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,

$$\text{logit}(p_1) = \sum_{i=1}^{m} \beta_i z_i + \beta_{2m+1} z_{2m+1}$$

$$\text{logit}(p_2) = \sum_{i=m+1}^{2m} \beta_i z_i + \beta_{2m+1} z_{2m+2}$$

and

$$\text{logit}(p_3) = \eta + \beta_{2m+1} z_{2m+3}$$

for fixed covariates $\{z_i\}$. The linear predictor η is defined in the formula.

Note: β_{2m+1} is the *same* variable in the three expressions. The allowed range for m is $0 \leq m \leq 25$.

Link-function

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

Hyperparameters

The $2m + 1$ regression coefficients $\{\beta_i\}$ 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 $n \times (2m + 3)$ matrix Z with the covariates $Z = c(z_1, \ldots, z_{2m+3})$, 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 spesification and default values

doc `Binomial mixture`

hyper

> **theta1**
>> **hyperid** `56551`
>> **name** `beta1`
>> **short.name** `beta1`
>> **output.name** `beta1 for binomialmix observations`
>> **output.name.intern** `beta1 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** `beta2`
>> **short.name** `beta2`
>> **output.name** `beta2 for binomialmix observations`
>> **output.name.intern** `beta2 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** `beta3`
>> **short.name** `beta3`
>> **output.name** `beta3 for binomialmix observations`
>> **output.name.intern** `beta3 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** `beta4`
>> **short.name** `beta4`
>> **output.name** `beta4 for binomialmix observations`
>> **output.name.intern** `beta4 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 beta5

short.name beta5

output.name beta5 for binomialmix observations

output.name.intern beta5 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 beta6

short.name beta6

output.name beta6 for binomialmix observations

output.name.intern beta6 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta7

hyperid 56557

name beta7

short.name beta7

output.name beta7 for binomialmix observations

output.name.intern beta7 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta8

hyperid 56558

name beta8

short.name beta8

output.name beta8 for binomialmix observations

output.name.intern beta8 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta `function(x) x`

from.theta `function(x) x`

theta9

    hyperid `56559`

    name `beta9`

    short.name `beta9`

    output.name `beta9 for binomialmix observations`

    output.name.intern `beta9 for binomialmix observations`

    initial `0`

    fixed `FALSE`

    prior `normal`

    param `0 100`

    to.theta `function(x) x`

    from.theta `function(x) x`

theta10

    hyperid `56560`

    name `beta10`

    short.name `beta10`

    output.name `beta10 for binomialmix observations`

    output.name.intern `beta10 for binomialmix observations`

    initial `0`

    fixed `FALSE`

    prior `normal`

    param `0 100`

    to.theta `function(x) x`

    from.theta `function(x) x`

theta11

    hyperid `56561`

    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`

theta12

    hyperid `56562`

    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`

theta13

    hyperid `56563`

    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`

theta14

    hyperid `56564`

    name `beta14`

    short.name `beta14`

    output.name `beta14 for binomialmix observations`

    output.name.intern `beta14 for binomialmix observations`

    initial `0`

    fixed `FALSE`

    prior `normal`

    param `0 100`

    to.theta `function(x) x`

    from.theta `function(x) x`

theta15

    hyperid `56565`

    name `beta15`

    short.name `beta15`

    output.name `beta15 for binomialmix observations`

    output.name.intern `beta15 for binomialmix observations`

    initial `0`

    fixed `FALSE`

    prior `normal`

    param `0 100`

    to.theta `function(x) x`

    from.theta `function(x) x`

theta16

    hyperid `56566`

    name `beta16`

    short.name `beta16`

    output.name `beta16 for binomialmix observations`

    output.name.intern `beta16 for binomialmix observations`

    initial `0`

    fixed `FALSE`

    prior `normal`

    param `0 100`

    to.theta `function(x) x`

    from.theta `function(x) x`

theta17

    hyperid 56567

    name beta17

    short.name beta17

    output.name beta17 for binomialmix observations

    output.name.intern beta17 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta18

    hyperid 56568

    name beta18

    short.name beta18

    output.name beta18 for binomialmix observations

    output.name.intern beta18 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta19

    hyperid 56569

    name beta19

    short.name beta19

    output.name beta19 for binomialmix observations

    output.name.intern beta19 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta20

    hyperid 56570

    name beta20

    short.name beta20

    output.name beta20 for binomialmix observations

    output.name.intern beta20 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta21

hyperid 56571

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

theta22

hyperid 56572

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

theta23

hyperid 56573

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

theta24

hyperid 56574

name beta24

short.name beta24

output.name beta24 for binomialmix observations

output.name.intern beta24 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta25

hyperid 56575

name beta25

short.name beta25

output.name beta25 for binomialmix observations

output.name.intern beta25 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta26

hyperid 56576

name beta26

short.name beta26

output.name beta26 for binomialmix observations

output.name.intern beta26 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta27

hyperid 56577

name beta27

short.name beta27

output.name beta27 for binomialmix observations

output.name.intern beta27 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta28

hyperid 56578

name beta28

short.name beta28

output.name beta28 for binomialmix observations

output.name.intern beta28 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta29

