Package ‘abc.n’

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Title abc.n

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Depends R (>= 2.10)

Description tools for ABC based on n summary values

License GPL (>=2)

LazyLoad yes

Collate ’nabc_functions.R’’KLdiv_functions.R’

R topics documented:

`dMuTOST_lkl` *Compute the density of the (possible truncated) summary likelihood for population means of normal summary values*

Description

Compute the density of the (possible truncated) summary likelihood for population means of normal summary values

Usage

```
dMuTOST_lkl(rho, n.of.x, s.of.x, norm = 1,
  support = c(-Inf, Inf), log = FALSE)
```

Arguments

`rho`	vector of quantile
`norm`	normalization constant for the truncated summary likelihood (must be <=1).
`support`	vector of dimension 2. Support of the truncated summary likelihood.
`log`	logical; if `TRUE`, densities d are given as log(d).
`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values

Note

Given `norm`, the `support` is equal to `s.of.x/sqrt(n.of.x)*qt(c(1-norm,1+norm)/2,n.of.x-1)`

dMuTOST_pow

Compute the density of the (possible truncated) power of the equivalence test for population means of normal summary values

Description

Compute the density of the (possible truncated) power of the equivalence test for population means of normal summary values

Usage

```
dMuTOST_pow(rho, df, s.of.T, tau.u, alpha, norm = 1,
  support = c(-Inf, Inf), log = FALSE)
```

Arguments

`rho`	vector of quantile
`norm`	normalization constant for the truncated power function.
`support`	vector of dimension 2. Support of the truncated power function.
`log`	logical; if `TRUE`, densities d are given as log(d).
`tau.u`	upper tolerance of the equivalence region. If `calibrate.tau.u==TRUE`, it's just a guess on an upper bound on the upper tolerance of the equivalence region.
`alpha`	level of the equivalence test
`df`	degrees of freedom of the simulated summary values
`s.of.T`	standard deviation of the test statistic

Note

If `norm = x`, the summary likelihood is truncated such that HPD = x and then renormalized.

integrand_KL_divergence_1D

Integrand of the Kullback-Leibler divergence D(P||Q) for generic distributions

Description

Integrand of the Kullback-Leibler divergence D(P||Q) for generic distributions

Usage

```
integrand_KL_divergence_1D(x, dP, dQ, P_arg, Q_arg)
```

Arguments

`x`	value at which integrand is evaluated. Can be a vector.
`dP,dQ`	name of the functions that compute the density of P and Q
`P_arg,Q_arg`	list of arguments for `dP` and `dQ`

KL_divergence_chisqstretch

Compute Kullback-Leibler divergence between the summary likelihood and the power function of mutost after calibration of tau.u

Description

Compute Kullback-Leibler divergence between the summary likelihood and the power function of mutost after calibration of tau.u

Usage

```
KL_divergence_chisqstretch(n.of.x, s.of.x, n.of.y,
  s.of.y, mx.pw, calibrate.tau.u = F, tau.u, alpha,
  lkl_norm = 1, lkl_support = c(-Inf, Inf), for.mle = 0,
  debug = 0, plot = F)
```

Arguments

`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values
`n.of.y`	number of simulated summary values
`s.of.y`	standard deviation of simulated summary values
`mx.pw`	maximum power at the point of reference (rho.star=0) (only when `calibrate.tau.u==TRUE`).
`calibrate.tau.u`	if `TRUE` the upper tolerance of the equivalence region (`tau.u`) is calibrated so that power at the point of reference is equal to `mx.pw`
`tau.u`	upper tolerance of the equivalence region. If `calibrate.tau.u==TRUE`, it's just a guess on an upper bound on the upper tolerance of the equivalence region.
`alpha`	level of the equivalence test
`lkl_norm`	normalization constant for truncated summary likelihood. Default=1
`lkl_support`	support of truncated summary likelihood. Default=c(-Inf,Inf).
`debug`	flag if C implementation is used
`plot`	whether to plot the two distributions

Value

vector of length 3

`KL_div`	the Kullback Leibler divergence
`tau.u`	upper tolerance of the equivalence region
`pw.cmx`	actual maximum power associated with the equivalence region

Note

If `calibrate.tau.u==TRUE`

Examples

```
KL_divergence_mutost(n.of.x=60,s.of.x=0.1,n.of.y=60,s.of.y=0.3, mx.pw=0.9,
calibrate.tau.u=T, tau.u=1, alpha=0.01, lkl_normplot=T)
```

KL_divergence_mutost *Compute Kullback-Leibler divergence between the summary likelihood and the power function of mutost after calibration of tau.u*

Description

Compute Kullback-Leibler divergence between the summary likelihood and the power function of mutost after calibration of tau.u

Usage

```
KL_divergence_mutost(n.of.x, s.of.x, n.of.y, s.of.y,
  mx.pw, alpha, calibrate.tau.u = F, tau.u,
  pow_scale = 1.5, debug = 0, plot = F)
```

