Randomly Censored Poisson (Experimental)

Parametrisation

The Poisson distribution is

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

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

The randomly-censored Poisson allow the observations to have a known or unknown censoring: event= 1 its observed as is, with event= 0 its right censored, so the likelihood is

$$\operatorname{Prob}(Y \ge y) = \sum_{y' \ge y} \frac{\lambda^{y'}}{y'!} \exp(-\lambda),$$

and for event $\neq 0,1$ (after rounding from double to int) then its randomly censored where

$$Prob(event = 1) = p(\cdot)$$

and

$$Prob(event = 0) = 1 - p(\cdot)$$

where $p(\cdot)$ depends on covariates

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

Link-function

The mean λ 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 η).

Hyperparameters

 β_1, β_2, \dots if in use. Maximum 10.

Specification

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

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

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

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hyper

theta1

```
hyperid 66701
    name beta1
    short.name beta1
    output.name beta1 rcpoisson observations
    output.name.intern beta1 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta2
    hyperid 66702
    name beta2
    short.name beta2
    output.name beta2 rcpoisson observations
    output.name.intern beta2 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta3
    hyperid 66703
    name beta3
    short.name beta3
    output.name beta3 rcpoisson observations
    output.name.intern beta3 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta4
    hyperid 66704
    name beta4
    short.name beta4
    output.name beta4 rcpoisson observations
    output.name.intern beta4 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
```

```
param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta5
    hyperid 66705
    name beta5
    short.name beta5
    output.name beta5 rcpoisson observations
    output.name.intern beta5 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta6
    hyperid 66706
    name beta6
    short.name beta6
    output.name beta6 rcpoisson observations
    output.name.intern beta6 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta7
    hyperid 66707
    name beta7
    short.name beta7
    output.name beta7 rcpoisson observations
    output.name.intern beta7 rcpoisson observations
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta8
    hyperid 66708
    name beta8
    short.name beta8
    output.name beta8 rcpoisson observations
```

```
output.name.intern beta8 rcpoisson observations
        initial 0
         fixed FALSE
         prior normal
         param 0 100
         to.theta function(x) x
         from.theta function(x) x
    theta9
        hyperid 66709
         name beta9
         short.name beta9
         output.name beta9 rcpoisson observations
         output.name.intern beta9 rcpoisson observations
        initial 0
         fixed FALSE
         prior normal
         param 0 100
         to.theta function(x) x
         from.theta function(x) x
    theta10
        hyperid 66710
         name beta10
         short.name beta10
         output.name beta10 rcpoisson observations
         output.name.intern beta10 rcpoisson observations
         initial 0
         fixed FALSE
         prior normal
         param 0 100
         to.theta function(x) x
         from.theta function(x) x
status experimental
survival FALSE
discrete TRUE
link default log
pdf rcpoisson
```

Example

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

```
n <- 30000
x \leftarrow rnorm(n)
eta <-1 + 0.2 * x
event \leftarrow rep(1, n)
E <- runif(n)
offset <- rnorm(n, sd = 0.5)
xx <- rnorm(n)
xxx <- rnorm(n)</pre>
eta.c <- offset + 0.3 * xx + 0.5 * xxx
## need two for the censoring
y <- rpois(n, E*exp(eta))
yy <- rpois(n, E*exp(eta))</pre>
for(i in 1:n) {
    event[i] \leftarrow sample(c(1, 0, 99), 1, prob = c(0.6, 0.1, 0.3))
    if (event[i] == 1) {
        ## y[i] <- y[i]
    } else if (event[i] == 0) {
        y[i] <- min(y[i], yy[i])
    } else {
        prob <- 1/(1+exp(-eta.c[i]))</pre>
        if (runif(1) < prob) {</pre>
             ## local.event = 1
             ## y[i] <- y[i]
        } else {
             ## local.event = 0
             y[i] <- min(y[i], yy[i])
        }
    }
}
Y <- inla.mdata(y, E, event, offset, xx, xxx)
r \leftarrow inla(Y ~1 + x,
           data = list(Y = Y, x = x),
          family = "rcpoisson",
           control.family = list(hyper = list(beta1 = list(param = c(0, 1)),
                                                 beta2 = list(param = c(0, 2))),
          verbose = !TRUE)
summary(r)
```

Notes