Package ‘ig’

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Description A collection of utilities for a general class of inverse Gaussian models known as inverse Gaussian type distribution (IGTD).

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`ig-package` *Package for a General Class of Inverse Gaussian Distributions*

Description

A collection of utilities for a general class of inverse Gaussian models known as inverse Gaussian type distribution (IGTD).

Details

Package:	ig
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Version:	1.2
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References

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

`aciigt` — *Approximate confidence region for the parameters of the IGTD*

Description

The function `aciigt()` produces a plot of an approximate confidence region and computes approximate confidence intervals (ACI) for the parameters mu and lambda of the IGTD from a sample of observations.

Usage

```
aciigt(x, kernel = "normal", confLevel = 95,
       chart = c(NULL, NULL, NULL, NULL),
       colourRegion = 1,
       colourEstimates = 2)
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`confLevel`	Confidence level of the region.
`chart`	Vector of limits of the graphs. It is a vector of the type: `c(xmin, xmax, ymin, ymax)`.
`colourRegion`	Color of an approximate confidence region in the plot.
`colourEstimates`	Color of MLE estimators in the plot.

Details

In order to construct a confidence region for μ and λ, we use the asymptotic normality of the MLEs.

Value

`aciigt()` shows a plot of an approximate confidence region and computes approximate confidence intervals (ACI) for the parameters of the IGTD considering the established confidence level from a sample of observatons giving results according to the following list:

- `muEstimate` Return the value of the MLE of mu.
- `muAci` Return 95% ACI for mu.
- `lambdaEstimate` Return the value of the MLE of lambda.
- `lambdaAci` Return 95% ACI for lambda.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Estimates the parameters of the IGTD with normal kernel by means of a
## 95
## region
aciigt(x, kernel = "normal", confLevel = 95, colourRegion = 3)
```

`descriptiveSummary` *Descriptive summary of the data*

Description

The function `descriptiveSummary()` gives a descriptive statistics of the data.

Usage

```
descriptiveSummary(x)
```

Arguments

- `x` Vector of observations.

Details

The function `descriptiveSummary()` gives a descriptive statistics of the data containing: mean ($\overline{x}$), median, mode, standard deviation (s), coefficients of variation, skewness and kurtosis, range, minimum, maximum and the number de observations. This function uses the command `searchMode()` that allows to find the empirical mode of the data.

Coefficient of variation (CV):

$$CV = \frac{s}{\overline{x}} \times 100 \quad (\text{in } \%).$$

Coefficient of skewness (CS):

$$CS = \frac{1}{n} \frac{\sum_{i=1}^{n} (x_i - \overline{x})^3}{s^3}.$$

Coefficient of kurtosis (CK):

$$CK = \frac{1}{n} \frac{\sum_{i=1}^{n} (x_i - \overline{x})^4}{s^4} - 3.$$

Value

The function `descriptiveSummary()` carries out a descriptive summary of the data

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces a descriptive statistics of the data x
descriptiveSummary(x)
```

diagnosticsigt *Influence diagnostics plots for the IGTD*

Description

The function `diagnosticsigt()` produces an index plot of total local influence.

Usage

```
diagnosticsigt(x, kernel = "normal", mainTitle = "", yRange = NULL)
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`mainTitle`	An overall title for the plot.
`yRange`	Limit for the y axis.

Details

The local influence diagnostics method (Cook, 1986) is used to evaluate the local influence by means of likelihood displacement.

Value

`diagnosticsigt()` gives an influence diagnostics through a graphical plot for the IGTD from a sample of observations.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces influence diagnostics for the IGTD with normal kernel
diagnosticsigt(x, kernel = "normal")
```

`digkotz` *Pdf of the IGTD generated from the Kotz kernel*

Description

This function computes the probabilility density function of inverse Gaussian distribution generated from the Kotz distribution with parameters `q`, `r` and `s`.

Usage