Arguments

`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values
`n.of.y`	number of simulated summary values
`s.of.y`	standard deviation of simulated summary values
`mx.pw`	maximum power at the point of reference (rho.star=0) (only when `calibrate.tau.u==TRUE`).
`alpha`	level of the equivalence test
`calibrate.tau.u`	if `TRUE` the upper tolerance of the equivalence region (`tau.u`) is calibrated so that power at the point of reference is equal to `mx.pw`
`tau.u`	upper tolerance of the equivalence region. If `calibrate.tau.u==TRUE`, it's just a guess on an upper bound on the upper tolerance of the equivalence region.
`pow_scale`	scale for the support of the standardized power. The power is truncated between `pow_scale*[-tau.u,tau.u]` and then standardized.
`debug`	flag if C implementation is used
`plot`	whether to plot the two distributions

Value

vector of length 3

`KL_div`	the Kullback Leibler divergence
`tau.u`	upper tolerance of the equivalence region
`pw.cmx`	actual maximum power associated with the equivalence region

Examples

```
KL_divergence_mutost(n.of.x=60,s.of.x=0.1,n.of.y=60,s.of.y=0.3, mx.pw=0.9,
alpha=0.01, calibrate.tau.u=T, tau.u=1, plot=T)
```

KL_divergence_mutost_optimize_n.of.y

A wrapper to minimize KL_divergence_mutost *over* n.of.y *using the function* optimize

Description

A wrapper to minimize KL_divergence_mutost over n.of.y using the function optimize

Usage

```
KL_divergence_mutost_optimize_n.of.y(n.of.y, n.of.x,
  s.of.x, s.of.y, mx.pw, alpha, calibrate.tau.u, tau.u,
  debug = 0, plot = F)
```

Arguments

n.of.y	number of simulated summary values
n.of.x	number of observed summary values
s.of.x	standard deviation of observed summary values
s.of.y	standard deviation of simulated summary values
mx.pw	maximum power at the point of reference (rho.star=0) (only when calibrate.tau.u==TRUE).
alpha	level of the equivalence test
calibrate.tau.u	if TRUE the upper tolerance of the equivalence region (tau.u) is calibrated so that power at the point of reference is equal to mx.pw
tau.u	upper tolerance of the equivalence region. If calibrate.tau.u==TRUE, it's just a guess on an upper bound on the upper tolerance of the equivalence region.
debug	flag if C implementation is used
plot	whether to plot the two distributions

KL_divergence_mutost_optimize_tau.u

A wrapper to minimize KL_divergence_mutost *over* tau.u *using the function* optimize

Description

A wrapper to minimize KL_divergence_mutost over tau.u using the function optimize

Usage

```
KL_divergence_mutost_optimize_tau.u(tau.u, n.of.x,
  s.of.x, n.of.y, s.of.y, mx.pw, alpha,
  calibrate.tau.u = F, debug = 0, plot = F)
```

Arguments

`tau.u`	upper tolerance of the equivalence region. If `calibrate.tau.u==TRUE`, it's just a guess on an upper bound on the upper tolerance of the equivalence region.
`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values
`n.of.y`	number of simulated summary values
`s.of.y`	standard deviation of simulated summary values
`mx.pw`	maximum power at the point of reference (rho.star=0) (only when `calibrate.tau.u==TRUE`).
`alpha`	level of the equivalence test
`calibrate.tau.u`	if `TRUE` the upper tolerance of the equivalence region (`tau.u`) is calibrated so that power at the point of reference is equal to `mx.pw`
`debug`	flag if C implementation is used
`plot`	whether to plot the two distributions

`nabc.acf.equivalence` *Perform the asymptotic equivalence test for autocorrelations at lag 1*

Description

Perform the asymptotic equivalence test for autocorrelations at lag 1

Usage

```
nabc.acf.equivalence(sim, obs, args = NA,
  verbose = FALSE, alpha = 0, leave.out = 0,
  normal.test = "sf.test")
```

Arguments

`sim`	simulated summary values
`obs`	observed summary values
`args`	argument that contains the equivalence region and the level of the test (see Examples). This is the preferred method for specifying arguments and overwrites the dummy default values
`verbose`	flag if detailed information on the computations should be printed to standard out
`alpha`	level of the equivalence test
`leave.out`	thinning, how many values in the pair sequence (x_i,x_i-1) should be left out. Defaults to zero.
`normal.test`	name of function with which normality of the summary values is tested

Value

vector containing

error	test statistic. Here, instead of T we return the p-value of the TOST.
cil	lower ABC tolerance. Here, instead of c^- we return 0.
cir	upper ABC tolerance. Here, instead of c^+ we return 'alpha'.
al	free entry. Here set to c^-.
ar	free entry. Here set to c^+.
mx.pw	Maximum power at the point of equality
rho.mc	sample estimate of 'rho'

