Package ‘condMVNorm’

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Title Conditional Multivariate Normal Distribution
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Description Computes conditional multivariate normal probabilities, random deviates and densities.
Imports stats
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License GPL-2
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cmvnorm Conditional Multivariate Normal Density and Random Deviates

Description

These functions provide the density function and a random number generator for the conditional multivariate normal distribution, [Y given X], where Z = (X,Y) is the fully-joint multivariate normal distribution with mean equal to mean and covariance matrix sigma.
Usage

dcmvnorm(x, mean, sigma, dependent.ind, given.ind, 
X.given, check.sigma=TRUE, log = FALSE)
rcmvnorm(n, mean, sigma, dependent.ind, given.ind, 
X.given, check.sigma=TRUE, 
method = c("eigen", "svd", "chol"))

Arguments

x vector or matrix of quantiles of Y. If x is a matrix, each row is taken to be a 
quantile.
n number of random deviates.
mean mean vector, which must be specified.
sigma a symmetric, positive-definite matrix of dimension n x n, which must be speci-
fied.
dependent.ind a vector of integers denoting the indices of dependent variable Y.
given.ind a vector of integers denoting the indices of conditioning variable X.
X.given a vector of reals denoting the conditioning value of X. When both 
given.ind and X.given are missing, the distribution of Y becomes Z[dependent.ind]
check.sigma logical; if TRUE, the variance-covariance matrix is checked for appropriateness 
(symmetry, positive-definiteness). This could be set to FALSE if the user knows 
it is appropriate.
log logical; if TRUE, densities d are given as log(d).
method string specifying the matrix decomposition used to determine the matrix root 
of sigma. Possible methods are eigenvalue decomposition ("eigen", default), 
singular value decomposition ("svd"), and Cholesky decomposition ("chol"). 
The Cholesky is typically fastest, not by much though.

See Also

pcmvnorm, pmvnorm, dmvnorm, qmvnorm

Examples

# 10-dimensional multivariate normal distribution
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

# density of Z[c(2,5)] given Z[c(1,4,7,9)]=c(1,1,0,-1)
dcmvnorm(x=c(1.2,-1), mean=rep(1,n), sigma=A, 
dependent.ind=c(2,5), given.ind=c(1,4,7,9), 
X.given=c(1,0,0,-1))
dcmvnorm(x=-1, mean=rep(1,n), sigma=A, dep=3, given=c(1,4,7,9,10), X=c(1,0,0,-1))
dcmvnorm(x=c(1.2,-1), mean=rep(1,n), sigma=A, dep=c(2,5))
# gives an error since 'x' and 'dep' are incompatibe
#dcmvnorm(x=-1, mean=rep(1,n), sigma=A, dep=c(2,3),
# given=c(1,4,7,9,10), X=c(1,1,0,0,-1))

rcmvnorm(n=10, mean=rep(1,n), sigma=A, dep=c(2,5),
given=c(1,4,7,9,10), X=c(1,1,0,0,-1),
method="eigen")

rcmvnorm(n=10, mean=rep(1,n), sigma=A, dep=3,
given=c(1,4,7,9,10), X=c(1,1,0,0,-1),
method="chol")

---

## Conditional Mean and Variance of Multivariate Normal Distribution

### Description

These functions provide the conditional mean and variance-covariance matrix of \([Y \mid X]\), where
\(Z = (X,Y)\) is the fully-joint multivariate normal distribution with mean equal to mean and covariance matrix sigma.

### Usage

```r
condMVN(mean, sigma, dependent.ind, given.ind, x.given, check.sigma=TRUE)
```

### Arguments

- **mean**: mean vector, which must be specified.
- **sigma**: a symmetric, positive-definite matrix of dimension n x n, which must be specified.
- **dependent.ind**: a vector of integers denoting the indices of dependent variable Y.
- **given.ind**: a vector of integers denoting the indices of conditioning variable X.
- **x.given**: a vector of reals denoting the conditioning value of X. When both given.ind and x.given are missing, the distribution of Y becomes \(Z[^{dependent.ind}]\).
- **check.sigma**: logical; if TRUE, the variance-covariance matrix is checked for appropriateness (symmetry, positive-definiteness). This could be set to FALSE if the user knows it is appropriate.

### See Also

dcmvnorm, pcmvnorm, pmvnorm, dmvnorm, qmvnorm
### Examples

```r
# 10-dimensional multivariate normal distribution
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

condMVN(mean=rep(1,n), sigma=A, dependent=c(2,3,5), given=c(1,4,7,9), X.given=c(1,1,0,-1))

condMVN(mean=rep(1,n), sigma=A, dep=3, given=c(1,4,7,9), X=c(1,1,0,-1))
```

### Description

Computes the distribution function of the conditional multivariate normal, \([Y \mid X]\), where \(Z = (X, Y)\) is the fully-joint multivariate normal distribution with mean equal to \(\text{mean}\) and covariance matrix \(\text{sigma}\).

### Usage

```r
pcmvnorm(lower=Inf, upper=Inf, mean, sigma, dependent.ind, given.ind, X.given, check.sigma=TRUE, algorithm = GenzBretz(), ...)
```

### Arguments

- **lower**: the vector of lower limits of length \(n\).
- **upper**: the vector of upper limits of length \(n\).
- **mean**: the mean vector of length \(n\).
- **sigma**: a symmetric, positive-definite matrix, of dimension \(n \times n\), which must be specified.
- **dependent.ind**: a vector of integers denoting the indices of the dependent variable \(Y\).
- **given.ind**: a vector of integers denoting the indices of the conditioning variable \(X\).
- **X.given**: a vector of reals denoting the conditioning value of \(X\). When both \(\text{given.ind}\) and \(\text{X.given}\) are missing, the distribution of \(Y\) becomes \(Z[\text{dependent.ind}]\).
- **check.sigma**: logical; if TRUE, the variance-covariance matrix is checked for appropriateness (symmetry, positive-definiteness). This could be set to FALSE if the user knows it is appropriate.
- **algorithm**: an object of class \(\text{GenzBretz}\), \(\text{Miwa}\) or \(\text{TVPACK}\) specifying both the algorithm to be used as well as the associated hyper parameters.
- **...**: additional parameters (currently given to \(\text{GenzBretz}\) for backward compatibility issues).
Details
This program involves the computation of multivariate normal probabilities with arbitrary correlation matrices.

Value
The evaluated distribution function is returned with attributes

- `error`: estimated absolute error and
- `msg`: status messages.

See Also
dcmvn, rcmvn, pmvn.

Examples
```r
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

pcmvnorm(lower=-Inf, upper=1, mean=rep(1,n), sigma=A, dependent.ind=3, given.ind=c(1,4,7,9,10),
X=given=c(1,1,0,0,-1))

pcmvnorm(lower=-Inf, upper=c(1,2), mean=rep(1,n),
sigma=A, dep=c(2,5), given=c(1,4,7,9,10),
X=c(1,1,0,0,-1))

pcmvnorm(lower=-Inf, upper=c(1,2), mean=rep(1,n), sigma=A,
dep=c(2,5))
```
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