```
digkotz(x, mu = 1.0, lambda = 1.0, parameters = c(1.0, 1.0, 1.0),
        log = FALSE)
```

Arguments

`x`	Vector of observations.
`mu`	Mean.
`lambda`	Scale parameter.
`parameters`	Parameters of the Kotz distribution, `c(q, r, s)`.
`log`	Logical; if TRUE, probabilities p are given as log(p).

Details

The IGTD has pdf given by

$$f_T(t) = f_Z(a_t)\sqrt{\lambda}/\sqrt{t^3},$$

with $t > 0$, $\mu > 0$ and $\lambda > 0$, where $f_Z(\cdot) = c\,g(\cdot)$ is the pdf of the Kotz distribution $a_t = a_t(\mu, \lambda) = \sqrt{\lambda/\mu}[\sqrt{t/\mu} - \sqrt{\mu/t}]$.

Value

`digkotz()` gives the pdf of an IGTD generated from the Kotz kernel.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
# Produces a graphical plot for the IGD from the Kotz kernel
# with parameters q = 1, r = 2 and s = 3
x <- seq(-3, 3, by = 0.01)
y <- digkotz(x, 1.0, 1.0, parameters = c(1, 2, 3))
plot(x, y, type = "l", xlab = "x", ylab = "f(x)")
```

---

digpvii *Density of the IGTD generated from the Pearson type VII kernel*

Description

Probabilility density function of the IGTD generated from the the Pearson type VII kernel with parameters q and r.

Usage

```
digpvii(x, mu = 1.0, lambda = 1.0, parameters = c(1.0, 1.0), log = FALSE)
```

Arguments

x	Vector of observations.
mu	Mean.
lambda	Scale parameter.
parameters	Parameters of the Kotz distribution, c(q, r).
log	Logical; if TRUE, probabilities p are given as log(p).

Details

The IGTD has pdf given by

$$f_T(t) = f_Z(a_t)\sqrt{\lambda}/\sqrt{t^3},$$

with $t > 0$, $\mu > 0$ and $\lambda > 0$, where $f_Z(\cdot) = c\,g(\cdot)$ is the pdf of the Pearson VII distribution $a_t = a_t(\mu, \lambda) = \sqrt{\lambda/\mu}[\sqrt{t/\mu} - \sqrt{\mu/t}]$.

Value

digpvii() gives the pdf of an IGTD generated from the Pearson VII kernel.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
# Produces a graphical plot for the IGD from the Pearson VII type kernel
# with parameters q = 1 y r = 2
x <- seq(-3, 3, by = 0.01)
y <- digpvii(x, 1.0, 1.0, parameters = c(1, 2))
plot(x, y, type = "l", xlab = "x", ylab = "f(x)")
```

`dlaplace` *Density of the Laplace distribution*

Description

Probabilility density function of the Laplace distribution.

Usage

```
dlaplace(x)
```

Arguments

`x`	Vector of observations.

Details

The Laplace distribution has pdf given by

$$f_T(t) = (1/2)\exp(-|t|),$$

with $-\infty < t < +\infty$.

Value

`dLaplace()` gives the pdf of an Laplace distribution.

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References

Mineo, A. (2003). A new package for the general error distribution. R News, 3(2), 13-16.

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
# Produces a graphical plot for the Laplace distribution
x <- seq(-3, 3, by = 0.01)
y <- dlaplace(x)
plot(x, y, type = "l", xlab = "x", ylab = "f(x)")
```

---

fracture *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(fracture)
```

Format

A vector containing 19 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

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Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

`hfigt` *Hazard function of the IGTD*

Description

Hazard function (hf) or failure rate for the IGTD with mean parameter mu, scale parameter lambda and associated kernel `g`.

Usage

```
hfigt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`mu`	Mean.
`lambda`	Scale parameter.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Details

The IGTD has hf given by

$$h_T(t) = \frac{f_Z(a_t)\,\frac{\sqrt{\lambda}}{\sqrt{t^3}}}{F_Z(-a_t) - \int_{b_t}^{\infty} c\, g(u^2 - \frac{4\,\lambda}{\mu})\mathrm{d}u}.$$