Examples

```
leave.out<- 2
tau.u<- 0.09
alpha<- 0.01
n<- 5e3
sigma<- 1
a<- 0.1
args<- paste("acfequiv",leave.out,tau.u,alpha,sep='/')
x<-rnorm(n+1,0,sigma)
x<- x[-1] + x[-(n+1)]*a
y<-rnorm(n+1,0,sigma)
y<- y[-1] + y[-(n+1)]*a
nabc.acf.equivalence(y,x,args)
```

---

nabc.acf.equivalence.abctol

Compute the ABC tolerances of the asymptotic equivalence test for autocorrelations at lag 1

Description

Compute the ABC tolerances of the asymptotic equivalence test for autocorrelations at lag 1

Usage

```
nabc.acf.equivalence.abctol(tau.l, tau.u, n, alpha)
```

Arguments

tau.l	lower tolerance of the equivalence region
tau.u	upper tolerance of the equivalence region
n	number of pairs (x_i,x_i-1) after thinning of the time series x_1, x_2, ...
alpha	level of the equivalence test

Value

vector of length 2, first entry is lower ABC tolerance, second entry is upper ABC tolerance

Examples

```
tau.u<- 0.09
tau.l<- -tau.u
sim.n<-5e3
leave.out<- 2
nabc.acf.equivalence.abctol(tau.l, tau.u, floor(sim.n / (1+leave.out)), 0.01)
```

`nabc.acf.equivalence.cor` *Compute the autocorrelation in a time series along with some other info*

Description

Compute the autocorrelation in a time series along with some other info

Usage

```
nabc.acf.equivalence.cor(x, leave.out = 0)
```

Arguments

x	time series (simply vector)
leave.out	thinning, how many values in the pair sequence (x_i,x_i-1) should be left out. Defaults to zero.

Value

cor	autocorrelation in the thinned sequence
z	Z-transformation of the autocorrelation (this is atanh of "cor")
n	Number of pairs (x_i,x_i-1) after thinning

Examples

```
nabc.acf.equivalence.cor(rnorm(100,0,1), leave.out=2)
```

`nabc.acf.equivalence.pow` *Compute power of the asymptotic equivalence test for autocorrelations at lag 1*

Description

Compute power of the asymptotic equivalence test for autocorrelations at lag 1

Usage

```
nabc.acf.equivalence.pow(rho, tau.u, alpha, s)
```

Arguments

`rho`	true difference in simulated and observed autocorrelation at lag 1
`tau.u`	upper tolerance of the equivalence region
`alpha`	level of the equivalence test
`s`	standard deviation of the test statistic

Value

power of the asymptotic test. this is approximate because the test is asymptotic

Examples

```
tau.u<- 0.09
tau.l<- -tau.u
sim.n<-5e3
rho<- seq(tau.l,tau.u,0.001)
pw<- nabc.acf.equivalence.pow(rho, tau.u, alpha, 1/sqrt(floor(sim.n/3)-3))
```

`nabc.acf.equivalence.tau.lowup`

Calibrate the equivalence region of the asymptotic equivalence test for autocorrelations at lag 1 for given maximum power

---

Description

Calibrate the equivalence region of the asymptotic equivalence test for autocorrelations at lag 1 for given maximum power

Usage

```
nabc.acf.equivalence.tau.lowup(mx.pw, tau.up.ub, n,
  alpha, rho.star = 0, tol = 1e-05, max.it = 100)
```

Arguments

`mx.pw`	maximum power at the point of reference (rho.star).
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`n`	number of pairs (x_i,x_i-1) after thinning of the time series x_1, x_2, ...
`alpha`	level of the equivalence test
`rho.star`	point of reference. Defaults to the point of equality rho.star=0.
`tol`	this algorithm stops when the actual maximum power is less than 'tol' from 'mx.pw'
`max.it`	this algorithm stops prematurely when the number of iterations to find the equivalence region exceeds 'max.it'

Value

vector of length 4

1	lower tolerance of the equivalence region
2	upper tolerance of the equivalence region
3	actual maximum power associated with the equivalence region
4	error ie abs(actual power - mx.pw)

Examples

```
tau.u<- 0.09
tau.l<- -tau.u
sim.n<-5e3
leave.out<- 2
nabc.acf.equivalence.tau.lowup(0.9, 2, floor(sim.n / (1+leave.out)), 0.01)
```

---

nabc.chisqstretch — *Perform the exact test for dispersion equivalence when the summary values are normally distributed*

Description

Perform the exact test for dispersion equivalence when the summary values are normally distributed

Usage

```
nabc.chisqstretch(sim, obs.mc, args = NA,
  verbose = FALSE, tau.l = 1, tau.u = 1, guess.tau.l = 0,
  alpha = 0, normal.test = "sf.test", for.mle = 0)
```

