THIS IS NOT IN USE

Negative Binomial

Parametrization

The negative Binomial distribution is

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

for responses $y = 0, 1, 2, \ldots$, where:

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

p: probability of success in each trial.

Link-function

The mean and variance of y are given as

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

and the mean is linked to the linear predictor by

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

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

Hyperparameters

The overdispersion parameter n is represented as

$$\theta = \log(n)$$

and the prior is defined on θ .

Specification

- family="nbinomial"
- Required argument: y and E (default E = 1).

Example

In the following example we specify the likelihood to be negative binomial, and assign the hyperparameter θ a Gaussian prior with mean 0 and standard deviation 0.01

n=100

a = 1

b = 1

E = rep(1,n)

z = rnorm(n)

Notes

As $n \to \infty$, the negative Binomial converges to the Poisson distribution. For numerical reasons, if n is too large:

 $\frac{\mu}{n} < 10^{-4},$

then the Poisson limit is used.