Value

`hfig()` gives the hf of an IGTD.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Computes the hf of the IGTD with normal kernel for a vector x with mu = 1.0,
## lambda = 1.0
x  <- seq(0.01, 4, by = 0.01)
hx <- hfigt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
print(hx)

## At the end there is the graph of this pdf
plot(x, hx, main = "hf of the IGTD (classical case)", ylab = "h(x)")
```

---

histigt — *Histogram, box-plot and estimated pdf of the IGTD*

Description

The function `histigt()` produces a histogram and a box-plot of the data. Also, the estimated pdf may be sketched on the histogram.

Usage

```
histigt(x, kernel = "normal", boxPlot = "TRUE", densityLine = "FALSE",
        mainTitle = "Histogram and boxplot", xLabel = "Data",
        yLabel = "Frequency", yRange = NULL, colourHistogram = "blue",
        colourDensity = "black", colourBoxPlot = "blue")
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`boxPlot`	Logical; if TRUE (default), the boxplot is plotted, otherwise not.
`densityLine`	Logical; if TRUE, the pdf is sketched on the histogram, otherwise not.
`mainTitle`	Main title of the graph.
`xLabel`	A title for the x axis.
`yLabel`	A title for the x axis.
`yRange`	Limit for the y axis.
`colourHistogram`	Color inside the histogram.
`colourDensity`	Color of the estimated pdf curve.
`colourBoxPlot`	Color inside the boxplot.

Details

The function `histigt()` simultaneously produces a box-plot and a histogram for the data. The box-plot may be supressed by the instruction `boxPlot = FALSE`. Also, the estimated pdf may be sketched on the histogram adding the instruction `densityLine = TRUE`.

Value

The function `histigt()` carries out an exploratory graphical analysis and can be also useful as a simple goodness-of-fit tool.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces a histogram for the IGTD with normal kernel from the data x
histigt(x,
        mainTitle = "",
        xLabel = "Data",
        kernel = "normal",
        colourHistogram = 4,
        colourBoxPlot = 4)
```

`igt` *The Inverse Gaussian Type Distribution (IGTD)*

Description

Density, distribution function, quantile function and random generation for the inverse gaussian type distribution with mean parameter mu, scale parameter $lambda$ and associated kernel.

Usage

```
digt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal",
     log = FALSE)

pigt(q, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal",
     lower.tail = TRUE, log.p = FALSE)

qigt(p, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal",
     lower.tail = TRUE, log.p = FALSE)

rigt(n, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
```

Arguments

`x, q`	Vector of observations (quantiles).
`p`	Vector of probabilities.
`mu`	Mean.
`lambda`	Scale parameter.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`n`	Number of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`log, log.p`	Logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	Logical; if TRUE (default), probabilities are P[X <= x], otherwise, P[X > x].

Details

Probability density function (pdf) for the IGTD with mean parameter mu, scale parameter lambda and associated kernel g. The IGTD is a generalization of the IGTD; for details see Sanhueza, Leiva and Balakrishnan (2008). The g argument corresponds to the kernel of the pdf of the associated symmetrical distribution. In the ig package, the IGTD can be obtained from the following kernels: Laplace, logistic, normal (classical case) and Student-t. All these kernels are implemented in the `R` software. The Laplace or double exponential distribution can be obtained from the **normalp** package developed by Mineo (2005).

If mu, lambda or g are not specified, then they assume the default values 1.0, 1.0 and `"normal"`, respectively.

The IGTD has pdf given by

$$f_T(t) = f_Z(a_t)\sqrt{\lambda}/\sqrt{t^3},$$

with $t > 0$, $\mu > 0$ and $\lambda > 0$, where $f_Z(\cdot) = c\,g(\cdot)$ is the pdf of the associated symmetrical about zero distribution and $a_t = a_t(\mu, \lambda) = \sqrt{\lambda/\mu}[\sqrt{t/\mu} - \sqrt{\mu/t}]$.

It is not possible to find the quantile function of the IGTD in a closed analytical form, so these values must be obtained by numerical methods.

Statistical inference tools may not exist in closed form for the IGTD, which is not the case for the classical IGTD. Hence, simulation and numerical studies are needed, which require a random number (r.n) generator. Next, we present a r.n. generator for the IGTD following a similar procedure to the one given in Chhikara and Folks (1989, pp. 52-53) for the classical inverse Gaussian distribution. This generator has been implemented in the **ig** package. Thus, if $T \sim \mathrm{IGT}(\mu, \lambda; g)$, the algorithm steps are:

- Generate a r.n. u from $U \sim G\chi^2(g)$ by using an appropriate generator.
- Generate a r.n. w from $W \sim U(0, 1)$.
- Set values for μ and λ and then compute a random number $t = t_1$ or $t = t_2$ from $T \sim IGT(\mu, \lambda; g)$ according to the following criterion:

1. If $w \leq p_0$, then $t_1 = \mu + \frac{\mu^2 u}{2\lambda} - \frac{\mu}{2\lambda}\sqrt{4\mu\lambda\, u + \mu^2\, u^2}$, where $p_0 = \frac{\mu}{\mu + t_1}$;
2. If $w > p_0$, then $t_2 = \frac{\mu^2}{t_1}$.

Value

`digt()` gives the density, `pigt()` gives the distribution function, `qigt()` gives the quantile function, and `rigt()` generates random deviates.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

Examples

