

The modal-Gamma-distribution

Parametrisation

The modal-Gamma-distribution has the following density

$$\pi(y) = \frac{b^a}{\Gamma(a)} y^{a-1} \exp(-by), \quad a > 1, \quad b > 0, \quad y > 0.$$

where the mode $m = (a - 1)/b$ is the target of the regression model instead of the mean or quantile.

Note the constraint $a > 1$.

With precision

$$\tau = (s\phi)/m^2$$

for fixed scaling s and precision parameter ϕ , this complete the specification. The mapping back to the (a, b) -parameterisation is then $\phi' = s\phi$, $\delta = \left(\sqrt{\phi'(\phi' + 4)} + \phi'\right)/2$, then

$$a = 1 + \delta \quad \text{and} \quad b = \delta/m$$

Link-function

The linear predictor η is linked to the mode m using a default log-link

$$m = \exp(\eta)$$

Hyperparameter

The hyperparameter is the precision parameter ϕ , which is represented as

$$\phi = \exp(\theta)$$

and the prior is defined on θ .

Specification

- `family="mgamma"` for regression models and `family="mgamma.surv"` for survival models.
- Required arguments: for `mgamma.surv`, y (to be given in a format by using `inla.surv()`), and for `mgamma`, y and s (default value 1).

The scalings s is **not** used for `family="mgamma.surv"`.

Hyperparameter specification and default values

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hyper

theta

hyperid 58002

name precision parameter

short.name prec

output.name Precision-parameter for the modal Gamma observations

output.name.intern Intern precision-parameter for the modal Gamma observations

initial 4.60517018598809

```

    fixed FALSE
    prior loggamma
    param 1 0.01
    to.theta function(x) log(x)
    from.theta function(x) exp(x)

survival FALSE

discrete FALSE

link default log

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hyper
  theta1
    hyperid 58121
    name precision parameter
    short.name prec
    output.name Precision-parameter for the modal Gamma surv observations
    output.name.intern Intern precision-parameter for the modal Gamma surv observations
    initial 0
    fixed FALSE
    prior loggamma
    param 1 0.01
    to.theta function(x) log(x)
    from.theta function(x) exp(x)
  theta2
    hyperid 58122
    name beta1
    short.name beta1
    output.name beta1 for modal Gamma-Cure
    output.name.intern beta1 for modal Gamma-Cure
    initial -7
    fixed FALSE
    prior normal
    param -4 100
    to.theta function(x) x
    from.theta function(x) x
  theta3
    hyperid 58123
    name beta2
    short.name beta2
    output.name beta2 for modal Gamma-Cure
    output.name.intern beta2 for modal Gamma-Cure

```

```

initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
theta4
  hyperid 58124
  name beta3
  short.name beta3
  output.name beta3 for modal Gamma-Cure
  output.name.intern beta3 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta5
  hyperid 58125
  name beta4
  short.name beta4
  output.name beta4 for Ga mma-Cure
  output.name.intern beta4 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta6
  hyperid 58126
  name beta5
  short.name beta5
  output.name beta5 for modal Gamma-Cure
  output.name.intern beta5 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta7
  hyperid 58127

```

```

name beta6
short.name beta6
output.name beta6 for modal Gamma-Cure
output.name.intern beta6 for modal Gamma-Cure
initial 0
fixed FALSE
prior normal
param 0 100
to.theta function(x) x
from.theta function(x) x
theta8
  hyperid 58128
  name beta7
  short.name beta7
  output.name beta7 for modal Gamma-Cure
  output.name.intern beta7 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta9
  hyperid 58129
  name beta8
  short.name beta8
  output.name beta8 for modal Gamma-Cure
  output.name.intern beta8 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100
  to.theta function(x) x
  from.theta function(x) x
theta10
  hyperid 58130
  name beta9
  short.name beta9
  output.name beta9 for modal Gamma-Cure
  output.name.intern beta9 for modal Gamma-Cure
  initial 0
  fixed FALSE
  prior normal
  param 0 100

```

```

    to.theta function(x) x
    from.theta function(x) x
  theta11
    hyperid 58131
    name beta10
    short.name beta10
    output.name beta10 for modal Gamma-Cure
    output.name.intern beta10 for modal Gamma-Cure
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x

survival TRUE

discrete FALSE

link default log neglog

pdf agamma

```

Example

In the following example we estimate the parameters in a simulated example.

```

n <- 10^4
phi <- 2.2
x <- rnorm(n)
m <- exp(1.1 + 1.2 * x)
delta <- (sqrt(phi * (phi + 4.0)) + phi) / 2.0

y <- rgamma(n, shape = 1 + delta, rate = delta / m)
r <- inla(y ~ 1 + x,
  data = data.frame(y, x),
  family = "mgamma",
  control.compute = list(cpo = T),
  verbose = TRUE)

Y <- inla.surv(y, 1)
rr <- inla(Y ~ 1 + x,
  data = list(Y = Y, x = x),
  family = "mgammasurv",
  control.compute = list(cpo = T),
  verbose = TRUE)

```

Notes

None.