Package 'RcppTN'

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Type Package

Title Rcpp-Based Truncated Normal Distribution RNG and Family

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Description R-level and C++-level functionality
to generate random deviates from and calculate moments of a
Truncated Normal distribution using the algo-
rithm of Robert (1995) <DOI:10.1007/BF00143942>.
In addition to RNG, functions for calculating moments, densities,
and entropies are provided at both levels.

URL http://github.com/olmjo/RcppTN

BugReports http://github.com/olmjo/RcppTN/issues

License GPL (>= 2)

Suggests testthat

LinkingTo Rcpp

Imports Rcpp

RoxygenNote 6.0.1

NeedsCompilation yes

Repository CRAN

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Contents

dtn *Truncated Normal Distribution Density*

Description

Calculate density of Truncated Normal distributions

Usage

```
dtn(.x = 0, .mean = rep(0, length(.x)), .sd = rep(1, length(.x)),
  .low = rep(-Inf, length(.x)), .high = rep(Inf, length(.x)),
  .checks = TRUE)
```

Arguments

.x	Length K vector of the points at which to evaluate the density
.mean	Length K vector with the means of the K Normal distributions *prior* to truncation
.sd	Length K vector with the standard deviations of the K Normal distributions *prior* to truncation
.low	Length K vector with the lower truncation bound of the K Normal distributions *prior* to truncation
.high	Length K vector with the upper truncation bound of the K Normal distributions *prior* to truncation
.checks	Logical indicating whether inputs and outputs should be checked and either stop (for bad inputs) or warn (for likely bad outputs)

Value

Length K vector with the entropies associated with each of the K Truncated Normal distributions

Author(s)

Jonathan Olmsted

Examples

```
lows <- c(-1, 5, -100, 4, 4, -100, 7)
highs <- c(1, 100, 10, 7, 4.1, 100, 100)
dtn(.x = rep(0, length(lows)),
    .mean = rep(0, length(lows)),
    .sd = rep(1, length(lows)),
    .high = highs
    )
```

enttn *Truncated Normal Distribution Entropy*

Description

Calculate entropy of Truncated Normal distributions

Usage

```
enttn(.mean = rep(0, 1), .sd = rep(1, length(.mean)), .low = rep(-Inf,
  length(.mean)), .high = rep(Inf, length(.mean)))
```

Arguments

.mean	Length K vector with the means of the K Normal distributions prior to truncation
.sd	Length K vector with the standard deviations of the K Normal distributions prior to truncation
.low	Length K vector with the lower truncation bound of the K Normal distributions prior to truncation
.high	Length K vector with the upper truncation bound of the K Normal distributions prior to truncation

Value

Length K vector with the entropies associated with each of the K Truncated Normal distributions

Author(s)

Jonathan Olmsted

Examples

```
lows <- c(-1, 5, -100, 4, 4, -100, 7)
highs <- c(1, 100, 10, 7, 4.1, 100, 100)
enttn(.mean = rep(0, length(lows)),
      .sd = rep(1, length(lows)),
      .low = lows,
      .high = highs
      )
```

etn *Truncated Normal Distribution Expectation*

Description

Calculate expectation of Truncated Normal distributions

Usage

```
etn(.mean = rep(0, 1), .sd = rep(1, length(.mean)), .low = rep(-Inf,
  length(.mean)), .high = rep(Inf, length(.mean)), .checks = TRUE)
```

Arguments

.mean	Length K vector with the means of the K Normal distributions prior to truncation
.sd	Length K vector with the standard deviations of the K Normal distributions prior to truncation
.low	Length K vector with the lower truncation bound of the K Normal distributions prior to truncation
.high	Length K vector with the upper truncation bound of the K Normal distributions prior to truncation
.checks	Length 1 logical vector indicating whether to perform checks (safer) or not (faster) on the input parameters

Details

The special values of -Inf and Inf are valid values in the .low and .high arguments, respectively.

Value

A length K vector of expectations corresponding to the Truncated Normal distributions. NAs are returned (with a warning) for invalid parameter values.