```
## Computes the pdf of the IGTD with g = "normal" for a vector x with mu = 1.0,
## lambda = 1.0
x  <- seq(0.01, 4, by = 0.01)
fx <- digt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
print(fx)

## At the end there is a graph of this pdf
plot(x, fx, main = "pdf of the IGTD (classical case)", ylab = "f(x)")

## Computes the cdf of the IGTD with g = "normal" for a vector x with mu = 1.0,
## lambda = 1.0
Fx <- pigt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
```

```
print(Fx)

## At the end there is a graph of this cdf
plot(x, Fx, main = "cdf of the IGTD (classical case)", ylab = "F(x)")

## Compute the 50 percentile (median) for a vector of probabilities x
## of the IGT with mu = 1.0, lambda = 1.0 and kernel = "normal"
q <- qigt(0.5, mu = 1.0, lambda = 1.0, kernel = "normal")
q

## Generates a sample x from the IGTD with normal kernel.
## At the end we have the histogram of x
x <- rigt(1000, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
hist(x, main = "Histogram of a sample from IGTD")
```

---

kappaii *Transformation of the IGTD distribution*

Description

This function gives the value of a tranformation of the IGT distribution.

Usage

```
kappaii(x, theta = c(1.0, 1.0))
```

Arguments

`x`	Vector of observations.
`theta`	Vector of parameters of mu and lambda.

Value

`kappaii()` computes the value of a tranformation of the IGTD.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

`ksigt` *Test of Kolmogorov-Smirnov for the IGTD*

Description

The function `ksigt` gives the values for the Kolmogorov-Smirnov (KS) test assuming an IGTD with parameters mu, lambda and an specific kernel. In addition, optionally, this function allows one to obtain a comparative graph between the empirical and theoretical cdfs for a given data set.

Usage

```
ksigt(x, kernel = "normal", graph = FALSE,
      mainTitle = "Cumulative distribution function", xLabel = "data",
      yLabel = "cdf")
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`graph`	Logical; if TRUE (default), the cdf plot is provided.
`mainTitle`	Main title of the graph.
`xLabel`	A title for the x axis.
`yLabel`	A title for the y axis.

Details

The Kolmogorov-Smirnov test is a goodness-of-fit technique based on the maximum distance between the empirical and theoretical cdfs.

