvecol`	color of the theoretical probability curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is negative binomial distribution

Examples

```
nbinom_est(rnbinom(1000,size=5,prob=0.2),size.known=TRUE,size=5)#no of successes known
nbinom_est(rnbinom(1000,size=10,prob=0.6))
```

`norm_est` *Method of Moments Estimation of Normal distribution*

Description

function to get the method of moment estimate(s) of normal distribution

Usage

```
norm_est(
  data,
  unknown = c("mean", "sd", "both"),
  mean = NULL,
  sd = NULL,
  plot = TRUE,
  curvecol = "red",
  ...
)
```

Arguments

`data`	A numeric vector.
`unknown`	A character string specifying which parameter is (are) unknown to the user.
`mean, sd`	mean and standard deviation of the distribution of the normal distribution, sd must be strictly positive.
`plot`	logical which controls whether the histogram of the data along with the density curve of the theoretical normal distribution with the estimated parameters.
`curvecol`	color of the theoretical density curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is normal distribution

Examples

```
norm_est(rnorm(1000),unknown="mean",sd=1)#mean unknown, but sd known
norm_est(rnorm(1000),unknown="sd",mean=0)#sd unknown, but mean known
norm_est(rnorm(1000),unknown="both")#both will be estimated
```

pois_est — *Method of Moments Estimation of Poisson distribution*

Description

function to get the method of moment estimate(s) of poisson distribution

Usage

```
pois_est(data, plot = TRUE, curvecol = "red", ...)
```

Arguments

`data`	A numeric vector.
`plot`	logical which controls whether the barplot of the data along with the probability curve of the theoretical poisson distribution with the estimated parameters.
`curvecol`	color of the theoretical probability curve
`...`	additional plotting parameters

Value

the estimated parameters by the method of moments of the data assuming the underlying distribution is poisson distribution

Examples

```
pois_est(data=rpois(1000,lambda=2),plot=TRUE)
pois_est(data=rpois(1000,lambda=0.2),plot=FALSE)#will not give the plot
```

sim_mp_test — *Most Powerful Test by Neyman-Pearson Lemma*

Description

It can be used to check whether a data comes from null distribution or from the alternative distribution

Usage

```
sim_mp_test(
  data,
 null.dist = c("uniform", "normal", "lognormal", "gamma", "cauchy", "pareto", "weibull",
    "rayleigh", "laplace", "beta", "binomial", "poisson", "negativebinomial",
    "geometric", "t", "f", "logarithmic"),
  null.par,
  alter.dist = c("uniform", "normal", "lognormal", "gamma", "cauchy", "pareto",
   "weibull", "rayleigh", "laplace", "beta", "binomial", "poisson", "negativebinomial",
    "geometric", "t", "f", "logarithmic"),
  alter.par,
  test.level = 0.95,
  sim.size = 1,
  power = TRUE
)
```

Arguments

`data`	A numeric vector
`null.dist`	The family of null distribution
`null.par`	The parameter values of the null distribution
`alter.dist`	The family of alternative distribution
`alter.par`	The parameter values of the alternative distribution
`test.level`	The level of significance of the test
`sim.size`	simulation size, increasing it will gives more accuracy.
`power`	A loogical vector, whether power of the test will be calculated.

Details

This function mainly test whether data comes from the null distribution or alternative distribution. It uses the theory of the Most Powerful (MP) test. It basically uses simulation to get the p value and make the decision. Increasing sim.size give more accuracy as well as test can be failed if you increase it heavily.

Value

A list of class `"momtest"` will be returned having the following components:

Method The Method's Name

Data The first 6 elements of input data

Null.Distrbution The family of null distribution

Null.Parameter The parameter values of the null distribution

Alternative.Distrbution The family of alternative distribution

Alternative.Parameter The parameter values of the alternative distribution

Sample.Size The sample size

Significance.level The level of the significance of the test

Decision The Test Result, wheter the null hypotheis is rejected or not

Power Power of the Test

Examples

```
sim_mp_test(rnorm(100),null.dist="normal",null.par=c(0,1),alter.dist="cauchy",alter.par=c(0,1))
sim_mp_test(rnorm(100),null.dist="nor",null.par=c(2,1),alter.dist="nor",alter.par=c(0,1))
```

---

sim_sam_int *Simulated confidence interval of a statistic*

Description

A function that returns a sampling interval for a statistic formed from random sample of certain probability distributions. The function generates the confidence interval using Monte Carlo simulations. The results might be unreliable if the resulting statistic has fat tailed distribution.

Usage

```
sim_sam_int(
  dist = c("normal", "lognormal", "gamma", "chisquare", "cauchy", "pareto", "weibull",
     "rayleigh", "laplace", "beta", "binomial", "poisson", "negativebinomial",
     "geometric", "t", "f", "uniform"),
  pop.par,
  FUN,
  side = c("lower", "upper", "both"),
  conf.coeff = 0.95,
  range = 1,
  n = 100,
  sim.size = 1000
)
```

Arguments

dist	The parent population distribution
pop.par	The value of the population parameters
FUN	The statistic as a function of random data
side	The type of the confidence interval (both sided, only lower bound or only upper bound)
conf.coeff	The confidence coefficient of the sampling interval
range	It controls the length of the interval in which the boundary points are searched for. One may increase the range in case the distribution of statistic is suspected to be fat tailed.
n	sample size
sim.size	simulation size, increasing it will gives more accuracy.

Details

The function asks the user to specify a distribution from which random sample is drawn and to specify a function of the random variables for which an approximate sampling Interval is to be provided. The function then uses Monte Carlo simulation technique to provide an approximate sampling interval of the statistic. This function might be useful when the sampling distribution for a particular statistic is unknown, but that statistic might be useful in drawing meaningful inference. Although this function is inferior to other sophisticated techniques to deal with this problem, it might come handy for a beginner.

Value

A list of class `"momint"` will be returned having the following components:

Method The Method's Name

Population.Distrbution The family of population distribution

Paramater The parameter values of the population distribution

Statistic The function of which the interval will be provided

Sample.Size The sample size

Confidence.Coefficient The confidence coefficient of the sampling interval

Sampling.Interval The estimated sampling interval

Examples

```
sim_sam_int(dist="normal",pop.par=c(0,1),FUN=mean,side="both")
sim_sam_int(dist="binomial",pop.par=c(5,0.5),FUN=sum,side="lower")
```

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