Author(s)

Jonathan Olmsted

Examples

```
etn() ## 0
etn(0, 1, -Inf, Inf) ## 0
etn(0, 1, -9999, 9999) ## 0

etn(0, 1, 0, Inf) ## 0.798

etn(0, 1, Inf, -Inf) ## NA with warning
```

```
etn(c(0, 0),
    c(1, 1),
    c(-Inf, 5),
    c(1, Inf)
    ) ## multiple expectations
```

---

rtn *Truncated Normal Distribution RNG*

Description

Sample from Truncated Normal distributions

Usage

```
rtn(.mean = rep(0, 1), .sd = rep(1, length(.mean)), .low = rep(-Inf,
  length(.mean)), .high = rep(Inf, length(.mean)), .checks = TRUE)
```

Arguments

.mean	Length K vector with the means of the K Normal distributions prior to truncation
.sd	Length K vector with the standard deviations of the K Normal distributions prior to truncation
.low	Length K vector with the lower truncation bound of the K Normal distributions prior to truncation
.high	Length K vector with the upper truncation bound of the K Normal distributions prior to truncation
.checks	Length 1 logical vector indicating whether to perform checks (safer) or not (faster) on the input parameters

Details

The special values of -Inf and Inf are valid values in the .low and .high arguments, respectively. The implementation is from Robert (1995). The computation is written in Rcpp-based C++ code, but respects R's RNG state. The draws from this function are reproducible because it respects R's RNG state. Draws using this algorithm (whether implemented in R code or C++) will be the same if seeded correctly. However, you should not expect these draws to match those from another algorithm.

Value

A length K vector of expectations corresponding to the Truncated Normal distributions. NAs are returned (with a warning) for invalid parameter values.

Author(s)

Jonathan Olmsted

References

Robert, Christian P. "Simulation of truncated normal variables". Statistics and Computing 5.2 (1995): 121-125. http://dx.doi.org/10.1007/BF00143942

Examples

```
set.seed(1)
rtn(0, 1, -Inf, Inf) # single draw from a single distribution

## [1] -0.6264538

set.seed(1)
rtn(0, 1, -Inf, Inf) # again, because it respects the RNG state

## [1] -0.6264538

rtn(rep(0, 3),
    rep(1, 3),
    rep(-Inf, 3),
    rep(Inf, 3)
    ) # multiple draws from a single distribution

## [1]  0.1836433 -0.8356286  1.5952808

rtn(c(0, 0),
    c(1, 1),
    c(-Inf, 5),
    c(1, Inf)
    ) # multiple draws, each from a different distribution
## [1] 0.3295078 5.3917301
```

---

vtn *Truncated Normal Distribution Variance*

Description

Calculate variance of Truncated Normal distributions

Usage

```
vtn(.mean = rep(0, 1), .sd = rep(1, length(.mean)), .low = rep(-Inf,
  length(.mean)), .high = rep(Inf, length(.mean)), .checks = TRUE)
```

Arguments

.mean	Length K vector with the means of the K Normal distributions prior to truncation
.sd	Length K vector with the standard deviations of the K Normal distributions prior to truncation
.low	Length K vector with the lower truncation bound of the K Normal distributions prior to truncation
.high	Length K vector with the upper truncation bound of the K Normal distributions prior to truncation
.checks	Length 1 logical vector indicating whether to perform checks (safer) or not (faster) on the input parameters

Details

The special values of -Inf and Inf are valid values in the .low and .high arguments, respectively.

Value

A length K vector of expectations corresponding to the Truncated Normal distributions. NAs are returned (with a warning) for invalid. parameter values.

Author(s)

Jonathan Olmsted

Examples

```
vtn() ## 1
vtn(0, 1, -Inf, Inf) ## 1
vtn(0, 1, -9999, 9999) ## 1

vtn(0, 1, 0, Inf) ## 0.36338

vtn(0, 1, Inf, -Inf) ## NA with warning

vtn(c(0, 0),
    c(1, 1),
    c(-Inf, 5),
    c(1, Inf)
    ) ## multiple variances
```

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