Value

The function `ksigt()` carries out de Kolmogorov-Smirnov test for the IGTD.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces a KS test abd produces a graph for the IGTD with normal kernel
  ksigt(x, kernel = "normal", graph = TRUE,
        xLabel = "Data",
        yLabel = "Cumulative distribution function")
```

`ll` *Analytical first derivative with respect to lambda of the IGTD*

Description

This function computes the first analytical derivative of the loglikelihood with respect to lambda of the IGTD.

Usage

```
ll(theta, x, nu = 1.0, kernel = "normal")
```

Arguments

`theta`	Vector of parameters `mu` and `lambda`.
`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`ll()` return the first analytical derivative of the loglikelihood with respect to lambda of the IGTD.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

`lll` *Analytical second derivative with respect to lambda of the IGTD*

Description

This function computes the second analytical derivative of the loglikelihood with respect to lambda of the IGTD.

Usage

```
lll(theta, x, nu = 1.0, kernel = "normal")
```

Arguments

`theta`	Vector of parameters `mu` and `lambda`.
`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`lll()` return the second analytical derivative of the loglikelihood with respect to lambda of the IGTD.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

lml *Analytical second derivative with respect to mu and lambda of the IGTD*

Description

This function computes the second analytical derivative of the loglikelihood with respect to mu and lambda of the IGTD.

Usage

```
lml(theta, x, nu = 1.0, kernel = "normal")
```

Arguments

`theta`	Vector of parameters `mu` and `lambda`.
`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`lml()` return the second analytical derivative of the loglikelihood with respect to mu and lambda of the IGTD.

Author(s)

Víctor Leiva <victor.leiva@uv.cl; victor.leiva@yahoo.com>,
Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

`lmm` *Analytical second derivative with respect to mu of the IGTD*

Description

This function computes the second analytical derivative of the loglikelihood with respect to mu of the IGTD.

Usage

```
lmm(theta, x, nu = 1.0, kernel = "normal")
```

Arguments

`theta`	Vector of parameters `mu` and `lambda`.
`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`lmm()` return the second analytical derivative of the loglikelihood with respect to mu of the IGTD.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

`lmu` *Analytical first derivative with respect to mu of the IGTD*

Description

This function computes the firt analytical derivative of the loglikelihood with respect to mu of the IGTD.

Usage

```
lmu(theta, x, nu = 1, kernel = "normal")
```

Arguments

`theta`	Vector of parameters `mu` and `lambda`.
`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`lmu()` return the firt analytical derivative of the loglikelihood with respect to mu of the IGTD.

Author(s)

Víctor Leiva <victor.leiva@uv.cl; victor.leiva@yahoo.com>,
Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

loglikigt — *Loglikelihood function associated with the IGTD*

Description

This function computes the numerical value of the loglikelihood function associated with the IGTD.

Usage

```
loglikigt(x, nu = 1.0, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

Compute the loglikelihood function associated to the inverse Gaussian type distribution.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Computes the valur for the likelihood for a sample x from the IGTD
## with normal kernel
loglikigt(x, nu = 1.0, kernel = "normal")
```

mleig *Maximum likelihood estimation of the IGTD*

Description

The function `mleig` gives the maximum likelihood estimate (MLE) of the parameters mu and lambda of the IGD (classical case) from a sample of observations based on this distribution.

Usage

```
mleig(x)
```

Arguments

`x`	Vector of observations.

Details

The MLEs of the parameters mu and lambda of the classical IG distribution are obtained using the analytical expressions of these estimators.

Value

`mleig()` computes MLEs for the parameters of the classical IGD giving results according to the following list:

`muEstimate`	Returns the value of the MLE of mu.
`lambdaEstimate`	Returns the value of the MLE of lambda.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Computes the likelihood for a sample x from the IGTD with normal kernel
mleig(x)
```

`mleigSt` *MLE of the parameters of the IGTD generated from the t kernel*

Description

The function `mleigSt` gives the maximum likelihood estimates (MLE) of the parameters mu and lambda of the IGTD generated from the t kernel based on a sample of observations based on this distribution.

Usage

```
mleigSt(x)
```

Arguments

`x`	Vector of observations.

Details

The MLEs of the parameters mu and lambda of the classical IG distribution are obtained using the analytical expressions of these estimators. In the case of the IGTD generated from the t kernel, the MLEs of the parameters mu and lambda must be obtained using numerical procedure already implmented in `R`. In this procedure, the parameter nu is obtained by using an optimal methodology based on the data.

