Package ‘poistweedie’

November 30, 2023

Version 1.0.2

Date 2010-02-28

Title Poisson-Tweedie Exponential Family Models

Author David Pechel Cactcha, Laure Pauline Fotso and Celestin C Kokonendji

Maintainer David Pechel Cactcha <davidpechel@uy1.uninet.cm>

Depends R (>= 2.10.0)

Description Simulation of models Poisson-Tweedie.

License GPL (>= 2)

URL https://CRAN.R-project.org/package=poistweedie

Repository CRAN

Date/Publication 2023-11-30 15:49:31 UTC

Encoding UTF-8

NeedsCompilation no

R topics documented:

`dpoistweedie` *The individual probabilities of Y when Y follows a Poisson-Tweedie Distributions*

Description

Let X be a non-negative random variable following $\mathcal{T}_P(\theta, \lambda)$. If a discrete random variable Y is such that the conditional distribution of Y given X is Poisson with mean X, then the EDM generated by the distribution of Y is of the Poisson-Tweedie class. For $p >= 1$ individual probabilities of $Y \sim \mathcal{PT_P}(\theta, \lambda)$ when Y follows a Poisson-Tweedie Distributions are: $Pr(Y = y) = \int_0^\infty \frac{e^{-x}x^y}{y!}\mathcal{T}_P(\theta, \lambda)d(x), y = 0, 1,.$
For p = 1, it is a Neyman type A distribution; for $1 < p < 2$, then Poisson-compound Poisson distribution is obtained; for p = 2,the Poisson-Tweedie model $PT_2\left(\mu, \lambda\right)$ correspond to the negative binomiale law $BN\left(\lambda, \frac{1}{1+\mu}\right)$; and, for p = 3, it is the Sichel or Poisson-inverse Gaussian distribution (e.g. Willmot, 1987). Also, when $p \longrightarrow \infty$, $\lambda = \frac{\mu\times(1-\theta_0)}{1+\mu}$ and the $\lambda = \mu \simeq -\theta_0$, the Poisson-Tweedie model $PT_p\left(\mu, \lambda\right)$ correspond to the poisson law $P_y\left(\lambda^2\right)$.

Usage

```
dpoistweedie(y, p, mu, lambda, theta0, log)
       densitept1(p, n, mu, lambda, theta0)
       densitept2(p, n, mu, lambda, theta0)
       dpt1(p, n, mu, lambda, theta0)
       dpt1Log(p, n, mu, lambda, theta0)
       dpt2(p, n, mu, lambda, theta0)
       dpt2Log(p, n, mu, lambda, theta0)
       dptp(p, n, mu, lambda, theta0)
       dptpLog(p, n, mu, lambda, theta0)
       gam1.1(y, lambda)
       gam1.2(y, lambda)
       imfx0(x0,p,mu,theta0)
       moyennePT(p,omega,theta0)
       omega(p,mu,theta0)
       testOmegaPT(p,n)
```

Arguments

y	vector of (non-negative integer) quantiles $Y = (y1, y2, ..., yn)\ where\ \ yii = 1, 2, ..., n$ are the integer.
p	is a real index related to a precise model $p >= 1$.
n	non-negative integer (length of y)
x0	is a real index
mu	the mean$\mu \in R^+$, .

`omega`	is a real index.$\omega \in R$
`lambda`	the dispersion parameter $\lambda \in R, \lambda > 0$.
`theta0`	the canonical parameter $\theta_0 \in R^-$.
`log`	logical; if TRUE, probabilities y are given as log(y).

Details

The Poisson-Tweedie distributions arethe EDMs with a variance of the form $V_p^{\mathcal{PT}}(\mu) = \mu + \mu^p \exp\{(2-p)\Phi_p(\mu)\}, \mu > 0$, where $\Phi_p(\mu)$ a generally implicit, denotes the inverse of the increansing function $\omega \longrightarrow \frac{d\{\ln IE(e^{wy})\}}{dw}$. omega(p,mu,theta0) is a function whose permit to determine the value of w.

Value

density (`dpoistweedie`),for the given Poisson-Tweedie distribution with parameters

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

References

Dunn, Peter K and Smyth, Gordon K (To appear). Series evaluation of Tweedie exponential dispersion model densities *Statistics and Computing*.

Dunn, Peter K and Smyth, Gordon K (2001). Tweedie family densities: methods of evaluation. *Proceedings of the 16th International Workshop on Statistical Modelling*, Odense, Denmark, 2–6 July

Hougaard, P., Lee, M-L.T. and Whitmore, G.A. (1997). Analysis of overdispersed count data by mixtures of Poisson variables and Poisson processes, *Biometrics* **53**, 1225–1238

Jorgensen, B. (1987). Exponential dispersion models. *Journal of the Royal Statistical Society*, B, **49**, 127–162.

Kokonendji, C.C., Demeetrio, C.G.B. and Dossou-Gbete, S. (2004). Some discrete exponential dispersion models: Poisson-Tweedie and Hinde-Demetrio classes. SORT: Statistics and Operations Research Transactions **28** (2), 201–214.