Arguments

sim	simulated summary values
obs.mc	variance of the observed summary values
args	argument that contains the equivalence region and the level of the test (see Examples). This is the preferred method for specifying arguments and overwrites the dummy default values
verbose	flag if detailed information on the computations should be printed to standard out
tau.l	lower tolerance of the equivalence region
tau.u	upper tolerance of the equivalence region
guess.tau.l	guess on the lower tolerance of the equivalence region. Used when the tolerances are annealed and calibration is numerically unstable.
alpha	level of the equivalence test
leave.out	thinning, how many values in the pair sequence (x_i,x_i-1) should be left out. Defaults to zero.
normal.test	name of function with which normality of the summary values is tested
for.mle	calibrate so that the mode of the power is at the MLE

Value

vector containing

`error`	test statistic, here var(sim)/obs.mc
`cil`	lower ABC tolerance c^-
`cir`	upper ABC tolerance c^+
`mx.pw`	Maximum power at the point of equality
`rho.mc`	log(var(sim) / obs.mc)

Examples

```
alpha<- 0.01; xn<- yn<- 60; xsigma2<- 1; tau.u<- 2.2
tau.l<- nabc.chisqstretch.tau.low(tau.u, yn-1, alpha)
args<- paste("chisqstretch",tau.l,tau.u,alpha,sep='/')
x<- rnorm(xn,0,sd=sqrt(xsigma2))
y<- rnorm(yn,0,sd=sqrt(xsigma2))
nabc.chisqstretch(y, var(x), args=args, verbose= 0)
```

---

nabc.chisqstretch.n.of.y

Calibrate the number of simulated summary values and the equivalence region for the test of dispersion equivalence

---

Description

Calibrate the number of simulated summary values and the equivalence region for the test of dispersion equivalence

Usage

```
nabc.chisqstretch.n.of.y(n.of.x, s.of.Sx, mx.pw, alpha,
  tau.u.ub = 2, tol = 1e-05, max.it = 100, for.mle = 0)
```

Arguments

`n.of.x`	number of observed summary values
`s.of.Sx`	standard deviation in the observed summary likelihood
`mx.pw`	maximum power at the point of reference (rho.star).
`alpha`	level of the equivalence test
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`tol`	this algorithm stops when the actual variation in the ABC approximation to the summary likelihood is less than 'tol' from 's.of.Sx*s.of.Sx'
`max.it`	this algorithm stops prematurely when the number of iterations to calibrate the number of simulated data points exceeds 'max.it'
`for.mle`	calibrate so that the mode of the power is at the MLE

Value

vector of length 8

1	number of simulated summary values
2	lower tolerance of the equivalence region
3	upper tolerance of the equivalence region
4	lower ABC tolerance c^-
5	upper ABC tolerance c^+
6	actual variation of the power
7	actual maximum power associated with the equivalence region
8	error ie abs(actual variation - variation in the observed summary likelihood)

Examples

```
xn<- 60; alpha <- 0.01; prior.u <- 3; prior.l <- 1/3; tau.u<- 2.5; xsig2 <- 1
#summary likelihood of sigma2 given sample mean and sum of squares
th <- seq(prior.l,prior.u,length.out=1e3)
shape <- (xn-2)/2
scale <- xsig2*xn*xn/(xn-1)/2
y <- densigamma(th, shape, scale)
var.Sx <- scale*scale/((shape-1)*(shape-1)*(shape-2))
#abc approximation to summary likelihood
nabc.chisqstretch.n.of.y(xn, sqrt(var.Sx), 0.9, alpha, tau.u.ub=tau.u)
yn <- tmp[1]
tau.l <- tmp[2]
tau.u <- tmp[3]
c.l <- tmp[4]
c.u <- tmp[5]
y2 <- nabc.chisqstretch.pow(th, yn-1, yn-1, c.l, c.u)
#plot the summary likelihood and the abc approximation
plot(th,y/mean(y),ylim=range(c(y/mean(y),y2/mean(y2))),type='l')
lines(th,y2/mean(y2),col="blue")
```

---

nabc.chisqstretch.n.of.y.KL

Calibrate the number of simulated summary values and the equivalence region for the test of dispersion equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Description

Calibrate the number of simulated summary values and the equivalence region for the test of dispersion equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Usage

```
nabc.chisqstretch.n.of.y.KL(n.of.x, s.of.x, n.of.y,
  s.of.y, mx.pw, alpha, tau.u.ub = 2, for.mle = 0,
  max.it = 100, debug = 0, plot = F)
```

Arguments

`plot`	if `TRUE`, the summary likelihood and abc approximation are plotted
`max.it`	this algorithm stops prematurely when the number of iterations to calibrate the number of simulated data points exceeds 'max.it'
`debug`	Flag if C implementation is used.
`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values
`n.of.y`	number of simulated summary values
`s.of.y`	standard deviation of simulated summary values
`mx.pw`	maximum power at the point of reference (rho.star=0) (only when `calibrate.tau.u==TRUE`).
`alpha`	level of the equivalence test