Value

`mleigSt()` computes MLEs for the parameters of the IGTD generated from the t kernel giving results according to the following list:

`muEstimate`	Returns the value of the MLE of mu.
`lambdaEstimate`	Returns the value of the MLE of lambda.
`nuOptimal`	Returns the optimal value for nu.
`loglikelihood`	Returns the value of the IGTD loglikelihood.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with t kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, nu = 5, kernel = "t")

## Computes the likelihood for a sample x from the IGTD with t kernel
mleigSt(x)
```

---

mleigStNuFixed   *MLE of the parameters of the IGT Student with fixed nu*

Description

The function `mleigStNuFixed` gives the maximum likelihood estimates (MLE) of the parameters mu and lambda of the IGTD generated from the t kernel based on a sample of observations based on this distribution.

Usage

```
mleigStNuFixed(x, nu = 1)
```

Arguments

`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution.

Details

The MLEs of the parameters mu and lambda of the classical IG distribution are obtained using the analytical expressions of these estimators. In the case of the IGTD generated from the t kernel, the MLEs of the parameters mu and lambda must be obtained using numerical procedure already implmented in `R`. In this procedure, the parameter nu is previosly fixed. This methodoly can be useful for simulation studies or to determine the optimal value of nu.

Value

`mleigStNuFixed()` computes MLEs for the parameters of the IGTD generated from the t kernel giving results according to the following list:

`muEstimate`	Returns the value of the MLE of mu.
`lambdaEstimate`	Returns the value of the MLE of lambda.
`nuFixed`	Returns the fixed value for nu.
`loglikelihood`	Returns the value of the IGTD loglikelihood.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with t kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, nu = 5, kernel = "t")

## Computes the likelihood for a sample x from the IGTD with t kernel
mleigStNuFixed(x, nu = 5)
```

`mleigt` *MLE of the parameters of the IGTD*

Description

The function `mleigt` gives the maximum likelihood estimates (MLE) of the parameters mu and lambda of the IGTD generated from the kernels: Laplace, logistic and normal (classical case) based on a sample of observations based on this distribution.

Usage

```
mleigt(x, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"` and `"normal"` are available.

Details

The MLEs of the parameters mu and lambda of the classical IG distribution are obtained using the analytical expressions of these estimators. In the case of the IGTD generated from the kernels: Laplace, logistic and normal, the MLEs of the parameters mu and lambda must be obtained using numerical procedure already implmented in `R`.

Value

`mleigt()` computes MLEs for the parameters of the IGTD generated from the kernels: Laplace, logistic and normal giving results according to the following list:

`muEstimate` Returns the value of the MLE of mu.

`lambdaEstimate`
Returns the value of the MLE of lambda.

`loglikelihood`
Returns the value of the IGTD loglikelihood.

Author(s)

Víctor Leiva <victor.leiva@uv.cl; victor.leiva@yahoo.com>,
Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with t kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, nu = 5, kernel = "normal")

## Computes the likelihood for a sample x from the IGTD with normal kernel
mleigt(x)
```

---

ppigt *probability versus probability plot for the the IGTD*

Description

The function `ppigt()` produces a probability-probability (pp) plot for the IGTD based on the MLE of their parameters. Also, a line going through the first and the third quartile can be sketched. In addition, the coefficient of determination of least squares for the fit line is given.

Usage

```
ppigt(x, kernel = "normal", line = FALSE,
      xLabel = "Empirical distribution function",
      yLabel = "Theorical distribution function")
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`line`	Logical; if TRUE (default), a line going by the first and third quartile is sketched.
`xLabel`	A title for the x axis.
`yLabel`	A title for the x axis.

Details

The function `ppigt()` carries out a pp plot for the IGTD.

Value

The function `ppigt()` carries out an graphical plot useful as goodness-of-fit tool.

Author(s)

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Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces a pp plot for the IGTD with normal kernel
ppigt(x, kernel = "normal", line = TRUE)
```

`precipitations` *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(precipitations)
```

Format

A vector containing 25 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

`psi26` *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(psi21)
```

Format

A vector containing 101 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Birnbaum Z. W. and Saunders S. C. (1969). Estimation for a family of life distributions. Journal of Applied Probability, 6, 319-327.