hyperid 56579

name beta29

short.name `beta29`

output.name `beta29 for binomialmix observations`

output.name.intern `beta29 for binomialmix observations`

initial `0`

fixed `FALSE`

prior `normal`

param `0 100`

to.theta `function(x) x`

from.theta `function(x) x`

theta30

hyperid `56580`

name `beta30`

short.name `beta30`

output.name `beta30 for binomialmix observations`

output.name.intern `beta30 for binomialmix observations`

initial `0`

fixed `FALSE`

prior `normal`

param `0 100`

to.theta `function(x) x`

from.theta `function(x) x`

theta31

hyperid `56581`

name `beta31`

short.name `beta31`

output.name `beta31 for binomialmix observations`

output.name.intern `beta31 for binomialmix observations`

initial `0`

fixed `FALSE`

prior `normal`

param `0 100`

to.theta `function(x) x`

from.theta `function(x) x`

theta32

hyperid `56582`

name `beta32`

short.name `beta32`

output.name `beta32 for binomialmix observations`

output.name.intern `beta32 for binomialmix observations`

initial `0`

fixed `FALSE`

prior `normal`

param `0 100`

to.theta `function(x) x`

from.theta `function(x) x`

theta33

hyperid `56583`

name `beta33`

short.name `beta33`

output.name beta33 for binomialmix observations
output.name.intern beta33 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta34

hyperid 56584
name beta34
short.name beta34
output.name beta34 for binomialmix observations
output.name.intern beta34 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta35

hyperid 56585
name beta35
short.name beta35
output.name beta35 for binomialmix observations
output.name.intern beta35 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta36

hyperid 56586
name beta36
short.name beta36
output.name beta36 for binomialmix observations
output.name.intern beta36 for binomialmix observations
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x

theta37

hyperid 56587
name beta37
short.name beta37
output.name beta37 for binomialmix observations

output.name.intern beta37 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta38

hyperid 56588

name beta38

short.name beta38

output.name beta38 for binomialmix observations

output.name.intern beta38 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta39

hyperid 56589

name beta39

short.name beta39

output.name beta39 for binomialmix observations

output.name.intern beta39 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta40

hyperid 56590

name beta40

short.name beta40

output.name beta40 for binomialmix observations

output.name.intern beta40 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta41

hyperid 56591

name beta41

short.name beta41

output.name beta41 for binomialmix observations

output.name.intern beta41 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta42

    hyperid 56592

    name beta42

    short.name beta42

    output.name beta42 for binomialmix observations

    output.name.intern beta42 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta43

    hyperid 56593

    name beta43

    short.name beta43

    output.name beta43 for binomialmix observations

    output.name.intern beta43 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta44

    hyperid 56594

    name beta44

    short.name beta44

    output.name beta44 for binomialmix observations

    output.name.intern beta44 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta45

    hyperid 56595

    name beta45

    short.name beta45

    output.name beta45 for binomialmix observations

    output.name.intern beta45 for binomialmix observations

    initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta46

hyperid 56596

name beta46

short.name beta46

output.name beta46 for binomialmix observations

output.name.intern beta46 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta47

hyperid 56597

name beta47

short.name beta47

output.name beta47 for binomialmix observations

output.name.intern beta47 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta48

hyperid 56598

name beta48

short.name beta48

output.name beta48 for binomialmix observations

output.name.intern beta48 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta49

hyperid 56599

name beta49

short.name beta49

output.name beta49 for binomialmix observations

output.name.intern beta49 for binomialmix observations

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta50

    hyperid 56600

    name beta50

    short.name beta50

    output.name beta50 for binomialmix observations

    output.name.intern beta50 for binomialmix observations

    initial 0

    fixed FALSE

    prior normal

    param 0 100

    to.theta function(x) x

    from.theta function(x) x

theta51

    hyperid 56601

    name beta51

    short.name beta51

    output.name beta51 for binomialmix observations

    output.name.intern beta51 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 <- 10^5
size <- sample(5:10, n, replace = TRUE)

m <- 5
m2 <- 2*m
beta.p1 <- rnorm(m, sd = 1/sqrt(m))
beta.p2 <- rnorm(m, sd = 1/sqrt(m))
beta.common <- rnorm(1, sd = 0.5)
beta <- c(beta.p1, beta.p2, beta.common)

Z <- matrix(NA, n, m2+3)
W <- matrix(NA, n, 2)
Y <- matrix(NA, n, 2)

x <- rnorm(n, sd = 0.5)
xx <- rnorm(n, sd = 0.5)
eta <- numeric(n)

for (i in 1:n) {
    Z[i, ] <- rnorm(m2+3)
    w <- c(rbeta(2, 1, 10), rbeta(1, 10, 1))
    w <- w/sum(w)
    W[i, ] <- w[1:2]

    p1 <- inla.link.invlogit(sum(beta.p1 * Z[i, seq_len(m)]) + beta.common * Z[i, m2+1])
    p2 <- inla.link.invlogit(sum(beta.p2 * Z[i, m + seq_len(m)]) + beta.common * Z[i, m2+2])

    eta[i] <-  1 + x[i] + xx[i] + beta.common * Z[i, m2+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,
          control.inla = list(int.strategy = "eb"))
## r <- inla.rerun(r)

print(round(dig = 4, cbind(estimate = r$summary.fixed[,"mean"], true = 1)))
print(round(dig = 4, cbind(estimate =  r$summary.hyperpar[,"mean"], true = beta)))
```