Value

vector of length 4

`n.of.y`	number of simulated summary values
`KL_div`	the Kullback Leibler divergence
`tau.u`	upper tolerance of the equivalence region
`pw.cmx`	actual maximum power associated with the equivalence region

---

`nabc.chisqstretch.pow` *Compute power of the exact equivalence test for dispersion*

Description

Compute power of the exact equivalence test for dispersion

Usage

```
nabc.chisqstretch.pow(rho, scale, df, cl, cu)
```

Arguments

`rho`	true ratio in simulated variance / observed variance
`scale`	scaling of T apart from rho, either n-1 for unbiased ABC or n for exact MAP
`df`	degrees of freedom
`cl`	lower ABC tolerance
`cu`	upper ABC tolerance

Value

power of the exact test. this is exact.

Examples

```
alpha<- 0.01
tau.up<- 1.09
yn<- 5e3
tau.low<- nabc.chisqstretch.tau.low(tau.up, yn-1, alpha)
rej<- .Call("abcScaledChiSq",c(yn-1,yn-1,tau.low,tau.up,alpha,1e-10,100,0.05) )
rho<- seq(tau.low,tau.up,by=0.001)
nabc.chisqstretch.pow(rho,yn-1,yn-1,rej[1],rej[2])
```

`nabc.chisqstretch.tau.low` *Calibrate the lower tolerance interval of the equivalence region for the test of dispersion equivalence*

Description

Calibrate the lower tolerance interval of the equivalence region for the test of dispersion equivalence

Usage

```
nabc.chisqstretch.tau.low(tau.up, df, alpha,
  rho.star = 1, tol = 1e-05, max.it = 100, for.mle = 0)
```

Arguments

`tau.up`	upper tolerance of the equivalence region
`df`	degrees of freedom
`alpha`	level of the equivalence test
`rho.star`	point of reference. Defaults to the point of equality rho.star=1
`tol`	this algorithm stops when the actual point of reference is less than 'tol' from 'rho.star'
`max.it`	this algorithm stops prematurely when the number of iterations to find the equivalence region exceeds 'max.it'
`for.mle`	calibrate so that the mode of the power is at the MLE

Value

tau.low, lower tolerance of the equivalence region

Examples

```
tau.u<- 2.2
 yn<- 60
tau.l<- nabc.chisqstretch.tau.low(tau.u, yn-1, 0.01)
```

nabc.chisqstretch.tau.lowup

Calibrate the equivalence region for the test of dispersion equivalence for given maximum power

Description

Calibrate the equivalence region for the test of dispersion equivalence for given maximum power

Usage

```
nabc.chisqstretch.tau.lowup(mx.pw, tau.up.ub, df, alpha,
  rho.star = 1, tol = 1e-05, max.it = 100, for.mle = 0)
```

Arguments

`mx.pw`	maximum power at the point of reference (rho.star).
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`df`	degrees of freedom
`alpha`	level of the equivalence test
`rho.star`	point of reference. Defaults to the point of equality rho.star=1.
`tol`	this algorithm stops when the actual maximum power is less than 'tol' from 'mx.pw'
`max.it`	this algorithm stops prematurely when the number of iterations to find the equivalence region exceeds 'max.it'
`for.mle`	calibrate so that the mode of the power is at the MLE

Value

vector of length 6

1	lower tolerance of the equivalence region
2	upper tolerance of the equivalence region
3	actual maximum power associated with the equivalence region
4	error ie abs(actual power - mx.pw)
5	lower point of critical region
6	upper point of critical region

Examples

```
yn<- 60
nabc.chisqstretch.tau.lowup(0.9, 2.5, yn-1, 0.01)
```

NABC.DEFAULT.ANS *this file contains all R functions of the abc-n package*

Description

this file contains all R functions of the abc-n package

Usage

```
NABC.DEFAULT.ANS
```

Format

Named num [1:17] 0 50 1 NA NA NA 0 0 0 0 ... - attr(*, "names")= chr [1:17] "lkl" "error" "pval" "link.mc.obs" ...

---

nabc.exprho.at.theta *Estimate summary parameter errors rho from unbiased Monte Carlo estimates rho.mc for all proposed theta including rejections*

Description

Estimate summary parameter errors rho from unbiased Monte Carlo estimates rho.mc for all proposed theta including rejections

Usage

```
nabc.exprho.at.theta(df, theta.names, rho.names,
  thin = 1)
```

Arguments

df	data frame with all proposed theta and corresponding rho.mc for each summary of interest
theta.names	vector of theta names (columns in df)
rho.names	vector of rho names (columns in df)
thin	thinning factor in case there are many rows in df

Value

matrix containing the estimated rho (per column). The ith row corresponds to the ith theta in df.