`psi26` *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(psi26)
```

Format

A vector containing 102 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Birnbaum Z. W. and Saunders S. C. (1969). Estimation for a family of life distributions. Journal of Applied Probability, 6, 319-327.

`psi31` *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(psi31)
```

Format

A vector containing 101 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Birnbaum Z. W. and Saunders S. C. (1969). Estimation for a family of life distributions. Journal of Applied Probability, 6, 319-327.

`qqigt` *Quantile versus quantile plot for the the IGTD*

Description

The function `qqigt()` produces a quantile-quantile (QQ) plot for the IGTD based on the MLE of their parameters. Also, a line going through the first and the third quartile can be sketched. In addition, the coefficient of determination of least squares for the fit line is given.

Usage

```
qqigt(x, kernel = "normal", line = FALSE, xLabel = "Empirical quantiles",
      yLabel = "Theoretical quantiles")
```

Arguments

`x`	Vector of observations.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.
`line`	Logical; if TRUE (default), a line going by the first and third quartile is sketched.
`xLabel`	A title for the x axis.
`yLabel`	A title for the x axis.

Details

The function `qqigt()` carries out a QQ plot for the IGTD.

Value

The function `qqigt()` carries out an graphical plot useful as goodness-of-fit tool.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Produces a QQ plot for the IGTD with normal kernel
qqigt(x, kernel = "normal", line = TRUE)
```

`rcigt` *Relative change on the MLE of the IGTD*

Description

The function `rcigt()` computes the relative change (RC) on the MLE when some observations are removed in order to evaluate the effect of their potentially influence.

Usage

```
rcigt(x, casesRemoved = NULL, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`casesRemoved`	Index of the potentially influential case(s) that must be removed.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Details

This function computes the relative changes (RC), in percentage, of each estimated parameter, defined by $\mathrm{RC}_{\theta_j} = |(\hat{\theta}_j - \hat{\theta}_{j(\mathrm{I})})/\hat{\theta}_j| \times 100\%$, where $\hat{\theta}_{j(\mathrm{I})}$ denotes the MLE of θ_j after the set I of cases has been removed.

Value

`rcigt()` gives the RCs on the MLEs of the parameters of the IGTD from a sample of observations without to consider some potentially influential case(s) related to the MLE of the complete sample.

Author(s)

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Antonio Sanhueza <asanhueza@ufro.cl>.

References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Computes the RC the MLE of the parameters of the IGTD with g="normal" when the
##  case 1 has been removed
rcigt(x, casesRemoved = c(1), kernel = "normal")
```

---

repairtimes *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(repairtimes)
```

Format

A vector containing 46 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

runoff *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

```
data(runoff)
```

Format

A vector containing 25 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

Author(s)

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Antonio Sanhueza <asanhueza@ufro.cl>.

Source

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

`searchMode` *Function for obtaining the empirical mode of the data*

Description

This function computes the empirical mode of the data.

Usage

```
searchMode(x)
```

Arguments

`x`	Vector of observations.

Value

`searcMode()` return the empirical mode (modal value) of the data.

Author(s)

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Hugo Hernández <hugo.hernandez.p@gmail.com> and
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`sfigt` *Survival function of the IGTD*

Description

Survival function (sf) for the IGTD with mean parameter mu, scale parameter lambda and associated kernel g.

Usage

```
sfigt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`mu`	Mean.
`lambda`	Scale parameter.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Details

The IGTD has sf given by

$$S_T(t) = F_Z(-a_t) - \int_{b_t}^{\infty} c\, g(u^2 - \frac{4\,\lambda}{\mu})\, \mathrm{d}u;\; t > 0.$$

Value

`sfig()` gives the sf of an IGTD.

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References

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Computes the sf of the IGTD with normal kernel for a vector x with mu = 1,
## lambda = 1
x  <- seq(0.01, 4, by = 0.01)
sx <- sfigt(x, mu = 1.0, lambda = 1.0, nu = 1.0, kernel = "normal")
print(sx)

## At the end there is the graph of this pdf
plot(x, sx, main = "sf of the IGTD (classical case)", ylab = "s(x)")
```

`shelflife` *Data set*

Description

Data set related to the IGTD which is available in the **ig** package. This data set has been taken from the literature of this topic.

