Package ‘csn’

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Title Closed Skew-Normal Distribution
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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.
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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)
The log-likelihood function

**Description**

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

**Usage**

```r
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

```r
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)
delta <- matrix(c(1, 0, 0, 1), 2)
L <- loglcsn(x, mu, sigma, gamma, nu, delta)
```

The cumulative distribution function

Description

The cumulative distribution function of the closed-skew normal distribution

Usage

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

Arguments

- `x`: this is either a vector of length \( n \) or a matrix with \( n \) columns, where \( n = \text{ncol}(\text{sigma}) \), 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

```r
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(1,1,2),2)
pcsn(6,5,9,1,0,0.05)
pcsn(c(3,4,5),mu,sigma, gamma, nu, delta)
```
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(1,1,2),2)
x1 <- rcsn(100, mu, sigma, gamma, nu, delta)
x2 <- rcsn(100,5,9,1,0.05)
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