Package 'countDM'

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Type Package

Title Estimation of Count Data Models

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Imports lamW, stats, numbers, maxLik, miscTools

Description
The maximum likelihood estimation (MLE) of the count data models along with standard error of the estimates and Akaike information model section criterion are provided. The functions allow to compute the MLE for the following distributions such as the Bell distribution, the Borel distribution, the Poisson distribution, zero inflated Bell distribution, zero inflated Bell Touchard distribution, zero inflated Poisson distribution, zero one inflated Bell distribution and zero one inflated Poisson distribution. Moreover, the probability mass function (PMF), distribution function (CDF), quantile function (QF) and random numbers generation of the Bell Touchard and zero inflated Bell Touchard distribution are also provided.

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`countDM-package` *Estimation of Count Data Models*

Description

It gives the maximum likelihood estimates and the corresponding estimate's standard error. It also provides the Akaike information model section criterion. With the help of these functions, the MLE can be calculated for a variety of distributions, including the Borel distribution, the Poisson distribution, zero infated Bell distribution, zero inflated Bell Touchard distribution, zero inflated Poisson distribution, zero one inflated Bell distribution and zero one inflated Poisson distribution. Moreover, the probability mass function, distribution function, quantile function and random numbers generation of the Bell Touchard and zero inflated Bell Touchard distribution are also provided.

Details

Package:	countDM
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Maintainers

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Author(s)

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Bell *MLE of the Bell distribtion*

Description

Evaluates the maximum likelihood estimate of the Bell distribtion. The PMF of the Bell distribution is as follows:

$$f(X = x \mid \theta) = \frac{\theta^x e^{e^\theta + 1} B_x}{x!}; \qquad x = 0, 1, 2, \ldots,$$

where $\theta > 0$ denotes the Bell parameter and B_x is the Bell number and it is given by

$$B_n = \frac{1}{e} \sum_{k=0}^{\infty} \frac{k^n}{k!}.$$

The Bell number B_n in the above equation is the nth moment of the Poisson distribution with parameter equal to 1.

Usage

```
bell_mle (x)
mle.bell (x, theta)
```

Arguments

x	A vector of (non-negative integer) discrete values.
theta	A vector of (non-negative integer) values.

Details

The function allows to estimate the unknown parameter of the Bell distribution with loglik value using a Newton-Raphson algorithm.

Value

bell_mle gives the maximum liklihood estimate of parameter theta. loglik gives value of the maximised log-likelihood. The mle.bell gives the maximum liklihood estimate with standard error and AIC,

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Ferrari, S. L., & Lemonte, A. J. (2018). On the Bell distribution and its associated regression model for count data. Applied Mathematical Modelling, 56, 172-185.

See Also

mle_borel, mle_poisson

Examples

```
x <- data_sbirth
bell_mle (x)
mle.bell (x, 1.2)
```

Bell Touchard	*PMF, CDF, QF, random generation and parameters estimation based on the Bell Touchard distribution*

Description

Evaluates the PMF, CDF, QF, random generation and MLE based on the Bell Touchard distribution. The PMF of the Bell Touchard distribution is as follows:

$$f\left(X = x \mid \lambda, \theta\right) = \exp\left\{\theta\left[1 - e^{\lambda}\right]\right\} \frac{\lambda^{x}\, T_{x}\left(\theta\right)}{x!}; \qquad x = 0, 1, 2, \ldots,$$

where $\lambda > 0$ and $\theta > 0$ are the two parameters and T_x are the Touchard polynomials, it is given by

$$T_n = \frac{1}{e} \sum_{k=0}^{\infty} \frac{k^n}{k!}.$$

It is important to note that when the parameter $\theta = 1$, the Bell Touchard distribution reduces to Bell distribution.

