Package ‘csn’

October 12, 2022

Type Package

Title Closed Skew-Normal Distribution

Version 1.1.3

Date 2015-05-09

Author Dmitry Pavlyuk, Eugene Girtcius

Maintainer Dmitry Pavlyuk <Dmitry.V.Pavlyuk@gmail.com>

Depends R (>= 2.2.0)

Imports mvtnorm

Description Provides functions for computing the density
and the log-likelihood function of closed-skew normal variates,
and for generating random vectors sampled from this distribution.
See Gonzalez-Farias, G., Dominguez-Molina, J., and Gupta, A. (2004).
The closed skew normal distribution,
Skew-elliptical distributions and their applications: a journey beyond normality,
Chapman and Hall/CRC, Boca Raton, FL, pp. 25-42.

License GPL-2

NeedsCompilation no

Repository CRAN

Repository/R-Forge/Project csn

Repository/R-Forge/Revision 10

Repository/R-Forge/DateTimeStamp 2015-05-09 07:20:52

Date/Publication 2015-05-10 23:27:41

R topics documented:

`dcsn` *The probability density function*

Description

The probability density function of the closed-skew normal distribution

Usage

```
dcsn(x, mu, sigma, gamma, nu, delta)
```

Arguments

`x`	this is either a vector of length `n` or a matrix with `n` columns, where `n=ncol(sigma)`, giving the coordinates of the point(s) where the density must be evaluated
`mu`	a numeric vector representing the location parameter of the distribution; it must be of length `n`, as defined above
`sigma`	a positive definite matrix representing the scale parameter of the distribution; a vector of length 1 is also allowed
`gamma`	a matrix representing the skewness parameter of the distribution; a vector of length 1 is also allowed
`nu`	a numeric vector allows for closure with conditional densities; it must be of length `q`, as defined above
`delta`	a positive definite matrix allows for closure with the marginal densities; a vector of length 1 is also allowed

Details

Function dcsn makes use of pmvnorm and dmvnorm from package mvtnorm

Value

`dcsn` returns a vector of density values

See Also

`pmvnorm`, `dmvnorm`

Examples

```
x1 <- seq(4.5,11,length=100)
x2 <- cbind(seq(3,9,length=100),seq(7,13,length=100))
mu <- c(5,7)
sigma <- matrix(c(1,0.2,0.2,4),2)
gamma <- matrix(c(4,0,0,5),2)
nu <- c(-2,6)
delta <- matrix(c(1,0,0,1),2)
```

```
f1 <- dcsn(x1,5,9,1,0,0.05)
f2 <- dcsn(x2, mu, sigma, gamma, nu, delta)
```

loglcsn *The log-likelihood function*

Description

The log-likelihood function of the closed-skew normal distribution

Usage

```
loglcsn(x, mu, sigma, gamma, nu, delta)
```

Arguments

x	this is either a vector of length n or a matrix with n columns, where n=ncol(sigma), giving the coordinates of the point(s) where the density must be evaluated
mu	a numeric vector representing the location parameter of the distribution; it must be of length n, as defined above
sigma	a positive definite matrix representing the scale parameter of the distribution; a vector of length 1 is also allowed
gamma	a matrix representing the skewness parameter of the distribution; a vector of length 1 is also allowed
nu	a numeric vector allows for closure with conditional densities; it must be of length q, as defined above
delta	a positive definite matrix allows for closure with the marginal densities; a vector of length 1 is also allowed

Details

Function loglcsn makes use of pmvnorm and dmvnorm from package mvtnorm

Value

loglcsn returns a sum of log-transformed density values

See Also

pmvnorm, dmvnorm

Examples

```
x <- cbind(seq(3,9,length=100),seq(7,13,length=100))
mu <- c(5,7)
sigma <- matrix(c(1,0.2,0.2,4),2)
gamma <- matrix(c(4,0,0,5),2)
nu <- c(-2,6)
delta <- matrix(c(1,0,0,1),2)
L <- loglcsn(x, mu, sigma, gamma, nu, delta)
```

---

pcsn *The cumulative distribution function*

Description

The cumulative distribution function of the closed-skew normal distribution

Usage

```
pcsn(x, mu, sigma, gamma, nu, delta)
```

Arguments

x	this is either a vector of length n or a matrix with n columns, where n=ncol(sigma), giving the coordinates of the point(s) where the cdf must be evaluated
mu	a numeric vector representing the location parameter of the distribution; it must be of length n, as defined above
sigma	a positive definite matrix representing the scale parameter of the distribution; a vector of length 1 is also allowed
gamma	a matrix representing the skewness parameter of the distribution; a vector of length 1 is also allowed
nu	a numeric vector allows for closure with conditional densities; it must be of length q, as defined above
delta	a positive definite matrix allows for closure with the marginal densities; a vector of length 1 is also allowed

Details

Function pcsn makes use of pmvnorm from package mvtnorm

Value

pcsn returns a vector of cdf values

See Also

pmvnorm

Examples

```
x1 <- seq(4,6,by = 0.1)
x2 <- x1+sin(x1)
x3 <- x1-cos(x1)
x <- cbind(x1,x2,x3)
mu <- c(1,2,3)
sigma <- matrix(c(2,-1,0,-1,2,-1,0,-1,2),3)
gamma <- matrix(c(0,1,0,2,2,3),2,3)
nu <- c(1,3)
delta <- matrix(c(1,1,1,2),2)
pcsn(6,5,9,1,0,0.05)
pcsn(c(3,4,5),mu,sigma,gamma,nu,delta)
pcsn(x,mu,sigma,gamma,nu,delta)
```

`rcsn` *Random number generation*

Description

Random number generation of the closed-skew normal distribution

Usage

```
rcsn(k, mu = rep(0, n), sigma, gamma, nu = rep(0, q), delta)
```

Arguments

`k`	the number of random numbers to be generated
`mu`	a numeric vector representing the location parameter of the distribution; it must be of length `n`, as defined above
`sigma`	a positive definite matrix representing the scale parameter of the distribution; a vector of length 1 is also allowed
`gamma`	a matrix representing the skewness parameter of the distribution; a vector of length 1 is also allowed
`nu`	a numeric vector allows for closure with conditional densities; it must be of length `q`, as defined above
`delta`	a positive definite matrix allows for closure with the marginal densities; a vector of length 1 is also allowed

Details

Function rcsn makes use of rmvnorm from package mvtnorm;

Value

`rcsn` returns a matrix of `k` rows of random vectors

See Also

rmvnorm

Examples

```
mu <- c(1,2,3)
sigma <- matrix(c(2,-1,0,-1,2,-1,0,-1,2),3)
gamma <- matrix(c(0,1,0,2,2,3),2,3)
nu <- c(1,3)
delta <- matrix(c(1,1,1,2),2)
x1 <- rcsn(100, mu, sigma, gamma, nu, delta)
x2 <- rcsn(100,5,9,1,0,0.05)
```

Index