

Binomial-mixture likelihood

Parametrisation

Details

This likelihood is a mixture of three binomials, where two of them are simple predictors and one is general. The probability for success is

$$p = w_1 p_1 + w_2 p_2 + w_3 p_3$$

where $w_1 + w_2 + w_3 = 1$ are the positive weights, and

$$\text{logit}(p_3) = \eta$$

where the linear predictor η is defined in the formula. Further,

$$\text{logit}(p_1) = \beta_1 z_1 + \beta_2 z_2 + \beta_3 z_3$$

and

$$\text{logit}(p_2) = \beta_4 z_4 + \beta_5 z_5 + \beta_6 z_6$$

for fixed covariates z_i .

Link-function

The link-function is given as usual, and they are all equal.

Hyperparameters

The six regression coefficients β_i are treated as hyperparameters.

Specification

- `family="binomialmix"`
- Required arguments: A $n \times 2$ matrix Y with the observations and the number of trials s , $Y = (y, s)$, a $n \times 6$ matrix Z with the covariates $Z = c(z_1, \dots, z_6)$, and a $n \times 2$ matrix W with weights $W = (w_1, w_2)$. The `inla.mdata` is used as

```
inla.mdata(Y, Z, W) ~ ...
```

Hyperparameter specification and default values

doc Binomial mixture

hyper

theta1

```
hyperid 56551
name beta11
short.name beta11
output.name beta11 for binomialmix observations
output.name.intern beta11 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
```

theta2

```
hyperid 56552
name beta12
short.name beta12
output.name beta12 for binomialmix observations
output.name.intern beta12 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
```

theta3

```
hyperid 56553
name beta13
short.name beta13
output.name beta13 for binomialmix observations
output.name.intern beta13 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
```

theta4

```
hyperid 56554
name beta21
short.name beta21
output.name beta21 for binomialmix observations
output.name.intern beta21 for binomialmix observations
initial 0
fixed FALSE
prior normal
```

```

param 0 100
to.theta function(x) x
from.theta function(x) x
theta5
  hyperid 56555
  name beta22
  short.name beta22
  output.name beta22 for binomialmix observations
  output.name.intern beta22 for binomialmix observations
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta6
  hyperid 56556
  name beta23
  short.name beta23
  output.name beta23 for binomialmix observations
  output.name.intern beta23 for binomialmix 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 logit probit
pdf binomialmix

```

Example

Here is a simple example.

```
n <- 30000

## this makes it to easy to its just to check the likelihood
## implementation
size <- sample(10:20, n, replace = TRUE)

beta1 <- rnorm(3, sd = 0.2)
beta2 <- rnorm(3, sd = 0.2)
beta <- c(beta1, beta2)
Z <- matrix(NA, n, 6)
W <- matrix(NA, n, 2)
Y <- matrix(NA, n, 2)

x <- rnorm(n, sd = 0.1)
xx <- rnorm(n, sd = 0.4)
eta <- 1 + x + xx

for (i in 1:n) {
  Z[i, ] <- rnorm(6)
  w <- c(rbeta(2, 1, 10), rbeta(1, 10, 1))
  w <- w/sum(w)
  W[i, ] <- w[1:2]

  p1 <- inla.link.invlogit(sum(beta1 * Z[i, 1:3]))
  p2 <- inla.link.invlogit(sum(beta2 * Z[i, 3 + 1:3]))
  p3 <- inla.link.invlogit(eta[i])
  p <- w[1] * p1 + w[2] * p2 + w[3] * p3
  Y[i, ] <- c(rbinom(1, size = size[i], prob = p), size[i])
}

r <- inla(inla.mdata(Y, Z, W) ~ 1 + x + xx,
  family = "binomialmix",
  data = list(Y = Y, Z = Z, W = W, x = x, xx = xx),
  verbose = TRUE)

cbind(estimate = r$summary.fixed["mean"], true = 1)
cbind(estimate = r$summary.hyperpar["mean"], true = beta)
```