Usage

```
dbellt (x, lambda, theta, log = FALSE)
pbellt (q, lambda, theta, lower.tail = TRUE, log.p = FALSE)
qbellt (p, lambda, theta, lower.tail = TRUE, log.p = FALSE)
rbellt (n, lambda, theta)
mle_bt (x, lambda, theta)
```

Arguments

x	A vector of (non-negative integer) discrete values.
lambda	A vector of (non-negative integer) values, $\lambda > 0$.
theta	A vector of (non-negative integer) values, $\theta > 0$.
q	A probablity or a vector of probablities.
p	A probablity or a vector of probablities.
n	A randomly generated values.
lower.tail	logical; if TRUE (default), probabilities will be P [X <= x], otherwise, P [X> x].
log	logical; if TRUE, probabilities p are given as log(p).
log.p	logical; if TRUE, probabilities p are given as log(p).

Details

Recently Castellares et al. (2020) proposed a two parameter discrete Bell Touchard distribution that overcomes the issue of over-dispersion (variance larger than mean). Often, we experience the over-dispersed data in practice, where the Poisson model may not be suitable because its variance is restricted to be equal to mean. The PMF of the Bell Touchard distribution is simple and tractible in order to find probablities as well as several properties of the distribution.

Value

dbellt gives the (log) probability function. pbellt gives the (log) distribution function. qbellt gives the quantile function. rbellt generates random values. mle_bt gives the maximum likelihood estimates with standard error of the estimates and model selection measure, the Akaike information criterion (AIC).

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Lemonte, A. J., & Moreno–Arenas, G. (2020). On the two-parameter Bell–Touchard discrete distribution. Communications in Statistics-Theory and Methods, 49(19), 4834-4852.

Castellares, F., Ferrari, S. L., & Lemonte, A. J. (2018). On the Bell distribution and its associated regression model for count data. Applied Mathematical Modelling, 56, 172-185.

See Also

`mle_borel`, `mle_poisson`, `bell_mle`

Examples

```
x<-2
dbellt (x, 2, 2)
pbellt (0.2, 2, 2)
pbellt (0.2, 2, 2)
rbellt (10, 2, 1)
x <- data_sbirth
mle_bt (x, 0.12, 0.2)

# Plot of PMF of the Bell Touchard distribution for selected parameteric values.
# The Bell Touchard distribution reduces to the Bell distribution for fixing theta=1.
x <- 0:50
lambda <- 2
theta <- 1.5

plot(dbellt(x, lambda, theta), type = "h", col="red",lwd = 3,
     main = "Bell Touchard distribution",
     ylab = "P(X = x)", xlab = "Number of events")
```

```
legend("topright",c(expression(lambda==2~~theta==1.5)),lty=1, col="red", lwd=2,cex=1.0)
```

Borel *MLE of the Borel distribution*

Description

Evaluates the MLE of the Borel distribution. It is defined by the following PMF:

$$f(X = x \mid \alpha) = \frac{(\alpha x)^{x-1} \, e^{-\alpha x}}{x!}; \qquad x = 1, 2, \ldots,$$

where the parameter $\alpha \in (0, 1)$.

Usage

```
mle_borel (x, alpha)
```

Arguments

x	A vector of (non-negative integer) discrete values.
alpha	A vector of (non-negative integer) values, $\alpha \in (0, 1)$.

Details

The function allows to estimate the unknown parameter of the Borel distribution with standard error of the estimate and model selection measure, the Akaike information criterion (AIC).

Value

mle_borel gives the MLE along with standard error of the estimate and model selction measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Tanner, J. C. (1961). A derivation of the Borel distribution. Biometrika, 48(1/2), 222-224.

See Also

mle.bell, mle_poisson

Examples

```
x <- c(rep(1,48), rep(2,20), rep(3,7), rep(4,5),rep(5,2),rep(6,6))
mle_borel (x, 0.8)
```

`Criminal acts` *The crime sociology consisting a sample of 4301 people with deviating behavior*

Description

The data set from crime sociology consisting a sample of 4301 people with deviating behavior.

Usage

```
data_criminal
```

Arguments

`data_criminal` A vector of (non-negative integer) count values.

