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Description Simulation of random vectors from truncated multivariate normal and t distributions based on the algorithms proposed by Yifang Li and Sujit K. Ghosh (2015) <doi:10.1080/15598608.2014.996690>.

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Contents

tmvtnsim-package 2
rtmvnorm 2
rtmvt 4
rtnorm 6

Index **7**

tmvtnsim-package *Truncated Multivariate Normal and t Distribution Simulation*

Description

Simulation of random vectors from truncated multivariate normal and t distributions based on the algorithms proposed by Yifang Li and Sujit K. Ghosh (2015) <doi:10.1080/15598608.2014.996690>. We allow the mean, lower and upper bounds to differ across samples to accommodate regression problems. The algorithms are implemented in C++ and hence are highly efficient.

Author(s)

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References

Yifang Li and Sujit K. Ghosh. Efficient Sampling Methods for Truncated Multivariate Normal and Student-t Distributions Subject to Linear Inequality Constraints. Journal of Statistical Theory and Practice. 2015;9:712-732. doi:10.1080/15598608.2014.996690

rtmvnorm *Random Generation for Truncated Multivariate Normal*

Description

Draws from truncated multivariate normal distribution subject to linear inequality constraints represented by a matrix.

Usage

```
rtmvnorm(
  mean,
  sigma,
  blc = NULL,
  lower,
  upper,
  init = NULL,
  burn = 10,
  n = NULL
)
```

Arguments

mean	n x p matrix of means. The number of rows is the number of observations. The number of columns is the dimension of the problem.
sigma	p x p covariance matrix.
blc	m x p matrix of coefficients for linear inequality constraints. If NULL, the p x p identity matrix will be used.
lower	n x m or 1 x m matrix of lower bounds for truncation.
upper	n x m or 1 x m matrix of upper bounds for truncation.
init	n x p or 1 x p matrix of initial values. If NULL, default initial values will be generated.
burn	number of burn-in iterations. Defaults to 10.
n	number of random samples when mean is a vector.

Value

Returns an n x p matrix of random numbers following the specified truncated multivariate normal distribution.

Examples

```
# Example 1: full rank blc
d = 3;
rho = 0.9;
sigma = matrix(0, d, d);
sigma = rho^abs(row(sigma) - col(sigma));
blc = diag(1,d);
n = 1000;
mean = matrix(rep(1:d,n), nrow=n, ncol=d, byrow=TRUE);
set.seed(1203)
result = rtmvnorm(mean, sigma, blc, -1, 1, burn=50)
apply(result, 2, summary)

# Example 2: use the alternative form of input
set.seed(1203)
result = rtmvnorm(mean=1:d, sigma, blc, -1, 1, burn=50, n=1000)
apply(result, 2, summary)

# Example 3: non-full rank blc
d = 3;
rho = 0.5;
sigma = matrix(0, d, d);
sigma = rho^abs(row(sigma) - col(sigma));
blc = matrix(c(1,1,1,0,1,0,1,0,1), ncol=d);
n = 100;
mean = matrix(rep(1:d,n), nrow=n, ncol=d, byrow=TRUE);
set.seed(1228)
result = rtmvnorm(mean, sigma, blc, -1, 1, burn=10)
apply(result, 2, summary)
```

```
# Example 4: non-full rank blc, alternative form of input
set.seed(1228)
result = rtmvnorm(mean=1:d, sigma, blc, -1, 1, burn=10, n=100)
apply(result, 2, summary)

# Example 5: means, lower, or upper bounds differ across samples
d = 3;
rho = 0.5;
sigma = matrix(0, d, d);
sigma = rho^abs(row(sigma) - col(sigma));
blc = matrix(c(1,0,1,1,1,0), ncol=d, byrow=TRUE)
n = 100;
set.seed(3084)
mean = matrix(runif(n*d), nrow=n, ncol=d);
result = rtmvnorm(mean, sigma, blc, -1, 1, burn=50)
apply(result, 2, summary)
```

`rtmvt` *Random Generation for Truncated Multivariate t*

Description

Draws from truncated multivariate t distribution subject to linear inequality constraints represented by a matrix.

Usage

```
rtmvt(
  mean,
  sigma,
  nu,
  blc = NULL,
  lower,
  upper,
  init = NULL,
  burn = 10,
  n = NULL
)
```

Arguments

`mean`	n x p matrix of means. The number of rows is the number of observations. The number of columns is the dimension of the problem.
`sigma`	p x p covariance matrix.
`nu`	degrees of freedom for Student-t distribution.
`blc`	m x p matrix of coefficients for linear inequality constraints. If `NULL`, the p x p identity matrix will be used.

lower	n x m or 1 x m matrix of lower bounds for truncation.
upper	n x m or 1 x m matrix of upper bounds for truncation.
init	n x p or 1 x p matrix of initial values. If NULL, default initial values will be generated.
burn	number of burn-in iterations. Defaults to 10.
n	number of random samples when mean is a vector.

Value

Returns an n x p matrix of random numbers following the specified truncated multivariate t distribution.

Examples

```
# Example 1: full rank blc
d = 3;
rho = 0.5;
sigma = matrix(0, d, d);
sigma = rho^abs(row(sigma) - col(sigma));
nu = 10;
blc = diag(1,d);
n = 1000;
mean = matrix(rep(1:d,n), nrow=n, ncol=d, byrow=TRUE);
set.seed(1203)
result = rtmvt(mean, sigma, nu, blc, -1, 1, burn=50)
apply(result, 2, summary)

# Example 2: use the alternative form of input
set.seed(1203)
result = rtmvt(mean=1:d, sigma, nu, blc, -1, 1, burn=50, n)
apply(result, 2, summary)

# Example 3: non-full rank blc, different means
d = 3;
rho = 0.5;
sigma = matrix(0, d, d);
sigma = rho^abs(row(sigma) - col(sigma));
nu = 10;
blc = matrix(c(1,0,1,1,1,0), nrow=d-1, ncol=d, byrow=TRUE)
n = 100;
set.seed(3084)
mean = matrix(runif(n*d), nrow=n, ncol=d);
result = rtmvt(mean, sigma, nu, blc, -1, 1, burn=50)
apply(result, 2, summary)
```

rtnorm *Random Generation for Truncated Univariate Normal*

Description

Draws from truncated univariate normal distribution within an interval.

Usage

```
rtnorm(mean, sd = 1, lower, upper, n = NULL)
```

Arguments

mean	vector of means. The length is the number of observations.
sd	standard deviation. Defaults to 1.
lower	a scalar of lower bound for truncation, or a vector of lower bounds with the same length as mean.
upper	a scalar of upper bound for truncation, or a vector of upper bounds with the same length as mean.
n	number of random samples when mean is a scalar.

Value

Returns a vector of random numbers following the specified truncated univariate normal distribution.

Examples

```
set.seed(1203)
x = rtnorm(mean=rep(1,1000), sd=2, lower=-2, upper=3)
summary(x)

# use the alternative form of input
set.seed(1203)
x = rtnorm(mean=1, sd=2, lower=-2, upper=3, n=1000)
summary(x)
```

Index

rtmvnorm, 2
rtmvt, 4
rtnorm, 6

tmvtnsim-package, 2