See Also

`ppoistweedie`

Examples

```
## dpoistweedie(y, power, mu,lambda,theta0,log = FALSE)
## Plot dpois() and dpoistweedie() with  log=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(2)
power <- exp(10)
```

```
mu <-10
lambda <- 10
theta0<--10
lambda1<-100
y <- 0:200
## plot  dpoistweedie function with log = FALSE
d1<-dpoistweedie(y,power,mu,lambda,theta0,log = FALSE)
d2<-dpois(y,lambda1,log=FALSE)
erreure<-d1-d2
plot (y,d1,col='blue', type='h',xlab="y
   avec  y=0:200,  power=exp(30),mu=10, lambda=10,
   theta0=-10,  lambda1=100", ylab="densite P(100)",
   main = "dpoistweedie(*,col='blue' log=FALSE)
   et dpois(*,col='red' log=FALSE)")
lines(y,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))



## Plot dnbinom() and dpoistweedie()
layout(matrix(1 :1, 1, 1))
layout.show(2)
power<-2
mu<-10
lambda <- 1
theta0<-0
prob<-1-(mu/(1+mu))
y <- seq(0,50, by =3)
## plot a dpoistweedie function with log=FALSE
d1<-dpoistweedie(y,power,mu,lambda,theta0,log=FALSE)
d2<-dnbinom(y,lambda,prob, log=FALSE)
erreure<-d1-d2
plot (y,d1,col='blue', type='h',xlab="y
   avec  y=seq(0,50,by=3),  power=2,mu=10,
   lambda=1, thetao=0", ylab="densite NB(1,1/11)"
   ,main = "dnpoistweedie(*,col='blue' log=FALSE)
   et dnbinom(*,col='red' log=FALSE)")
lines(y,d2,type ="p",col='red',lwd=2)
abs(erreure)
```

`poistweedie` *Poisson-Tweedie (Some discrete exponential dispersion models)*

Description

Density, Log of density, variance for the Poisson-Tweedie family of distributions

Usage

```
poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE, log.p = FALSE,
    fonction = "PROBABILITE")
poisson(x, n, p, lambda1, lower.tail = TRUE, log.p = FALSE,
    fonction = "PROBABILITE")
nbinomiale(x, n, p, lambda1, p1, lower.tail = TRUE, log.p = FALSE,
    fonction = "PROBABILITE")
```

Arguments

`x`	vector of (non-negative integer) quantiles.
`p`	is a real index related to a precise model.
`p1`	is a real index related to a precise model.
`n`	non-negative integer
`mu`	the mean.
`lambda`	the dispersion parameter.
`lambda1`	the dispersion parameter.
`theta0`	the canonical parameter.
`log, log.p`	logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	logical; if TRUE (default), probabilities are P[X <= x], otherwise, P[X > x].
`fonction`	is a string

Details

Density, Log of density, variance for the Poisson-Tweedie family of distributions

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

See Also

dpoistweedie, ppoistweedie

Examples

```
## poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE,
##             log.p = FALSE, fonction = "PROBABILITE")
x <- 0:200
p <- 1.5
mu <-10
lambda <- 10
theta0<--10
d1<-poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE,
log.p = FALSE, fonction = "PROBABILITE")
```

ppoistweedie *Distribution function for the Poisson-Tweedie family*

Description

Distribution function, for the Poisson-Tweedie family of distributions

Usage

```
ppoistweedie(q, p, mu, lambda, theta0, lower.tail, log.p)
```

Arguments

q	vector of quantiles.
p	is a real index related to a precise model.
mu	the mean.
lambda	the dispersion parameter.
theta0	the canonical parameter.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are P[X <= x], otherwise, P[X > x].

Details

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models.

Value

probability (ppoistweedie), for the given Poisson-Tweedie distribution with parameters

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

See Also

qpoistweedie

Examples

```
## function ppoistweedie(q, power, mu,lambda,theta0,
## lower.tail = TRUE, log.p = FALSE)
## Plot ppois() et ppoistweedie() avec log.p=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(1)
power<-exp(30)
mu<-5
lambda <- 5
theta0<--5
prob<-1-(mu/(1+mu))
lambda1<-lambda^2
q <- 0:100
## function ppoistweedie function with log=FALSE
d1<-ppoistweedie(q,power,mu,lambda,theta0,lower.tail=TRUE,log.p=FALSE)
d2<-ppois(q,lambda1,lower.tail=TRUE,log.p=FALSE)
erreure<- d1-d2
plot (q,d1,col='blue', type='h',xlab="q
 avec  q=0:100,  power=exp(30),mu=5, lambda=5,
 theta0=-5, lambda1=25", ylab="fonction de
 repartition P(25)",main = "ppoistweedie(*,col='blue' log=FALSE)
 et ppois(*,col='red' log=FALSE)")
lines(q,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))
```

`qpoistweedie` *Quantile function for the Poisson-Tweedie family of distributions*

Description

Quantile function for the Poisson-Tweedie family of distributions

Usage

```
qpoistweedie(p1, p, mu, lambda, theta0, lower.tail, log.p)
```

Arguments

`p1`	vector of probabilities.
`p`	is a real index related to a precise model.
`mu`	the mean.
`lambda`	the dispersion parameter.
`theta0`	the canonical parameter.
`log, log.p`	logical; if TRUE, probabilities p are given as log(p).
`lower.tail`	logical; if TRUE (default), probabilities are P[X <= x], otherwise, P[X > x].