Details

The data set from crime sociology consisting a sample of 4301 people with deviating behavior. Recently, it is used by Zhang et al. (2016), fitted the zero one inflated Poisson distribution.

Value

data_criminal gives the crime sociology consisting a sample of 4301 people with deviating behavior.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Zhang, C., Tian, G. L., & Ng, K. W. (2016). Properties of the zero-and-one inflated Poisson distribution and likelihood-based inference methods. Statistics and its interface, 9(1), 11-32.

See Also

`data_sbirth`

Examples

```
x <- data_criminal
table (x)
```

Poisson *MLE of the Poisson distribution*

Description

Evaluates the MLE of the Poisson distribtion. The PMF of the Poisson distribution is as follows:

$$f(X = x \mid \theta) = \frac{\theta^x e^{-\theta}}{x!}; \qquad x = 0, 1, 2, \ldots,$$

where parameter $\theta > 0$ and it is equal to the expected or mean value of X and also to its variance.

Usage

```
mle_poisson (x, theta)
```

Arguments

x	A vector of (non-negative integer) discrete values.
theta	A vector of (non-negative integer) values, $\theta > 0$.

Details

The function allows to estimate the unknown parameter of Poisson distribution with standard error of the estimate and model selection measure, the Akaike information criterion (AIC).

Value

mle_poisson gives the MLE along with standard error of the estimate and model selection measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Frank A. Haight (1967). Handbook of the Poisson Distribution. New York: John Wiley & Sons.

See Also

mle.bell, mle_borel

Examples

```
x <- data_sbirth
mle_poisson (x, 0.2)
```

Stillbirths *Still births of New Zealand white rabbits*

Description

The number of stillbirths of New Zealand white rabbits.

Usage

```
data_sbirth
```

Arguments

data_sbirth	A vector of (non-negative integer) count values.

Details

The data set consists of frequencies of still births in 402 litters of New Zealand white rabbits, originally used by Morgan et al. (2007).

Value

data_sbirth gives the frequencies of still births in 402 litters of New Zealand white rabbits.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Morgan, B. T., Palmer, K. J., & Ridout, M. S. (2007). Negative score test statistic. The American Statistician, 61(4), 285-288.

Alshkaki, R. S. A. (2016). On the zero-one inflated Poisson distribution. Int J Stat Distrib Appl, 2(4), 42-8.

Pudprommarat, C. (2020, March). Zero-one inflated negative binomial-Sushila distribution and its application. In International Academic Multidisciplinary Research Conference in Rome 2020 (pp. 20-28).

See Also

data_criminal

Examples

```
x <- data_sbirth
table (x)
```

`Touchard polynomials` *Touchard polynomials*

Description

The function allows to compute the Touchard polynomial. It is mathematically defined by

$$T_x\left(\theta\right) = \frac{1}{e^{\theta}} \sum_{k=0}^{\infty} \frac{k^x}{k!} \theta^k.$$

The first few Touchard polynomials are as follows:

$$\begin{cases} T_0\left(\theta\right) & = & 1 \\ T_1\left(\theta\right) & = & \theta \\ T_2\left(\theta\right) & = & \theta^2 & + & \theta \\ T_3\left(\theta\right) & = & \theta^3 & + & 3\theta^2 & + & \theta \\ T_4\left(\theta\right) & = & \theta^4 & + & 6\theta^3 & + & 7\theta^2 & + & \theta. \end{cases}.$$

Usage

```
TP (x, theta)
```

Arguments

`x`	A vector of (non-negative integer) discrete values.
`theta`	A vector of (non-negative integer) values.

Details

The function allows to provide the Touchard polynomials.

Value

TP gives the Touchard polynomials after specifying parameteric value.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Lemonte, A. J., & Moreno–Arenas, G. (2020). On the two-parameter Bell–Touchard discrete distribution. Communications in Statistics-Theory and Methods, 49(19), 4834-4852.

