

Package: gamlssbssn (via r-universe)

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Type Package

Title Bimodal Skew Symmetric Normal Distribution

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Author Abu Hossain, Robert Rigby, Mikis Stasinopoulos

Maintainer Abu Hossain <a.hossain@londonmet.ac.uk>

Description Density, distribution function, quantile function and random generation for the bimodal skew symmetric normal distribution of Hassan and El-Bassiouni (2016) <[doi:10.1080/03610926.2014.882950](https://doi.org/10.1080/03610926.2014.882950)>.

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Encoding UTF-8

LazyData true

RoxygenNote 6.0.1

Imports MASS,gamlss

Depends R (>= 3.3.0), gamlss.dist (>= 4.3.1)

NeedsCompilation no

Repository CRAN

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Description

These functions define the Bimodal Skew Symmetric Normal Distribution. This is a four parameter distribution and can be used to fit a GAMLSS model. The functions `dBSSN`, `pBSSN`, `qBSSN` and `rBSSN` define the probability distribution function, the cumulative distribution function, the inverse cumulative distribution functions and the random generation for the Bimodal Skew Symmetric Normal Distribution; respectively.

Usage

```
BSSN(mu.link = "identity", sigma.link = "log", nu.link = "identity",
     tau.link = "log")
```

```
dBSSN(x, mu = 0, sigma = 1, nu = 1, tau = 0.5, log = FALSE)
```

```
pBSSN(q, mu = 0, sigma = 1, nu = 1, tau = 0.5, lower.tail = TRUE,
     log.p = FALSE, log = T)
```

```
qBSSN(p, mu = 0, sigma = 1, nu = 1, tau = 0.5, lower.tail = TRUE,
     log.p = FALSE)
```

```
rBSSN(n, mu = 0, sigma = 1, nu = 1, tau = 0.5)
```

Arguments

<code>mu.link</code>	Defines the <code>mu.link</code> , with identity link as the default for the <code>mu</code> parameter
<code>sigma.link</code>	Defines the <code>sigma.link</code> , with log link as the default for the <code>sigma</code> parameter
<code>nu.link</code>	Defines the <code>nu.link</code> , with identity link as the default for the <code>nu</code> parameter
<code>tau.link</code>	Defines the <code>tau.link</code> , with log link as the default for the <code>tau</code> parameter
<code>x, q</code>	Vector of quantiles
<code>mu</code>	Vector of location parameter values
<code>sigma</code>	Vector of scale parameter values
<code>nu</code>	Vector of <code>nu</code> parameter values
<code>tau</code>	Vector of bimodality parameter values
<code>log, log.p</code>	logical; if TRUE, probabilities <code>p</code> are given as $\log(p)$
<code>lower.tail</code>	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$
<code>p</code>	Vector of probabilities
<code>n</code>	number of observations; if $\text{length}(n) > 1$, the length is taken to be the number required

Details

The probability density function of the BSSN distribution is given by

$$f_Y(y|\mu, \sigma, \nu, \tau) = c[\tau + (y - \nu)^2]e^{-\sigma(y-\mu)^2}$$

for $-\infty < y < \infty$, where $c = 2\sigma^{3/2}/\gamma\sqrt{\pi}$, $\gamma = 1 + 2\sigma\theta$, $\theta = \tau + \delta^2$, $\delta = \nu - \mu$. $-\infty < \mu < \infty$ and $-\infty < \nu < \infty$ are location parameters and $\sigma > 0$ and $\tau \geq 0$ denote the scale and bimodality parameters respectively.

References

Hassan, M. Y. and El-Bassiouni M. Y. (2015). Bimodal skew-symmetric normal distribution, *Communications in Statistics-Theory and Methods*, **45**, part 5, pp 1527–1541.

Hossain, A. Rigby, R. A. Stasinopoulos D. M. and Enea, M. A flexible approach for modelling proportion response variable: LGD, *31st International workshop for Statistical Modelling Society*, **1**, pp 127–132.

Rigby, R. A. and Stasinopoulos D. M. (2005). Generalized additive models for location, scale and shape, (with discussion), *Appl. Statist.*, **54**, part 3, pp 507-554.

Examples

```
op<-par(mfrow=c(3,3))
curve(dBSSN(x, mu=1, sigma=0.1, nu=1, tau=1),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=1, sigma=0.1, nu=1, tau=5),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=1, sigma=0.1, nu=1, tau=10),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=1, sigma=0.1, nu=1, tau=20),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=1, sigma=0.1, nu=0, tau=4),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=-1, sigma=0.1, nu=0, tau=3),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=1, sigma=0.1, nu=2, tau=0),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=-1, sigma=0.1, nu=-2, tau=0),-12, 12, ylab="f(x)", main="BSSN")
curve(dBSSN(x, mu=-1, sigma=0.1, nu=-3, tau=0.8),-12, 12, ylab="f(x)", main="BSSN")
par(op)
```

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