Package ‘RcppTN’

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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-
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
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R topics documented:

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**Description**

Calculate density of Truncated Normal distributions

**Usage**

```r
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**

```r
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)
```
Truncated Normal Distribution Entropy

Description

Calculate entropy of Truncated Normal distributions

Usage

\[
\text{enttn}(.\text{mean} = \text{rep}(0, 1), .\text{sd} = \text{rep}(1, \text{length}(.\text{mean})), .\text{low} = \text{rep}(-\infty, \text{length}(.\text{mean})), .\text{high} = \text{rep}(\infty, \text{length}(.\text{mean})))
\]

Arguments

- \text{.mean}: Length K vector with the means of the K Normal distributions prior to truncation
- \text{.sd}: Length K vector with the standard deviations of the K Normal distributions prior to truncation
- \text{.low}: Length K vector with the lower truncation bound of the K Normal distributions prior to truncation
- \text{.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

\[
\text{lows} <- \text{c}(-1, 5, -100, 4, 4, -100, 7) \\
\text{highs} <- \text{c}(1, 100, 10, 7, 4.1, 100, 100) \\
\text{enttn}(\text{.mean} = \text{rep}(0, \text{length}(\text{lows})), \\
\quad \text{.sd} = \text{rep}(1, \text{length}(\text{lows})), \\
\quad \text{.low} = \text{lows}, \\
\quad \text{.high} = \text{highs})
\]

Description

Calculate expectation of Truncated Normal distributions

Usage

\[
\text{etn}(.\text{mean} = \text{rep}(0, 1), .\text{sd} = \text{rep}(1, \text{length}(.\text{mean})), .\text{low} = \text{rep}(-\text{Inf}, \text{length}(.\text{mean})), .\text{high} = \text{rep}(<\text{Inf}, \text{length}(.\text{mean})), .\text{checks} = \text{TRUE})
\]

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

\[
\begin{align*}
\text{etn}() & \# \# 0 \\
\text{etn}(0, 1, -\text{Inf}, \text{Inf}) & \# \# 0 \\
\text{etn}(0, 1, -9999, 9999) & \# \# 0 \\
\text{etn}(0, 1, 0, \text{Inf}) & \# 0.798 \\
\text{etn}(0, 1, \text{Inf}, -\text{Inf}) & \# \text{NA with warning}
\end{align*}
\]
## multiple expectations

### rtn

#### Description

Sample from Truncated Normal distributions

#### Usage

```r
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.
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Author(s)
Jonathan Olmsted

References

Examples

```r
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

```r
evtn(.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

```r
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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