Examples

```
TP (2,3)
```

`Zero inflated Bell` *MLE of the zero inflated Bell distribtion*

Description

Evaluates the MLE of the zero inflated Bell (ZIBELL) distribtion. The PMF of the ZIBELL distribution is as follows:

$$f\left(X=x \mid \alpha,\, \lambda\right)=\begin{cases}\alpha+(1-\alpha)\exp\left\{\theta\left[1-e^{\lambda}\right]\right\}, & x=0\\ (1-\alpha)\exp\left\{\theta\left[1-e^{\lambda}\right]\right\}\frac{\lambda^{x}\,B_{x}}{x!}, & x=1,2\cdots,\end{cases}$$

where $\alpha \in (0,1)$, $\lambda > 0$ and B_x are the Bell numbers and it is given by

$$B_n=\frac{1}{e}\sum_{k=0}^{\infty}\frac{k^n}{k!}.$$

Usage

```
mle_zibell (x, alpha, lambda)
```

Arguments

`x`	A vector of (non-negative integer) values, discrete values.
`lambda`	A vector of (non-negative integer) values, $\lambda > 0$.
`alpha`	A vector of (non-negative integer) values, $\alpha \in (0,1)$.

Details

The function allows to estimate the unknown parameter of the ZIBELL distribution with standard error of the estimate and model selection measure, the Akaike information criterion (AIC).

Value

mle_zibell gives the MLE along with standard error of the estimate and model selction measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Ferrari, S. L., & Lemonte, A. J. (2018). On the Bell distribution and its associated regression model for count data. Applied Mathematical Modelling, 56, 172-185.

See Also

mle_zibellt

Examples

```
x <- data_sbirth
mle_zibell (x, 0.2, 1.5)
```

Zero inflated Bell Touchard

MLE of the zero inflated Bell Touchard distribution

Description

Evaluates the maximum likelihood estimate of the zero inflated Bell Touchard (ZIBELLT) distribution. The PMF of the ZIBELLT distribution is as follows:

$$f\left(X=x \mid p_i,\, \lambda, \theta\right) = \begin{cases} p_i + (1-p_i)\exp\left\{\theta\left[1-e^{\lambda}\right]\right\}, & x=0 \\ (1-p_i)\exp\left\{\theta\left[1-e^{\lambda}\right]\right\}\frac{\lambda^x T_x(\theta)}{x!}, & x=1,2\cdots, \end{cases}$$

where $pi \in (0,1)$, $\lambda > 0$ and $\theta > 0$ T_x are the Touchard polynomials, it is given by

$$T_n = \frac{1}{e}\sum_{k=0}^{\infty}\frac{k^n}{k!}.$$

It is important to note that when the parameter $\theta = 1$, the ZIBELLT distribution reduces to ZIBELL distribution. On the other side, when the parameter $\theta = 1$ and pi=0, the ZIBELLT distribution reduces to BELL distribution. So therefore, we can evaluate the PMF, CDF, QF and random numbers of the Bell and ZIBELL distribution by using the following functions.

Usage

```
dzibellt (x, lambda, theta, pi, log = FALSE)
pzibellt (q, lambda, theta, pi, lower.tail = TRUE, log.p = FALSE)
qzibellt (p, lambda, theta, pi, lower.tail = TRUE, log.p = FALSE)
rzibellt (n, lambda, theta, pi)
mle_zibellt (x, lambda, theta, pi)
```

Arguments

x	A vector of (non-negative integer) discrete values.
lambda	A vector of (non-negative integer) values, $\lambda > 0$.
theta	A vector of (non-negative integer) values, $\theta > 0$.
n	The number of random values generated under zero inflated Bell Touchard distribution.
pi	A vector of (non-negative integer) values, $pi \in (0,1)$.

`q`	A vector of (non-negative integer) probablities.
`p`	A vector of (non-negative integer) probablities.
`lower.tail`	logical; if TRUE (default), probabilities will be P [X <= x], otherwise, P [X> x].
`log`	logical; if TRUE, probabilities p are given as log(p).
`log.p`	logical; if TRUE, probabilities p are given as log(p).

