

Censored Negative Binomial (version2)

Parametrisation

The negative Binomial distribution is

$$\text{Prob}(y) = \frac{\Gamma(y+n)}{\Gamma(n)\Gamma(y+1)} p^n (1-p)^y$$

for responses $y = 0, 1, 2, \dots$, where

n : number of successful trials (*size*), or dispersion parameter. Must be strictly positive, need not be integer.

p : probability of success in each trial.

The censoring is that response values in the interval $L \leq y \leq H$ are censored (and reported as a value in the interval, like $y = L$, say), whereas other values are reported as is.

This function is the nbinoial version of `cenpoisson2`.

Link-function

The mean and variance of (the uncensored) y are given as

$$\mu = n \frac{1-p}{p} \quad \text{and} \quad \sigma^2 = \mu \left(1 + \frac{\mu}{n}\right)$$

and the mean is linked to the linear predictor by

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

where the hyperparameter n (*size*) plays the role of an dispersion parameter. E represents known constant and $\log(E)$ is the offset of η .

Hyperparameters

The default parameterization (`variant=0`) is that the dispersion parameter n (*size*) is represented as

$$n = \exp(\theta)$$

and the prior is defined on θ .

If `variant=1`, then dispersion parameter n (*size*) is represented as

$$n = E \exp(\theta)$$

and the prior is defined on θ .

If `variant=2`, then dispersion parameter n (*size*) is represented as

$$n = S \exp(\theta)$$

where S is `scale`, and the prior is defined on θ .

Specification

- `family="nbinomial"`
- Required arguments: (y, L, H) [see below] and E (default $E = 1$) and `scale` (default `scale=1`)
- Chose variant with either `control.family = list(variant=0)` (default) or `control.family = list(variant=1)` or `control.family = list(variant=2)`.
- Data and censoring information is given by the triplet: y, L and H , and must be defined as a `inla.mdata`-object. L and H are vectors of same length as y giving the censoring information for each observation. L and H must be integer valued or `Inf`.

If $y[i]$ is not in the interval, then the observation is not censored.

$L[i] = \text{Inf}$ and/or $H[i] = \text{Inf}$ is equivalent to $L[i] = -1$ and/or $H[i] = -1$.

$L[i] = \text{Inf}$ implies no interval censoring. $H[i] = \text{Inf}$ and $0 \leq L[i] < \infty$ implies right censoring.

Hyperparameter spesification and default values

`doc` The CenNegBinomial2 likelihood (similar to `cenpoisson2`)

`hyper`

`theta`

`hyperid` 63101

`name` size

`short.name` size

`output.name` size for the `cennbinomial2` observations (1/overdispersion)

`output.name.intern` log size for the `cennbinomial2` observations (1/overdispersion)

`initial` 2.30258509299405

`fixed` FALSE

`prior` `pc.mgamma`

`param` 7

`to.theta` `function(x) log(x)`

`from.theta` `function(x) exp(x)`

`status` `experimental`

`survival` FALSE

`discrete` TRUE

`link` `default` `log` `logoffset` `quantile`

`pdf` `cennbinomial2`

Example

In the following example we estimate the parameters in a simulated example.

```
n = 300
```

```
x = rnorm(n, sd = 0.2)
```

```
eta = 1 + x
```

```
E = runif(n, min = 0.5, max=2)
```

```
S = runif(n, min = 0.5, max=2)
```

```

## variant 0
mu = E * exp(eta)
size = 1
prob = size/(size + mu)
y = rnbino(n, size, mu=mu)

y.low <- sample(c(1:4, Inf), n, replace = TRUE)
y.high <- y.low + sample(c(1:5, Inf), n, replace = TRUE)

Y <- inla.mdata(cbind(y, y.low, y.high))
r = inla(Y ~ 1 + x,
        data = list(Y = Y, x = x, E = E),
        family = "cennbinomial2",
        control.family = list(variant = 0),
        E=E, scale = S)
summary(r)
censored = which(y >= y.low & y <= y.high)
print(length(censored)/ n)

## variant 1
mu = E * exp(eta)
size = 1 * E
prob = size/(size + mu)
y = rnbino(n, size, mu=mu)

y.low <- sample(c(1:4, Inf), n, replace = TRUE)
y.high <- y.low + sample(c(1:5, Inf), n, replace = TRUE)

Y <- inla.mdata(cbind(y, y.low, y.high))
r = inla(Y ~ 1 + x,
        data = list(Y = Y, x = x, E = E),
        family = "cennbinomial2",
        control.family = list(variant = 1),
        E=E)

summary(r)
censored = which(y >= y.low & y <= y.high)
print(length(censored)/ n)

## variant 2
mu = E * exp(eta)
size = 1 * S
prob = size/(size + mu)
y = rnbino(n, size, mu=mu)

y.low <- sample(c(1:4, Inf), n, replace = TRUE)
y.high <- y.low + sample(c(1:5, Inf), n, replace = TRUE)

Y <- inla.mdata(cbind(y, y.low, y.high))
r = inla(Y ~ 1 + x,
        data = list(Y = Y, x = x, E = E, S = S),
        family = "cennbinomial2",
        control.family = list(variant = 2),
        E=E, scale = S)

summary(r)

```

```
censored = which(y >= y.low & y <= y.high)
print(length(censored)/ n)
```

Notes