Package 'NTLKwIEx'

July 21, 2025

Type Package

Title Computation of NTLKwIEx Distribution Properties

Version 0.1.0

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Description Implements statistical tools for analyzing, simulating, and computing properties of the New Topp-Leone Kumaraswamy Inverse Exponential (NTLKwIEx) distribution. See Atchadé M, Otodji T, and Djibril A (2024) <doi:10.1063/5.0179458> and Atchadé M, Otodji T, Djibril A, and N'bouké M (2023) <doi:10.1515/phys-2023-0151> for details.

Depends R (>= 3.6.0), stats, dplyr, ggplot2

License GPL-2

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

VignetteBuilder knitr

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Language fr

Config/testthat/edition 3

NeedsCompilation no

Repository CRAN

Date/Publication 2024-02-05 19:30:07 UTC

Contents

`ConductorFailureTimes` *Dataset: ConductorFailureTimes*

Description

This dataset contains failure times measured in hours from an accelerated life test with 59 conductors.

Usage

```
data(ConductorFailureTimes)
```

Format

A numeric vector of failure times.

Details

This dataset contains failure times (measured in hours) obtained from an accelerated life test involving 59 conductors. The data are presented as a numeric vector.

References

Nasiri, B., et al. (2010). "Bayesian analysis of the accelerated life model with Type-II censoring." Journal of Statistical Planning and Inference, 140(6), 1565-1572.

Schafft, H. A., et al. (1987). "Reproducibility of the accelerated test for electric cable insulation." IEEE Transactions on Electrical Insulation, 22(5), 739-746.

`C_NTLKwIEx` *Cumulative Distribution Function (CDF) of the NTLKwIEx distribution*

Description

This function calculates the Cumulative density function (CDF) of the NTLKwIEx distribution.

Usage

```
C_NTLKwIEx(x, teta, alpha, a, b, m)
```

Arguments

x	Value up to which to calculate the CDF.
teta	Parameter teta of the distribution representing the distribution of the inverse exponential component.
alpha	Parameter alpha of the distribution representing the distribution of the new proposal component.
a	Parameter a of the distribution representing the distribution of the Kumaraswamy component.
b	Parameter b of the distribution representing the distribution of the Kumaraswamy component.
m	Parameter m of the distribution representing the distribution of the Topp Leone component.

Details

It takes parameters x, teta, alpha, a, b, and m, and returns the CDF value at x based on these parameters. The formula used for the calculation is provided in the documentation header. The Cumulative Distribution Function (CDF) of the NTLKwIEx distribution is defined as:

$$F(x; a, b, m, \alpha, \theta) = \left[1 - \left(1 - K(x, \xi)^{a\alpha^{K(x,\xi)}}\right)^{2b}\right]^m$$

where $\alpha, a, b, m, \theta > 0$.

Value

Value of the CDF for the NTLKwIEx distribution evaluated at x

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E_NTLKwIEx *Estimate parameters with constraints*

Description

This function estimates the parameters of the NTLKwIEx distribution while adhering to parameter constraints. It employs the maximum likelihood estimation method and returns estimated values for each parameter based on a given dataset and the specified constraints.

Usage

```
E_NTLKwIEx(data)
```

Arguments

data	Numeric vector of data values.

Value

Numeric vector of estimated parameters.

`Plot_CNTLKwIEx` *Graphical representation of the Cumulative Distribution Function (CDF) of the NTLKwIEx distribution*

Description

This function generates a plot of the Cumulative Distribution Function (CDF) of the NTLKwIEx distribution over a specified range of x values.

Usage

```
Plot_CNTLKwIEx(teta, alpha, a, b, m, min_x, max_x)
```

Arguments

`teta`	Parameter teta of the distribution
`alpha`	Parameter alpha of the distribution
`a`	Parameter a of the distribution
`b`	Parameter b of the distribution
`m`	Parameter m of the distribution
`min_x`	Minimum value of x for the plot
`max_x`	Maximum value of x for the plot

Value

A plot of the CDF of the NTLKwIEx distribution

`Plot_PNTLKwIEx` *Graphical representation of the probability density function (PDF) of the NTLKwIEx distribution*

Description

This function generates a graph of the probability density function (PDF) of the NTLKwIEx distribution over a specified range of x values.

Usage

```
Plot_PNTLKwIEx(teta, alpha, a, b, m, min_x, max_x)
```

Arguments

teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution
min_x	Minimum value of x for the graph
max_x	Maximum value of x for the graph

Value

A graph of the PDF of the NTLKwIEx distribution

P_NTLKwIEx *Probability Density Function (PDF) of the NTLKwIEx distribution*

Description

The Probability Density Function (PDF) of the NTLKwIEx distribution is defined as:

Usage

```
P_NTLKwIEx(x, teta, alpha, a, b, m)
```

Arguments

x	Value to evaluate the PDF at
teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution

Details

$$f(x,\theta,\alpha,a,b,m) = 2abm\frac{\theta}{x^2}\left(-\frac{\theta}{x}log\left(\alpha\right)+exp\left(\frac{\theta}{x}\right)\right)exp\left\{-\frac{\theta}{x}\left(1+a\alpha^{exp\left(-\frac{\theta}{x}\right)}\right)\right\}\left\{1-exp\left(-a\frac{\theta}{x}\alpha^{exp\left(-\frac{\theta}{x}\right)}\right)\right\}^{2b-}$$

Value

Value of the PDF for the NTLKwIEx distribution evaluated at x

Q_NTLKwIEx *Quantile Value of the NTLKwIEx distribution*

Description

This function calculates the quantile value of the NTLKwIEx distribution for a given probability p.

Usage

```
Q_NTLKwIEx(p, teta, alpha, a, b, m)
```

Arguments

p	Probability for which the quantile value is to be calculated (0 <= p <= 1)
teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution

Value

The quantile value corresponding to the probability p for the NTLKwIEx distribution

R_NTLKwIEx *Random Sampling from the NTLKwIEx distribution*

Description

This function generates random samples from the NTLKwIEx distribution based on the given parameters.

Usage

```
R_NTLKwIEx(n, teta, alpha, a, b, m)
```

Arguments

n	Number of random samples to generate
teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution

Value

A vector of n random samples from the NTLKwIEx distribution

`Sim_NTLKwIEx` *Estimate parameters with constraints*

Description

This function generates a histogram that depicts the distribution of the provided input data. Additionally, it estimates the parameters of a distribution that would correspond to the given data. By overlaying the estimated density function onto the histogram, Sim_NTLKwIEx enables an immediate comparison between the empirical distribution and the estimated one. Sim_NTLKwIEx proves to be a valuable tool for initial data exploration, streamlining trend identification, and understanding key features. Its usage comes recommended for tasks that require a swift exploratory analysis of data distributions.

Usage

```
Sim_NTLKwIEx(data)
```

Arguments

`data`	Numeric vector of data values.

Value

Numeric vector of estimated parameters.

Examples

```
Sim_NTLKwIEx(c(38.181,38.542,38.928,39.334,35.8))
```

Index