Package 'gldist'

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Title An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution.

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Description The generalized lambda distribution (GLD) is a versatile distribution that can accommodate a wide range of shapes,including fat-tailed and asymmetric distributions. This package implements a more intuitive parameterization of the GLD that expresses the location and scale parameters directly as the median and inter-quartile range of the distribution. The remaining two shape parameters characterize the asymmetry and steepness of the distribution respectively. The fitting of the GLD to empirical data can be reduced to a two-parameter estimation problem where the location and scale parameters are estimated by their robust sample estimators. Moreover, the parameterization can be used to compare data sets in a convenient asymmetry and steepness shape plot. The underline C routines are written such that compilers that support vectorized mathematical operations can automatically vectorize the most time consuming loops (tested with icc 12.1.0). The package includes the usual distribution functions, fitting routines and a shape plot function.

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`gldist-package` *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution.*

Description

The generalized lambda distribution (GLD) is a versatile distribution that can accommodate a wide range of shapes, including fat-tailed and asymmetric distributions. This package implements a more intuitive parameterization of the GLD that expresses the location and scale parameters directly as the median and inter-quartile range of the distribution. The remaining two shape parameters characterize the asymmetry and steepness of the distribution respectively. The fitting of the GLD to empirical data can be reduced to a two-parameter estimation problem where the location and scale parameters are estimated by their robust sample estimators. Moreover, the parameterization can be used to compare data sets in a convenient asymmetry and steepness shape plot. The underline C routines are written such that compilers that support vectorized mathematical operations can automatically vectorize the most time consuming loops (tested with icc 12.1.0).

The package includes the usual distribution functions, fitting routines and a shape plot function.

The other parametrization of the GLD (RS and FKML) are implemented in the packages **gld** and **GLDEX** and are available on CRAN.

Author(s)

Yohan Chalabi and Diethelm Wuertz.

References

Y. Chalabi, D. J. Scott and D. Wuertz, *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution*. Working paper, 2012.

See Also

gldist, fitgl, glshapeplot, FKML2CSW, CSW2FKML

`fitgl` *Fitting of the Generalized Lambda Distribution.*

Description

Fitting of the Generalized Lambda Distribution with different estimators.

Usage

```
fitgl(x, start, inc = FALSE, na.rm = FALSE, method = c("mle", "hist",
"prob", "quant", "shape"), ...)
```

Arguments

`x`	A numeric vector of length at least one containing only finite values.
`start`	A numeric vector (optional), initial values for the parameters to be optimized.
`inc`	A logical value indicating wether the location (median) and scale (inter-quartile) should be included in the optimization or estimated by their smaple estimators. FALSE by default.
`method`	A character value specifying the method to use to fit the data.
`na.rm`	logical. Should missing values (including 'NaN') be removed?
`...`	additional arguments to be passed to the optimization function 'nlminb' or to the objective function. See 'method' argument for the availalbe additional arguments of the objective function.

Details

FIXME

Value

A list with components.

`call`	Calling function.
`par`	The best set of parameters found.
`objective`	The value of `objective` corresponding to `par`.
`convergence`	An integer code. `0` indicates successful convergence.
`message`	A character string giving any additional information returned by the optimizer, or `NULL`. For details, see `nlminb` documentation.
`iterations`	Number of iterations performed.
`evaluations`	Number of objective function and gradient function evaluations.

Author(s)

Yohan Chalabi and Diethelm Wuertz

References

Y. Chalabi, D. J. Scott and D. Wuertz, *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution*. Working paper, 2012.

See Also

gldist, gldist-package

Examples

```
# Generate deviates
x <- rgl(1000, med = 1, iqr = 2, chi = 0, xi = .5)

# Fit the data set with the different methods
fitgl(x, inc = FALSE, method = "mle")
fitgl(x, inc = TRUE, method = "mle")

fitgl(x, inc = FALSE, method = "hist", breaks = "FD")
fitgl(x, inc = TRUE, method = "hist", breaks = "FD")

fitgl(x, inc = FALSE, method = "prob")
fitgl(x, inc = TRUE, method = "prob")

fitgl(x, inc = FALSE, method = "quant", len = 1000)
fitgl(x, inc = TRUE, method = "quant", len = 1000)

fitgl(x, method = "shape")
```

`gldist` *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution.*

Description

Density, distribution function, quantile function, quantile density function and random generation for the generalized Tukey Lambda distribution in asymmetry-steepness parametrization. It has location equal to the 'median', scale equal to the inter-quartile range and tow shape parameters 'chi' and 'xi'.