`nabc.generic.tost` *Perform a generic two one sided test. This is an internal function.*

Description

Perform a generic two one sided test. This is an internal function.

Usage

```
nabc.generic.tost(tost.args, tau.l, tau.u, alpha,
  tost.distr = "t")
```

Arguments

`tost.args`	vector of arguments for generic TOST
`tau.l`	lower tolerance of equivalence region
`tau.u`	upper tolerance of equivalence region
`alpha`	level of equivalence test
`tost.distr`	name of distribution of tost

Value

vector of length 7

`nabc.get.pfam.pval` *Test if summary values are normally distributed*

Description

Test if summary values are normally distributed

Usage

```
nabc.get.pfam.pval(x, normal.test)
```

Arguments

`x`	summary values
`norma.test`	name of function with which normality of the summary values is tested

Value

p value of the test

Examples

```
nabc.get.pfam.pval(rnorm(1e4),"shapiro.test")
```

`nabc.mutost.onesample` *Perform the exact TOST for location equivalence when the summary values are normally distributed*

Description

Perform the exact TOST for location equivalence when the summary values are normally distributed

Usage

```
nabc.mutost.onesample(sim, obs, obs.n = NA, obs.sd = NA,
  args = NA, verbose = FALSE, tau.u = 0, tau.l = -tau.u,
  alpha = 0, mx.pw = 0.9, annealing = 1,
  normal.test = "sf.test", plot = 0, legend.txt = "")
```

Arguments

`sim`	simulated summary values
`obs`	observed summary values
`args`	argument that contains the equivalence region and the level of the test (see Examples). This is the preferred method for specifying arguments and overwrites the dummy default values
`verbose`	flag if detailed information on the computations should be printed to standard out
`s.of.x`	standard deviation of the observed summary values
`tau.u`	upper tolerance of the equivalence region
`tau.l`	lower tolerance of the equivalence region
`alpha`	level of the equivalence test
`mx.pw`	maximum power at the point of equality
`annealing`	inflation factor of tolerances of the equivalence region
`normal.test`	name of function with which normality of the summary values is tested

Value

vector containing

`error`	test statistic, here p-value of TOST
`cil`	lower ABC tolerance, here 0
`cir`	upper ABC tolerance, here alpha
`mx.pw`	Maximum power at the point of equality
`rho.mc`	mean(sim) - obs.mean

Examples

```
tau.u<- 0.5; tau.l<- -tau.u; alpha<- 0.01; xn<- yn<- 60; xmu<- ymu<- 0.5; xsigma2<- ysigma2<- 2
args<- paste("mutost",1,tau.u,alpha,sep='/')
x<- rnorm(xn,xmu,sd=sqrt(xsigma2))
y<- rnorm(yn,ymu,sd=sqrt(ysigma2))
nabc.mutost.onesample(y, x, args= args, verbose= 0)
```

nabc.mutost.onesample.n.of.y

Calibrate the number of simulated summary values and the equivalence region for the test of location equivalence

Description

Calibrate the number of simulated summary values and the equivalence region for the test of location equivalence

Usage

```
nabc.mutost.onesample.n.of.y(n.of.x, s.of.Sx, mx.pw,
  s.of.y, alpha, tau.u.ub = 2, tol = 1e-05, max.it = 100,
  debug = 0)
```

Arguments

`n.of.x`	number of observed summary values
`s.of.Sx`	standard deviation in the observed summary likelihood
`mx.pw`	maximum power at the point of reference (rho.star).
`s.of.y`	standard deviation in the simulated summary values
`alpha`	level of the equivalence test
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`tol`	this algorithm stops when the actual variation in the ABC approximation to the summary likelihood is less than 'tol' from 's.of.Sx*s.of.Sx'
`max.it`	this algorithm stops prematurely when the number of iterations to calibrate the number of simulated data points exceeds 'max.it'
`debug`	Flag if C implementation is used.

Value

vector of length 6

1	number of simulated summary values
2	lower tolerance of the equivalence region
3	upper tolerance of the equivalence region
4	actual variation of the power
5	actual maximum power associated with the equivalence region
6	error ie abs(actual variation - variation in the observed summary likelihood)