Details

Recently Castellares et al. (2020) proposed a two parameter discrete Bell Touchard distribution that overcomes the issue of over-dispersion (variance larger than mean). Often, we experience the over-dispersed data in practice, where the Poisson model may not be suitable because its variance is restricted to be equal to mean. The PMF of the Bell Touchard distribution is simple and tractible in order to find probablities as well as several properties of the distribution. We extend it to the ZIBELLT distribution and evaluated by the following functions.

Value

dzibellt gives the (log) probability function. pzibellt gives the (log) distribution function. qzibellt gives the quantile function. rzibellt generates random values. mle_zibell gives the maximum likelihood estimates with standard error of the estimates and model selection measure, the Akaike information criterion (AIC).

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran <imranshakoor84@yahoo.com> and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Lemonte, A. J., & Moreno–Arenas, G. (2020). On the two-parameter Bell–Touchard discrete distribution. Communications in Statistics-Theory and Methods, 49(19), 4834-4852.

Castellares, F., Ferrari, S. L., & Lemonte, A. J. (2018). On the Bell distribution and its associated regression model for count data. Applied Mathematical Modelling, 56, 172-185.

See Also

`mle_zibell`

Examples

```
dzibellt (2, 0.12, 0.2,0.2)

x <- data_sbirth
mle_zibellt (x, 0.15,1.8,1.05)

# Plot of PMF of the ZIBELLT distribution for selected parameteric values.
# The ZIBELLT distribution reduces to the ZIBELL distribution for fixing theta=1.
```

```
x <- 0:30
lambda <- 1.2
theta <- 1.2
pi <- 0.01
plot(dzibellt(x, lambda, theta, pi), type = "h", col="red",lwd = 3,
     main = "Zero inflated Bell Touchard distribution",
     ylab = "P(X = x)", xlab = "Number of events")

legend("topright",c(expression(lambda==2~~theta==1.5~~pi==0.01)),
lty=1, col="red", lwd=2,cex=1.0)
```

`Zero inflated Poisson` *MLE of the zero inflated Poisson distribtion*

Description

Evaluates the MLE of the zero inflated Poisson (ZIP) distribtion. The PMF of the ZIP is as follows:

$$f\left(X=x \mid \alpha,\,\theta\right)=\begin{cases}\alpha+\left(1-\alpha\right)e^{-\theta}, & x=0\\ \left(1-\alpha\right)\frac{\theta^{x}e^{-\theta}}{x!}, & x=1,2\cdots,\end{cases}$$

where $\alpha \in (0,1)$ denotes the probability of extra zeros and $\theta > 0$ is a Poisson parameter, which is also its mean and variance.

Usage

```
mle_zip (x, alpha, theta)
```

Arguments

`x`	A vector of (non-negative integer) discrete values.
`theta`	A vector of (non-negative integer) values, $\theta > 0$.
`alpha`	A vector of (non-negative integer) values, $\alpha \in (0,1)$.

Details

The function allows to estimate the unknown parameter of the ZIP distribution with standard error of the estimate and model selection measure, the Akaike information criterion (AIC).

Value

mle_zip gives the MLE along with standard error of the estimate and model selction measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Beckett, S., Jee, J., Ncube, T., Pompilus, S., Washington, Q., Singh, A., & Pal, N. (2014). Zero-inflated Poisson (ZIP) distribution: Parameter estimation and applications to model data from natural calamities. Involve, a Journal of Mathematics, 7(6), 751-767.

