Package 'gb'

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Title Generalize Lambda Distribution and Generalized Bootstrapping

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Depends R (>= 2.5.0), boot, KernSmooth

Description A collection of algorithms and functions
for fitting data to a generalized lambda distribution
via moment matching methods, and generalized
bootstrapping.

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R topics documented:

ARL1 *Compute Average Run Length*

Description

Compute average run length for control chart.

Usage

```
ARL1(x,K,pm1,pI1)
ARL0(x,ARL0=370,gridsize=20)
```

Arguments

x	An R object generate using kde function from package ks.
K	a vector of the levels
ARL0	in-control average run length
pm1,pI1	out-of-control parameters for the control chart.
gridsize	Gridsize of countour levels to search for ARL.

Author(s)

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References

Yang, S.F. and Wang, B. "Using A Kernel Control Region to Monitor Both the Process Location and Dispersion".

degld *Basic functions for RS-GLD*

Description

To compute the density, distribution, quantile, and to generate random sample for RS-GLD.

Usage

```
## Default S3 method:
degld(x,lambda)
pegld(x,lambda)
qegld(p,lambda)
regld(n,lambda)
```

Arguments

x	a numeric value or a vector.
p	a probability or a vector of probabilities.
n	sample size.
lambda	a vector of four parameters for RS-GLD.

Author(s)

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References

Karian, Z.A., Dudewicz, E.J., McDonald, P., 1996. The Extended Generalized Lambda Distribution System for Fitting Distributions to Data: history,completion of theory, tables, applications, the "final word" on moment fits, *Comm. in Statist.- Simul. \& Comput.* **25**(3), 611-642.

Karian, Z.A., Dudewicz, E.J., 2000. *Fitting Statistical Distributions: The Generalized Lambda Distribution and Generalized Bootstrap Methods*, Chapman and Hall/CRC.

See Also

fit.egld, qrsgld,prsgld, rrsgld,drsgld.

Examples

```
lambdas = c(2,4,3,4)
shape=3;scale=4
x0 = rbeta(5,shape,scale)
x1 = x0*lambdas[2]+lambdas[1]
qegld(c(0,.1,.5,.7,1),lambdas)
qbeta(c(0,.1,.5,.7,1),shape,scale)*lambdas[2]+lambdas[1]

pegld(x1,lambdas)
pbeta(x0,shape,scale)

degld(x1,lambdas)
dbeta(x0,shape,scale)/lambdas[2]

x0 = sort(rbeta(1000,shape,scale))
y = x0*lambdas[2]+lambdas[1]
plot(dbeta(x0,shape,scale)/lambdas[2]~y,type='l')
lines(degld(y,lambdas)~y,lty=2,col=2)
lines(density(y),col=4,lty=3)
```

drsgld *Basic functions for RS-GLD*

Description

To compute the density, distribution, quantile, and to generate random sample for RS-GLD.

Usage

```
## Default S3 method:
drsgld(x,lambda)
prsgld(x,lambda)
qrsgld(p,lambda)
rrsgld(n,lambda)
```

Arguments

x	a numeric value or a vector.
p	a probability or a vector of probabilities.
n	sample size.
lambda	a vector of four parameters for RS-GLD.

Author(s)

B. Wang <bwang@jaguar1.usouthal.edu>

References

Karian, Z.A., Dudewicz, E.J., McDonald, P., 1996. The Extended Generalized Lambda Distribution System for Fitting Distributions to Data: history,completion of theory, tables, applications, the "final word" on moment fits, *Comm. in Statist.- Simul. \& Comput.* **25**(3), 611-642.

Karian, Z.A., Dudewicz, E.J., 2000. *Fitting Statistical Distributions: The Generalized Lambda Distribution and Generalized Bootstrap Methods*, Chapman and Hall/CRC.

See Also

fit.gld, qegld,pegld, regld,degld.

