

CBinomial

Parametrisation

The clustered/clumped-Binomial distribution arrives from a transformation of Binomial observations. Let z be Binomial distributed

$$\text{Prob}(z) = \binom{n}{z} p^z (1-p)^{n-z}$$

for $z = 0, 1, 2, \dots, n$, where

n : number of trials.

p : probability of success in each trial.

Then binary CBinomial distribution is the distribution for y , where

$$y = \begin{cases} 0 & z = 0 \\ 1 & z > 0 \end{cases}$$

It then follows that $\text{Prob}(y = 0) = (1-p)^n$ and $\text{Prob}(y = 1) = 1 - (1-p)^n$, i.e. y is Binomial distributed with size 1 and probability for success $1 - (1-p)^n$. In general we have k independent experiments, y_1, \dots, y_k , and let $w = y_1 + \dots + y_k$. Then w is CBinomial(k, n, p) distributed, i.e. w is Binomial($k, 1 - (1-p)^n$).

Link-function

The probability p is by default linked to the linear predictor by

$$p(\eta) = \frac{\exp(\eta)}{1 + \exp(\eta)}$$

but other choices are also available.

Hyperparameters

None.

Hyperparameter spesification and default values

doc The clustered Binomial likelihood

hyper

survival FALSE

discrete TRUE

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Specification

- `family="cbinomial"`
- Required arguments: the response w and the parameters k and n (keyword `Ntrials`, where the argument is a **two-column matrix**: `Ntrials = cbind(k,n)`)

Example

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

```
N=1000
a = -1
b = 1
z = rnorm(N)
eta = a + b*z
n = sample(c(1,5,10,15), size=N, replace=TRUE)
p = exp(eta)/(1 + exp(eta))
prob = 1.0 - (1-p)^n
k = sample(c(1,5,10,15), size=N, replace=TRUE)
y = rbinom(N, size=k, prob = prob)

data = list(y=y,z=z)
formula = y ~ 1+z
result = inla(formula, family = "cbinomial", data = data,
              Ntrials=cbind(k, n), verbose=TRUE)
summary(result)
```

Notes

None.