Examples

```
prior.u<- 2; prior.l<- -prior.u; tau.u<- 0.75; xn<- yn<- 60; xmu<- 0.5; xsigma2<- ysigma2<- 2; alpha<- 0.01
rho<- seq(prior.l,prior.u,length.out=1e3)
#summary likelihood
y<-dnorm(rho,0,sqrt(xsigma2/xn))
y<- y / diff(pnorm(c(prior.l,prior.u),0,sqrt(xsigma2/xn)))
#abc approximation to summary likelihood based on equivalence test
tmp <- nabc.mutost.onesample.n.of.y(xn, sqrt(xsigma2/xn), 0.9, sqrt(ysigma2), alpha, tau.u.ub=2*tau.u )
yn <- tmp[1]
tau.u <- tmp[3]
y2<- nabc.mutost.pow(rho, yn-1, tau.u, sqrt(ysigma2/yn), alpha)
rho2<- rho[which(y2!=0)]
y2<- y2[which(y2!=0)]
y2<- y2/sum(diff(rho2)*y2[-1])
#plot summary likelihood and abc approximation thereof
plot(1,1,type='n',xlim=range(rho),ylim=range(c(y,y2)),xlab=expression(rho))
lines(rho,y,col="red")
lines(rho2,y2,col="blue")
abline(v=0,col="red")
```

---

nabc.mutost.onesample.n.of.y.KL

Calibrate the number of simulated summary values and the equivalence region for the test of location equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Description

Calibrate the number of simulated summary values and the equivalence region for the test of location equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Usage

```
nabc.mutost.onesample.n.of.y.KL(n.of.x, s.of.x, n.of.y,
  s.of.y, mx.pw, alpha, tau.u.ub = 2, max.it = 100,
  debug = 0, plot = F)
```

Arguments

`plot`	if `TRUE`, the summary likelihood and abc approximation are plotted
`max.it`	this algorithm stops prematurely when the number of iterations to calibrate the number of simulated data points exceeds 'max.it'
`debug`	Flag if C implementation is used.
`n.of.x`	number of observed summary values
`s.of.x`	standard deviation of observed summary values
`n.of.y`	number of simulated summary values
`s.of.y`	standard deviation of simulated summary values
`mx.pw`	maximum power at the point of reference (rho.star=0) (only when `calibrate.tau.u==TRUE`).
`alpha`	level of the equivalence test

Value

vector of length 4

n.of.y	number of simulated summary values
KL_div	the Kullback Leibler divergence
tau.u	upper tolerance of the equivalence region
pw.cmx	actual maximum power associated with the equivalence region

Examples

```
xn <- 60
yn <- xn
xmean <- 2
xsigma <- 2
ymean <- 2
ysigma <- 3

obs <- rnorm(xn, xmean, xsigma)
obs <- (obs - mean(obs))/sd(obs) * xsigma + xmean
sim <- rnorm(yn, ymean, ysigma)

n.of.x <- xn
s.of.x <- sd(obs)
n.of.y <- yn
s.of.y <- sd(sim)
mx.pw <- 0.9
alpha <- 0.01
tau.u.ub <- 2

#compute the Kullback-Leibler divergence between the summary likelihood and the power; and plot.
KL_divergence_mutost(n.of.x, s.of.x, n.of.y, s.of.y, mx.pw, alpha, calibrate.tau.u = T, tau.u = tau.u.ub,
plot = T)

#adjust n.of.y to minimize the Kullback-Leibler divergence, and plot result.
nabc.mutost.onesample.n.of.y.KL(n.of.x, s.of.x, n.of.y, s.of.y, mx.pw, alpha, plot = T)
```

---

nabc.mutost.onesample.tau.lowup.KL

Calibrate the equivalence region for the test of location equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Description

Calibrate the equivalence region for the test of location equivalence by minimising the Kullback-Leibler divergence between the power function and the summary likelihood.

Usage

```
nabc.mutost.onesample.tau.lowup.KL(n.of.x, s.of.x,
  n.of.y, s.of.y, mx.pw, alpha, tau.u.lb = 0,
  max.it = 100, debug = 0, plot = F)
```

Arguments

plot	if TRUE, the summary likelihood and abc approximation are plotted
max.it	this algorithm stops prematurely when the number of iterations to calibrate the number of simulated data points exceeds 'max.it'
debug	Flag if C implementation is used.
n.of.x	number of observed summary values
s.of.x	standard deviation of observed summary values
n.of.y	number of simulated summary values
s.of.y	standard deviation of simulated summary values
mx.pw	maximum power at the point of reference (rho.star=0) (only when calibrate.tau.u==TRUE).
alpha	level of the equivalence test

Value

vector of length 4

n.of.y	number of simulated summary values
KL_div	the Kullback Leibler divergence
tau.u	upper tolerance of the equivalence region
pw.cmx	actual maximum power associated with the equivalence region