Usage

`data(shelflife)`

Format

A vector containing 26 observations.

Details

`psi21`, `psi26` and `psi31` were taken from Birnbaum and Saunders (1969), who reported fatigue life data correspond to the cycles ($\times 10^{-3}$) of aluminum specimens of type 6061-T6. These specimens were cut in a parallel angle to the direction of rotation and oscillating at 18 cycles per seconds. They were exposed to a pressure with maximum stress of 21,000, 26,000 and 31,000 psi (pounds per square inch), for $n = 101, 102$, and 101 specimens, respectively.

Other data set names are: `repairtimes`, `shelflife`, `fracture`, `precipitations` and `runoff`, which correspond to maintenance data on active repair times (in hours) for an airborne communications transceiver, shelflife (in days) of a food product, fracture toughnesses of welds, precipitation (in inches) and runoff amounts at Jug Bridge, Maryland, respectively.

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Source

Chhikara, R. S. and Folks, J. L. (1989). The Inverse Gaussian Distribution. Marcel Dekker, New York.

`sicigt` *Schwartz information criterion for a sample from the IGTD*

Description

The function `sicig()` gives the Schwartz information criterion (SIC) value assuming an IGTD with parameters mu, lambda and a specific kernel.

Usage

```
sicigt(x, nu = 1.0, kernel = "normal")
```

Arguments

`x`	Vector of observations.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Details

The SIC is a selection model criterion based on information loss. According to this criterion, it is possible to choice a hypothetic model that better describe the data set considering the smaller SIC value. The SIC is defined as $SIC = -l(\theta)/n + p\log(n)/(2n)$, where $l(\theta)$ is the log-likelihood function associated with the model, n is the sample size and p is the number of involved parameters; for more details see Spieglhaiter, Best, Carlin and van der Linde (2002).

Value

`sicigt()` gives the value for the SIC of the IGTD.

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References

Spieglhaiter, D. J., Best, N. G., Carlin, B. P., van der Linde, A. (2002). Bayesian measures of complexity and fit. Journal of the Royal Statistical Society Series B 64, 1-34.

Sanhueza, A., Leiva, V., Balakrishnan, N. (2008). A new class of inverse Gaussian type distributions. Metrika (in press).

Examples

```
## Generates a sample from the IGTD with normal kernel
x <- rigt(300, mu = 1.0, lambda = 1.0, kernel = "normal")

## Computes the SIC value of the IGTD with normal kernel from the data x
sicigt(x, 1.0, kernel = "normal")
```

`wg` *Weights in the likelihood of the IGTD*

Description

This function computes the weights in the likelihood function of the inverse Gaussian type distribution given by: $w = g'(u)/g(u)$, where g is the kernel of the pdf of the symmetrical distribution.

Usage

```
wg(u, nu = 1.0, kernel = "normal")
```

Arguments

`u`	Vector of values.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`wg()` return the weights in the likelihood function of the inverse Gaussian type distribution.

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References

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`wgp` *Derivatives of the weights in the likelihood of the IGTD*

Description

This function computes the derivatives of the weights in the likelihood function of the inverse Gaussian type distribution.

Usage

```
wgp(u, nu = 1.0, kernel = "normal")
```

Arguments

`u`	Vector of values.
`nu`	Shape parameter corresponding to the degrees of freedom of the t distribution. In the case of the Laplace, logistic, normal kernels, nu can be fixed at the value 1.0 since this parameter is not involved in these kernels.
`kernel`	Kernel of the pdf of the associated symmetrical distribution by means of which the IGTD is obtained. The kernels: `"laplace"`, `"logistic"`, `"normal"` and `"t"` are available.

Value

`wgp()` return the derivatives of the weights in the likelihood function of the inverse Gaussian type distribution.

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