Usage

```
dgl(x, med = 0, iqr = 1, chi = 0, xi = 0.6, maxit = 1000L)
pgl(q, med = 0, iqr = 1, chi = 0, xi = 0.6, maxit = 1000L)
qgl(p, med = 0, iqr = 1, chi = 0, xi = 0.6)
qdgl(p, med = 0, iqr = 1, chi = 0, xi = 0.6)
rgl(n, med = 0, iqr = 1, chi = 0, xi = 0.6)
```

Arguments

x,q	vector of quantiles.
p	vector of probabilities.
n	number of observations. If 'length(n) > 1', the length is taken to be the number required.
med	location parameter (median). If 'length(med) == 4', the vector is taken as a description of all four paramters of the distribution.
iqr	scale parameter (inter-quartile range).
chi	asymmetry parameter with range -1 < chi < 1.
xi	steepness parameter with range 0 < xi < 1.
maxit	maximum number of iteration when calculation inverse of quantile function.

Value

'dgl' gives the density, 'pgl' gives the distribution function, 'qgl' gives the quantile function, 'qdgl' gives the quantile density function, and 'rgl' generates random deviates.

Author(s)

Yohan Chalabi and Diethelm Wuertz

Source

Y. Chalabi, D. J. Scott and D. Wuertz, *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution*. Working paper, 2012.

See Also

fitgl, gldist-package

`glshapeplot` *Plot fitted shape parameters of the Generalized Lambda Distribution.*

Description

Plot fitted shape parameters of the Generalized Lambda Distribution.

Usage

```
glshapeplot(x, method, moments = 1:4, ...)
```

Arguments

`x`	A numeric vector or a numeric matrix of values. Can be `NULL` if one wants to only draw the line of moments condition of existence.
`method`	A character value specifying which method should be used in `fitgl`.
`moments`	A numeric vector specifying which line of moments conditions should be drawn. Can be `NULL` if condition of existence of moments are not desired.
`...`	additional arguments passed to `fitgl()`.

Value

A list with the output of `fitgl` for each column of `x`. Is `NULL` if no data was fitted, i.e. `x = NULL`.

Author(s)

Yohan Chalabi and Diethelm Wuertz

References

Y. Chalabi, D. J. Scott and D. Wuertz, *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution*. Working paper, 2012.

See Also

fitgl, gldist, gldist-package

Examples

```
# Daily Closing Prices of Major European Stock Indices, 1991-1998
data("EuStockMarkets", package = "datasets")

# use percentile log returns
x <- apply(EuStockMarkets, 2, function(x) diff(log(x)))
```

```
# Fitted shape parameters
glshapeplot(x)

# without the line conditions of existence of moments
glshapeplot(x, method = "quant", moments = NULL)

# only the conditions of existence of the first 4 moments
glshapeplot(NULL, moments = 1:4)
```

`Parametrization conversion`
Parameter conversion for the FKML and CSW parameterization.

Description

Parameter conversion for the FKML and CSW parametrization.

- CSW2FKMLConvert parameters from the CSW to the FMKL paramtrization.
- FKML2CSWConvert parameters from the FMKL to the CSW paramtrization.

Usage

```
CSW2FKML(med, iqr, chi, xi)
FKML2CSW(lambda1, lambda2, lambda3, lambda4)
```

Arguments

`med, iqr, chi, xi`
: parameters of the Generalized Lambda distribution in the CSW parametrization.

`lambda1, lambda2, lambda3, lambda4`
: parameters of the Generalized Lambda distribution in the FKML parametrization.

Value

A numeric vector of length 4.

Author(s)

Yohan Chalabi and Diethelm Wuertz

References

Y. Chalabi, D. J. Scott and D. Wuertz, *An Asymmetry-Steepness Parameterization of the Generalized Lambda Distribution*. Working paper, 2012.

M. Freimer, G. Kollia, G. Mudholkar, and C. Lin. *A study of the generalized Tukey lambda family*. Communications in Statistics-Theory and Methods, 17(10):3547–3567, 1988.

See Also

gldist, gldist-package

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