See Also

mle_zibell, mle_zibellt

Examples

```
x <- data_sbirth
mle_zip (x, 0.2, 1.5)
```

`Zero one inflated Bell` *MLE of the zero one inflated Bell distrubution*

Description

Evaluates the MLE of the zero one inflated Bell (ZOIBELL)distribtion.

$$f\left(X=x \mid \alpha,\, \beta,\, \theta\right)=\begin{cases}\alpha+(1-\alpha-\beta)\exp\left(1-e^{\theta}\right), & x=0\\ \beta+(1-\alpha-\beta)\,\theta\exp\left(1-e^{\theta}\right), & x=1\\ (1-\alpha-\beta)\exp\left(1-e^{\theta}\right)\frac{\theta^x\,B_x}{x!}, & x=2,3,\ldots,\end{cases}$$

where $\theta > 0$, the two parameters $\alpha \in (0,1)$ and $\beta \in (0,1)$, respectively, denotes the unknown proportion for incorporating extra zeros and extra ones than those allowed by the traditional Bell distribution.

Usage

```
mle_zoibell (x, alpha, beta, theta)
```

Arguments

`x`	A vector of (non-negative integer) values, discrete values.
`theta`	A vector of (non-negative integer) values, $\theta > 0$.
`alpha`	A vector of (non-negative integer) values, $\alpha \in (0,1)$.
`beta`	A vector of (non-negative integer) values, $\beta \in (0,1)$.

Details

Inflated models have become quite popular in the recent applied statistical literature. In many scientific studies, we often experience situations, the data consists of a large proportion of zeros and ones. Castellares et al. proposed a single-parameter discrete Bell distribution. We extended the Bell distribution into zero one inflated Bell distribution.

Value

mle_zoibell gives the MLE along with standard error of the estimate and model selction measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Castellares, F., Ferrari, S. L., & Lemonte, A. J. (2018). On the Bell distribution and its associated regression model for count data. Applied Mathematical Modelling, 56, 172-185.

See Also

mle_zoip

Examples

```
x <- data_sbirth
mle_zoibell (x, 0.1,0.2,0.2)
```

`Zero one inflated Poisson` *MLE of the zero one inflated Poisson distrubution*

Description

Evaluates the MLE of the zero one inflated Poisson (ZOIP)distribtion.

$$f\left(X=x\mid\alpha,\,\beta,\,\theta\right)=\begin{cases}\alpha+\left(1-\alpha-\beta\right)e^{-\theta}, & x=0\\ \beta+\left(1-\alpha-\beta\right)\theta e^{-\theta}, & x=1\\ \left(1-\alpha-\beta\right)e^{-\theta}\frac{\theta^{x}}{x!}, & x=2,3,\ldots\end{cases}$$

where $\theta > 0$, the two parameters $\alpha \in (0,1)$ and $\beta \in (0,1)$, respectively denotes the unknown proportion for incorporating extra zeros and extra ones than those allowed by the traditional Poisson distribution.

Usage

```
mle_zoip (x, alpha, beta, theta)
```

Arguments

`x`	A vector of (non-negative integer) values, discrete values.
`alpha`	A vector of (non-negative integer) values, $\alpha \in (0, 1)$.
`beta`	A vector of (non-negative integer) values, $\beta \in (0, 1)$.
`theta`	A vector of (non-negative integer) values, $\theta > 0$.

Details

The function allows to estimate the unknown parameter of the ZOIP distribution with standard error of the estimate and model selection measure, the Akaike information criterion (AIC).

Value

mle_zoip gives the MLE along with standard error of the estimate and model selction measure AIC.

Author(s)

Muhammad Imran and M.H. Tahir.

R implementation and documentation: Muhammad Imran `<imranshakoor84@yahoo.com>` and M.H. Tahir <mht@iub.edu.pk>.

References

Zhang, C., Tian, G. L., & Ng, K. W. (2016). Properties of the zero-and-one inflated Poisson distribution and likelihood-based inference methods. Statistics and its interface, 9(1), 11-32.

Tang, Y., Liu, W., & Xu, A. (2017). Statistical inference for zero-and-one-inflated Poisson models. Statistical Theory and Related Fields, 1(2), 216-226.

Alshkaki, R. S. A. (2016). On the zero-one inflated Poisson distribution. Int J Stat Distrib Appl, 2(4), 42-8.

See Also

`mle_zoibell`

Examples

```
x <- data_sbirth
mle_zoip (x, 0.2,0.1, 0.5)
```

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