CBinomial

Parametrisation

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

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

for $z = 0, 1, 2, \ldots, n$, 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, $y_1, \ldots, y_k$, and let $w = y_1 + \cdots + y_k$. Then w is $\text{CBinomial}(k, n, p)$ distributed, i.e. w is $\text{Binomial}(k, 1 - (1-p)^n)$.

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

link default logit cauchit probit cloglog loglog

status experimental

pdf cbinomial

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.