# Censored Poisson (version 2)

#### Parametrisation

The Poisson distribution is

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

for responses y=0,1,2,..., where  $\lambda$  is the expected value. The cencored version is that reponse response in the interval  $L \leq y \leq H$  are cencored (and reported as y=L, say), whereas other values are reported as is. This is often due to privacy issue, for example using L=1 and H=5, for example.

The "cenpoisson" probability distribution is then, for  $y = 0, 1, \ldots$ ,

$$\operatorname{Prob}^*(y) = \begin{cases} \sum_{z=L}^H \frac{\lambda^z}{z!} \exp(-\lambda) & L \leq y \leq H\\ \frac{\lambda^y}{y!} \exp(-\lambda) & \text{otherwise} \end{cases}$$

#### **Link-function**

The mean-parameter is  $\lambda$  and is linked to the linear predictor  $\eta$  by

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

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

#### Hyperparameters

None.

### Specification

- family="cenpoisson2"
- The cenpoisson2 differ from cenpoisson, in that L and H are vectors and not scalars, hence different observations can have different censoring.
- Required arguments: y, E, L and H. The vector of the triplet  $(y_i, L_i, H_i)$  must be given as a inla.mdata-object. L and H are vectors of same length as y hence the cencoring can be different for each observation. L and H must be integer valued or Inf.

L[i] = Inf and/or H[i] = Inf are allowed, which is equivalent to L[i] = -1 and/or H[i] = -1. See the example for details.

## Example

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

```
n <- 300
a <- 0
b <- 1
x <- rnorm(n, sd = 0.3)
eta = a + b*x
low = sample(c(0, 1, 4, Inf), n, replace = TRUE)
high <- low + sample(c(0, 1, 2, Inf), n, replace = TRUE)

E = sample(1:10, n, replace=TRUE)
lambda = E*exp(eta)</pre>
```

# Notes

For censored values, then y must be one arbitrary value in the interval; NA does not work!!!