Examples

```
lambdas = c(0, 0.1975, 0.1349,0.1349)
qrsgld(c(0,.1,.5,.7,1),lambdas)
prsgld(c(-10,0,1,3,20),lambdas)
drsgld(c(-10,0,1,3,20),lambdas)
x = sort(rrsgld(100,lambdas))
plot(dnorm(x)~x,type='l')
```

```
lines(drsgld(x,lambdas)~x,lty=2,col=2)
lines(density(x),col=4,lty=3)
```

`fit.egld` *Fit Extended Generalized Lambda Distribution (EGLD/GBD)*

Description

To fit a EGLD or generalize beta distribution with the maximum likelihood methods.

Usage

```
fit.egld(x,xmin=NULL,xmax=NULL)
```

Arguments

`x`	A sample. 'NA' values will be automatically removed.
`xmin`	The lower limit of the underlying distribution. Default: NULL.
`xmax`	The upper limit of the underlying distribution. Default: NULL.

Author(s)

B. Wang <bwang@jaguar1.usouthal.edu>

References

Karian, Z.A., Dudewicz, E.J., McDonald, P., 1996. The Extended Generalized Lambda Distribution System for Fitting Distributions to Data: history,completion of theory, tables, applications, the "final word" on moment fits, *Comm. in Statist.- Simul. \& Comput.* **25**(3), 611-642.

Karian, Z.A., Dudewicz, E.J., 2000. *Fitting Statistical Distributions: The Generalized Lambda Distribution and Generalized Bootstrap Methods*, Chapman and Hall/CRC.

See Also

`fit.gld`, `qrsgld`,`prsgld`, `rrsgld`,`drsgld`.

Examples

```
b3=4;b4=4; b1=1;b2=5; # EGLD(b1,b2,b3,b4)
b1=0;b2=1; # equivalently beta(b3,b4)
b1=-3;b2=5;
xr = rbeta(100,b3,b4)
x = xr * b2 + b1
min(x); range(x)
sum(dbeta(xr,b3,b4,1))
x0 = seq(min(x),max(x),length=100)
```

```
x1 = (x0-b1)/b2
plot(dbeta(x1,b3,b4)/b2~x0,type='l',lwd=2,col=2)
lines(density(x),lty=2, col=2)

## no prior information on min and max
(out0 = fit.egld(x))
lines(out0,col=1)
## xmin known
(out1 = fit.egld(x,xmin=-3))
lines(out1,col=3,lwd=2)
## xmax known
(out2 = fit.egld(x,xmax=2))
lines(out2, col=4)
## both known
(out3 = fit.egld(x,xmin=-3,xmax=2))
lines(out3, col=5)
```

`fit.gld` *Fitting a Ramberg-Schmeiser-Tukey (RST) lambda distribution*

Description

To fit a Ramberg-Schmeiser-Tukey (RST) lambda distribution with the three moment-matching methods.

Usage

```
fit.gld(x,method='LMoM')
```

Arguments

`x`	A sample of size at least 6. 'NA' values will be automatically removed.
`method`	Choose GLD fitting method. Default: 'LMoM'. Other options: 'MoM'– method of moments; "MoP", method of percentiles; "LMoM", method of L-moments. 'best' chooses the best fit from the above three methods, which takes a while.

Author(s)

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References

Karian, Z.A., Dudewicz, E.J., McDonald, P., 1996. The Extended Generalized Lambda Distribution System for Fitting Distributions to Data: history,completion of theory, tables, applications, the "final word" on moment fits, *Comm. in Statist.- Simul. \& Comput.* **25**(3), 611-642.

Karian, Z.A., Dudewicz, E.J., 2000. *Fitting Statistical Distributions: The Generalized Lambda Distribution and Generalized Bootstrap Methods*, Chapman and Hall/CRC.

See Also

fit.egld, qrsgld,prsgld, rrsgld,drsgld.

