Package 'GIGrvg'

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Type Package

Title Random Variate Generator for the GIG Distribution

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Description Generator and density function for the Generalized Inverse Gaussian (GIG) distribution.

License GPL (>= 2)

LazyLoad yes

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Contents

`GIGrvg-package` *Generator and density for the Generalized Inverse Gaussian (GIG) distribution*

Description

This package provides a generator and the density for the Generalized Inverse Gaussian (GIG) distribution. It uses the parametrization with density proportional to

$$f(x) = x^{\lambda-1} e^{-\frac{1}{2}(\chi/x + \psi x)}$$

Details

Package:	GIGrvg
Type:	Package
Version:	0.8
Date:	2023-03-22
License:	GPL 2 or later

Package **GIGrvg** provides two routines:

`rgig` generates GIG distributed random variates. It is especially designed for the varying parameter case, i.e., for sample size `n=1`.

`dgig` computes the density of the GIG distribution.

Note that the parameters of the distribution are assumed to be single values. If a vector is provided then just the first value is used!

For the very fast generation of large samples more efficient algorithms exists. We recommend package **Runuran**.

Author(s)

Josef Leydold <josef.leydold@wu.ac.at> and Wolfgang Hörmann.

References

Wolfgang Hörmann and Josef Leydold (2014). Generating generalized inverse Gaussian random variates, Statistics and Computing 24, 547–557, DOI: 10.1007/s11222-013-9387-3

See also Research Report Series / Department of Statistics and Mathematics Nr. 123, Department of Statistics and Mathematics, WU Vienna University of Economics and Business, https://research.wu.ac.at/en/publications/generating-generalized-inverse-gaussian-random-variates-3.

J. S. Dagpunar (1989). An easily implemented generalised inverse Gaussian generator, Comm. Statist. B – Simulation Comput. 18, 703–710.

Karl Lehner (1989). Erzeugung von Zufallszahlen für zwei exotische stetige Verteilungen, Diploma Thesis, 107 pp., Technical University Graz, Austria (in German).

Examples

```
## Draw a random sample
rgig(n=10, lambda=0.5, chi=0.1, psi=2)

## Evaluate the density
dgig(0.3, lambda=0.5, chi=0.1, psi=2)
```

rgig *Generator and Density of Generalized Inverse Gaussian (GIG) distribution.*

Description

Random variate generator for the Generalized Inverse Gaussian (GIG) distribution. The generator is especially designed for the varying parameter case, i.e., for sample size n=1.

Usage

```
rgig(n=1, lambda, chi, psi)
dgig(x, lambda, chi, psi, log = FALSE)
```

Arguments

n	Number of observations
lambda	Shape parameter
chi	Shape and scale parameter. Must be nonnegative for positive lambda and positive else.
psi	Shape and scale parameter. Must be nonnegative for negative lambda and positive else.
x	Argument of pdf
log	If TRUE the logarithm of the density will be returned.

Details

The package uses a parametrization for the GIG distribution where the density is proportional to

$$f(x) = x^{\lambda-1} e^{-\frac{1}{2}(\chi/x+\psi x)}.$$

The parameters have to satisfy the conditions

$$\begin{array}{ll} \lambda > 0,\ \psi > 0, \chi \geq 0, & \text{or} \\ \lambda = 0,\ \psi > 0, \chi > 0, & \text{or} \\ \lambda < 0,\ \psi \geq 0, \chi > 0. & \end{array}$$

The generator is especially designed for the varying parameter case, i.e., for sample size n=1.

Note that the arguments n, lambda, chi, psi for these two R routines are assumed to be single values. If a vector is provided, then just the first value is used!

For the generation of large samples more efficient algorithms exist. We recommend package **Runuran**. The fast numeric inversion function pinvd.new is usable for GIG. It is about three times faster than rgig for large values of n. However, it requires a slow set-up and is therefore not useful for the varying parameter case. For the usage of the Runuran functions see the last example below.

Routine rgig applies three different algorithms depending on the given parameters. When the density is T-concave (roughly spoken when $\lambda \geq 1$ or $\psi\,\chi \geq 1/4$ two variants of the Ratio-of-Uniforms method due to Lehner (1989) are used. These are quite similar to the widely used algorithm by Dapunar but have a faster setup. When the density is not T-concave then a new algorithm with a uniformly rejection constant is used. (In the latter case Dagpunar's algorithm may become extremely slow or may sample from an invalid distribution.)

Value

rgig creates a random sample of size n. In case of invalid arguments the routine simply stops execution.

dgig evaluates the density of the GIG distribution.

Author(s)

Josef Leydold <josef.leydold@wu.ac.at> and Wolfgang Hörmann.

References

Wolfgang Hörmann and Josef Leydold (2013). Generating generalized inverse Gaussian random variates, Statistics and Computing 24, 547–557, DOI: 10.1007/s11222-013-9387-3

J. S. Dagpunar (1989). An easily implemented generalised inverse Gaussian generator, Comm. Statist. B – Simulation Comput. 18, 703–710.

Karl Lehner (1989). Erzeugung von Zufallszahlen für zwei exotische stetige Verteilungen, Diploma Thesis, 107 pp., Technical University Graz, Austria (in German).

Examples

```
## Draw a random sample
x <- rgig(n=10, lambda=0.5, chi=0.1, psi=2)

## Evaluate the density
x <- dgig(0.3, lambda=0.5, chi=0.1, psi=2)

## Create a random sample and create a histgram
y <- rgig(n=10^5,0.1,2,3)
hist(y,breaks=100,freq=FALSE)
xval <- seq(0,max(y),0.01) # to add plot the corresponding density
lines(xval,dgig(xval,0.1,2,3))

## Not run:
## Use a fast method from package Runuran for large samples
## (method PINV implements an approximate inversion method)
library("Runuran")
gen <- pinvd.new(udgig(theta=0.2, psi=0.05, chi=0.05))
x <- ur(gen, 10^6)

## End(Not run)
```

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