

# Thinned Poisson (Experimental)

## Parametrisation

The Poisson distribution is

$$\text{Prob}(y) = \frac{\lambda^y}{y!} \exp(-\lambda)$$

for responses  $y = 0, 1, 2, \dots$ , where  $\lambda$  is the expected value.

The thinned Poisson allow the observations to have a known or unknown thinning: **event**= 1 its observed as is. With **event**= 0 (or  $\neq 1$ ) its thinned, so the likelihood is Poisson with mean  $p(\cdot)\lambda$  where

$$\text{logit}(p(\cdot)) = \text{offset} + \sum_{i=1} \beta_i x_i$$

## Link-function

The mean  $\lambda$  is linked to the linear predictor by

$$\lambda(\eta) = E \exp(\eta)$$

where  $E > 0$  is a known constant (or  $\log(E)$  is the offset of  $\eta$ ).

## Hyperparameters

$\beta_1, \beta_2, \dots$  if in use. Maximum 10.

## Specification

- **family**="tpoisson"
- Data are given as an **inla.mdata**-object, with format

$$\text{inla.mdata}(y, E, \text{event}, \text{offset}, x_1, x_2, \dots)$$

where maximum 10 covariates can be given. Each argument is a vector. Note that the four first columns are required, and the covariates can be omitted if there are none.

## Hyperparameter spesification and default values

**doc** Thinned Poisson

**hyper**

**theta1**

**hyperid** 66721

**name** beta1

**short.name** beta1

**output.name** beta1 tpoisson observations

**output.name.intern** beta1 tpoisson observations

**initial** 0

**fixed** FALSE

**prior** normal

**param** 0 100

**to.theta** function(x) x

```

    from.theta function(x) x
theta2
    hyperid 66722
    name beta2
    short.name beta2
    output.name beta2 tpoisson observations
    output.name.intern beta2 tpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta3
    hyperid 66723
    name beta3
    short.name beta3
    output.name beta3 tpoisson observations
    output.name.intern beta3 tpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta4
    hyperid 66724
    name beta4
    short.name beta4
    output.name beta4 tpoisson observations
    output.name.intern beta4 tpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta5
    hyperid 66725
    name beta5
    short.name beta5
    output.name beta5 tpoisson observations
    output.name.intern beta5 tpoisson observations
    initial 0

```

```

fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
theta6
  hyperid 66726
  name beta6
  short.name beta6
  output.name beta6 tpoisson observations
  output.name.intern beta6 tpoisson observations
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta7
  hyperid 66727
  name beta7
  short.name beta7
  output.name beta7 tpoisson observations
  output.name.intern beta7 tpoisson observations
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta8
  hyperid 66728
  name beta8
  short.name beta8
  output.name beta8 tpoisson observations
  output.name.intern beta8 tpoisson observations
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta9
  hyperid 66729
  name beta9

```

```

    short.name beta9
    output.name beta9 tpoisson observations
    output.name.intern beta9 tpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
  theta10
    hyperid 66730
    name beta10
    short.name beta10
    output.name beta10 tpoisson observations
    output.name.intern beta10 tpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x

survival FALSE

discrete TRUE

link default log

pdf tpoisson

```

## Example

In the following example we estimate the parameters in a simulated example with Poisson responses.

```

n <- 3000
x <- rnorm(n)
eta <- 1 + 0.2 * x
event <- rep(1, n)
E <- runif(n)

offset <- rnorm(n, sd = 0.3)
xx <- rnorm(n)
xxx <- rnorm(n)
eta.c <- offset + 0.3 * xx + 0.4 * xxx

y <- numeric(n)
prob <- 1/(1+exp(-eta.c))
event <- sample(c(1, 0), n, prob = c(0.6, 0.4), replace = TRUE)
prob[which(event == 1)] <- 1
y <- rpois(n, prob * E * exp(eta))

```

```
Y <- inla.mdata(y, E, event, offset, xx, xxx)
r <- inla(Y ~ 1 + x,
  data = list(Y = Y, x = x),
  family = "tpoisson",
  control.family = list(hyper = list(beta1 = list(param = c(0, 1)),
    beta2 = list(param = c(0, 2)))),
  verbose = TRUE,
  debug = TRUE)
summary(r)
```

Notes