Examples

```
mu = 34.5; sig=1.5
y = rnorm(1000,mu,sig)
x = round(y)  ###  rounding errors

x0 = seq(min(y),max(y),length=100)
f0 = dnorm(x0,mu,sig)
plot(f0~x0,type='l')
lines(density(y),col=4)
## fit with method of moments
(out1 = fit.gld(x, method='MoM'))
lines(out1,col=2)
##  Method of percentile
(out2 = fit.gld(x, method='mop'))
lines(out2, col=3)
## Method of L-moments
(out3 = fit.gld(x, method='lmom'))
lines(out3, col=5)
##  Fitting EGLD
(out0 = fit.egld(x))
lines(out0,col=6)

legend(max(x0), max(f0), xjust=1,yjust=1,
  legend=c("true","kde","MoM","MoP","LMoM","egld"),
  lty=c(1,1,1,1,1,1),
  col=c(1,4,2,3,5,6))
```

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fkde *Estimate Asymptotic Joint Distribution of EWMA variables*

Description

Estimate Asymptotic Joint Distribution of EWMA variables for control chart.

Usage

```
fkde(n=5, pm0=0.5, pI0=0.2, lambda=0.05,
     gridsize=100,B=10000,T=10000)
```

Arguments

n	sample size.
lambda	a parameter to compute EWMA
pm0,pI0	in-control parameters for the control chart.
gridsize	gridsize to evalue the joint PDF values
B, T	iteration times and maximum time of t to generate random samples for density estimation

Author(s)

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References

Yang, S.F. and Wang, B. "Using A Kernel Control Region to Monitor Both the Process Location and Dispersion".

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gboot *Generalized bootstrapping*

Description

Generalized bootstrapping

Usage

```
gboot(x,gldobj,statistic,...)
```

Arguments

x	A random sample.
gldobj	Either an object fitting a GLD or EGLD to data 'x'.
statistic	User defined function to resample from 'x'. 'fun' could be parametric or non-parametric.
...	Controls

References

Wang, B., Mishra, S.N., Mulekar, M., Mishra, N.S., Huang, K., (2010). Generalized Bootstrap Confidence Intervals for High Quantiles, In: *Karian ZA, Dudewicz, EJ eds. The Handbook on Fitting Statistical Distributions with R*. CRC Press. 2010: 877-913.

Wang, B., Mishra, S.N., Mulekar, M., Mishra, N.S., Huang, K., (2010). Comparison of bootstrap and generalized bootstrap methods for estimating high quantiles, *Journal of Statistical Planning and Inferences*, **140**. 2926-2935. DOI: 10.1016/j.jspi.2010.03.016.

Karian, Z.A., Dudewicz, E.J., McDonald, P., 1996. The Extended Generalized Lambda Distribution System for Fitting Distributions to Data: history,completion of theory, tables, applications, the "final word" on moment fits, *Comm. in Statist.- Simul. \& Comput.* **25**(3), 611-642.

Karian, Z.A., Dudewicz, E.J., 2000. *Fitting Statistical Distributions: The Generalized Lambda Distribution and Generalized Bootstrap Methods*, Chapman and Hall/CRC.

Dudewicz, E.J., 1992. The Generalized Bootstrap, Bootstrapping and Related Techniques, In: K.H., G. Rothe, W. Sendler, eds., V. 376 of *Lecture Notes in Economics and Mathematical Systems*, Springer-Verlag, Berlin, 31-37.

Examples

```
data(ofc)
X = ofc$x0
Ta = function(x) mean(x<31)
gld0 = fit.gld(X)
(out = gboot(X,gld0,statistic=Ta,R=100))
gld1 = fit.egld(X)
(out = gboot(X,gld1,statistic=Ta,R=100))
```

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ofc *OFC data*

Description

Simulated head size data of new borns.

Usage

```
data(ofc)
```

Format

A data frame with 1000 observations on 2 variables.

x0	numeric	Original OFC values
x	numeric	OFC values rounded to centimeters

References

Wang, CSDA and JSS papers.

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