Details

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models. T

Value

quantile (qpoistweedie) for the given Poisson-Tweedie distribution with parameters

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

See Also

poistweedie

Examples

```
## function qpoistweedie(p, power, mu,lambda,theta0,
## lower.tail = TRUE, log.p = FALSE)
## Plot qpois() and qpoistweedie() with log.p=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(1)
power<-exp(30)
mu<-10
lambda <- 10
theta0<--10
prob<-1-(mu/(1+mu))
lambda1<-100
p <- runif(50)
p
## plot of qpoistweedie function with log=FALSE
d1<-ppoistweedie(p,power,mu,lambda,theta0,lower.tail=TRUE,log.p=FALSE)
d2<-ppois(p,lambda1,lower.tail=TRUE,log.p=FALSE)
erreure<- d1-d2
plot (p,d1,col='blue', type='h',xlab="p
   avec  p=runif(50),  power=exp(30),mu=10, lambda=10,
   theta0=-10, lambda1=100, lower.tail=TRUE",
   ylab="quantile function P(100)",main =
   "qpoistweedie(*,col='blue' log.p=FALSE)
   et qpois(*,col='red' log.p=FALSE)")
lines(p,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))
```

`rpoistweedie` *Random generation for the Poisson-Tweedie family of distributions*

Description

Random generation for the Poisson-Tweedie family of distributions

Usage

```
rpoistweedie(n, p, mu, lambda, theta0)
```

Arguments

`n`	number of random values to return.
`p`	vector of probabilities.
`mu`	the mean.
`lambda`	the dispersion parameter.
`theta0`	the canonical parameter.

Details

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models.

Value

random sample (`rpoistweedie`) for the given Poisson-Tweedie distribution with parameters

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

See Also

`varpt`

Examples

```
## --------------- function rpoistweedie()---------------- ##
layout(matrix(2 :1, 2,1))
layout.show(2)
power<-exp(30)
mu<-10
lambda <- 10
theta0<--10
```

```
prob<-1-(mu/(1+mu))
lambda1<-100
n<-10
set.seed(123)
x1<-rpoistweedie(n,power,mu,lambda,theta0)
set.seed(123)
x2<-rpois(n,lambda1)
hist(x1, xlim = c(min(x1),max(x1)), probability = FALSE,
  col ='blue',xlab="modalit\'{e}s: x1",ylab="effectifs ",
  nclass = max(x1) - min(x1),main="Histogramme de x1
 (lambda=100, n=10)")
hist(x2, xlim = c(min(x2),max(x2)), probability = FALSE,
  col ='blue',xlab="modalit\'{e}s: x2 ",ylab="effectifs ",
  nclass = max(x2) - min(x2),main="Histogramme de x2
  (lambda1=100, n=10)")
sum(x2-x1)
```

---

varpt *variance for the Poisson-Tweedie family of distributions*

Description

Variance for the Poisson-Tweedie family of distributions

Usage

```
varpt(mu, p,  theta0)
```

Arguments

p	is a real index related to a precise model.
mu	the mean.
theta0	the canonical parameter.

Details

variance for the Poisson-Tweedie family of distributions

Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

See Also

dpoistweedie, ppoistweedie

Examples

```
## plot of variance
layout(matrix(1:1,1,1))
layout.show(1)
mu <- seq(0.001,6,l=100)
var <-varpt(mu,p=5000,theta0=-150)
plot(mu, var, type = "l", col = "green", lwd=1,main="variance(p,mu,theta0=-150)")
grid(nx=1,ny=1, lty=1,lwd=2)
lines(mu,varpt(mu,p=1,theta0=-150), type = "l", col = "blue", lwd=1)
lines(mu,varpt(mu,p=2,theta0=-150), type = "l", col = "black", lwd=1)
lines(mu,varpt(mu,p=1.5,theta0=-150), type = "l", col = "yellow", lwd=1)
lines(mu,varpt(mu,p=2.5,theta0=-150), type = "l", col = "cyan", lwd=1)
lines(mu,varpt(mu,p=3,theta0=-150), type = "l", col = "magenta", lwd=1)
segments(4,2.5,4.5,2.5,col="blue" )
  text(5,2.5,"p=1",cex=0.8)
segments(4,2,4.5,2,col="yellow" )
  text(5,2,"1.5",cex=0.8)
segments(4,1.5,4.5,1.5,col= "black")
  text(5, 1.5,"p=2",cex=0.8)
segments(4,1,4.5,1,col="cyan" )
  text(5, 1,"p=2.5" ,cex=0.8)
segments(4,0.5,4.5,0.5,col="magenta" )
  text(5, 0.5,"p=3" ,cex=0.8)
segments(4,0,4.5,0,col= "green" )
  text(5, 0,"p=5000",cex=0.8)
```

Index