Examples

```
prior.u<- 2; prior.l<- -prior.u; tau.u<- 0.75; xn<- yn<- 60; xmu<- 0.5;
xsigma2<- ysigma2<- 2; alpha<- 0.01
rho<- seq(prior.l,prior.u,length.out=1e3)
#summary likelihood
y<-dnorm(rho,0,sqrt(xsigma2/xn))
y<- y / diff(pnorm(c(prior.l,prior.u),0,sqrt(xsigma2/xn)))
#abc approximation to summary likelihood based on equivalence test
tmp <- nabc.mutost.onesample.n.of.y.KL(xn, sqrt(xsigma2/xn), yn,
sqrt(ysigma2),0.9, alpha, tau.u.ub=2*tau.u,plot=T)
yn <- tmp["n.of.y"]
tau.u <- tmp["tau.u"]
y2<- nabc.mutost.pow(rho, yn-1, tau.u, sqrt(ysigma2/yn), alpha)
rho2<- rho[which(y2!=0)]
y2<- y2[which(y2!=0)]
y2<- y2/sum(diff(rho2)*y2[-1])
#plot summary likelihood and abc approximation thereof
plot(1,1,type='n',xlim=range(rho),ylim=range(c(y,y2)),xlab=expression(rho))
lines(rho,y,col="red")
lines(rho2,y2,col="blue")
abline(v=0,col="red")
```

`nabc.mutost.onesample.tau.lowup.pw`
Calibrate the equivalence region for the test of location equivalence for given maximum power

---

Description

Calibrate the equivalence region for the test of location equivalence for given maximum power

Usage

```
nabc.mutost.onesample.tau.lowup.pw(mx.pw, df, s.of.T,
  tau.up.ub, alpha, rho.star = 0, tol = 1e-05,
  max.it = 100, debug = 0)
```

Arguments

`mx.pw`	maximum power at the point of reference (rho.star).
`df`	degrees of freedom
`s.of.T`	standard deviation of the test statistic
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`alpha`	level of the equivalence test
`rho.star`	point of reference. Defaults to the point of equality rho.star=0.
`tol`	this algorithm stops when the actual maximum power is less than 'tol' from 'mx.pw'
`max.it`	this algorithm stops prematurely when the number of iterations to find the equivalence region exceeds 'max.it'
`debug`	Flag if C implementation is used.

Value

vector of length 4

1	lower tolerance of the equivalence region
2	upper tolerance of the equivalence region
3	actual maximum power associated with the equivalence region
4	error ie abs(actual power - mx.pw)

Examples

```
yn<- 60; ysigma2<- 1; alpha<- 0.01
nabc.mutost.onesample.tau.lowup.pw(0.9, yn-1, sqrt(ysigma2/yn), 2, alpha )
```

nabc.mutost.onesample.tau.lowup.var

Calibrate the equivalence region for the test of location equivalence for given variance of the summary likelihood

Description

Calibrate the equivalence region for the test of location equivalence for given variance of the summary likelihood

Usage

```
nabc.mutost.onesample.tau.lowup.var(s.of.Sx, df, s.of.T,
  tau.up.ub, alpha, rho.star = 0, tol = 1e-05,
  max.it = 100, debug = 0)
```

Arguments

`s.of.Sx`	standard deviation of the summary likelihood
`df`	degrees of freedom
`s.of.T`	standard deviation of the test statistic
`tau.up.ub`	guess on an upper bound on the upper tolerance of the equivalence region
`alpha`	level of the equivalence test
`rho.star`	point of reference. Defaults to the point of equality rho.star=0.
`tol`	this algorithm stops when the actual maximum power is less than 'tol' from 'mx.pw'
`max.it`	this algorithm stops prematurely when the number of iterations to find the equivalence region exceeds 'max.it'
`debug`	Flag if C implementation is used.

Value

vector of length 4

1	lower tolerance of the equivalence region
2	upper tolerance of the equivalence region
3	actual variance associated with the power
4	error ie abs(actual var(power) - var(summary likelihood))

Examples

```
yn<- 60; ysigma2<- 1; alpha<- 0.01
nabc.mutost.onesample.tau.lowup.var(0.002, yn-1, sqrt(ysigma2/yn), 2, alpha )
```

`nabc.mutost.pow` *Compute power of the equivalence test for population means of normal summary values*

Description

Compute power of the equivalence test for population means of normal summary values

Usage

```
nabc.mutost.pow(rho, df, tau.u, s.of.T, alpha,
  rtn.fun = FALSE, force = FALSE)
```

Arguments

`rho`	true difference in simulated and observed population means
`df`	degrees of freedom of the simulated summary values
`tau.u`	upper tolerance of the equivalence region
`s.of.T`	standard deviation of the test statistic
`alpha`	level of the equivalence test
`rtn.fun`	indicator if a function to compute the power should be returned. Defaults to 0.
`force`	if TRUE, enforce power computation outside of acceptance region

Value

approximate power of the exact test. this is approximate because the standard deviation of the normal model for the simulated summary values is not known.

Examples

```
prior.u<- 5; prior.l<- -prior.u; tau.u <- 0.75; yn<- 60; ysigma2<- 1; alpha<- 0.01
rho <- seq(prior.l,prior.u,length.out=1e3)
nabc.mutost.pow(rho, yn-1, tau.u, sqrt(ysigma2/yn), alpha)
```

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