

# LogNormal

## Parametrisation

The LogNormal has density

$$f(y) = \frac{1}{y\sqrt{2\pi}} \sqrt{\tau} \exp\left(-\frac{1}{2}\tau(\log y - \mu)^2\right), \quad y > 0$$

where

$\tau > 0$  is the precision parameter,

$\mu$  is the mean parameter.

## Link-function

The parameter  $\mu$  is linked to the linear predictor as:

$$\eta = \mu$$

## Hyperparameters

The  $\tau$  parameter is represented as

$$\theta = \log \tau$$

and the prior is defined on  $\theta$ .

## Specification

- family = `lognormal` for regression models and family = `lognormalsurv` for survival models.
- Required arguments:  $y$ . Given in a format by using `inla.surv()` function for family = `lognormal.surv`

## Hyperparameter spesification and default values

### lognormal

**doc** The log-Normal likelihood

**hyper**

**theta**

**hyperid** 77101

**name** log precision

**short.name** prec

**initial** 0

**fixed** FALSE

**prior** loggamma

**param** 1 5e-05

**to.theta** function(x) log(x)

**from.theta** function(x) exp(x)

**survival** FALSE

**discrete** FALSE

**link** default identity

**pdf** lognormal

## lognormalsurv

**doc** The log-Normal likelihood (survival)

**hyper**

**theta**

**hyperid** 78001

**name** log precision

**short.name** prec

**initial** 0

**fixed** FALSE

**prior** loggamma

**param** 1 5e-05

**to.theta** function(x) log(x)

**from.theta** function(x) exp(x)

**theta2**

**hyperid** 78002

**name** beta1

**short.name** beta1

**initial** -7

**fixed** FALSE

**prior** normal

**param** -4 100

**to.theta** function(x) x

**from.theta** function(x) x

**theta3**

**hyperid** 78003

**name** beta2

**short.name** beta2

**initial** 0

**fixed** FALSE

**prior** normal

**param** 0 100

**to.theta** function(x) x

**from.theta** function(x) x

**theta4**

**hyperid** 78004

**name** beta3

**short.name** beta3

**initial** 0

**fixed** FALSE

**prior** normal

**param** 0 100

**to.theta** function(x) x

**from.theta** function(x) x

**theta5**

```

    hyperid 78005
    name beta4
    short.name beta4
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta6
    hyperid 78006
    name beta5
    short.name beta5
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta7
    hyperid 78007
    name beta6
    short.name beta6
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta8
    hyperid 78008
    name beta7
    short.name beta7
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta9
    hyperid 78009
    name beta8
    short.name beta8
    initial 0
    fixed FALSE

```

```

    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
  theta10
    hyperid 78010
    name beta9
    short.name beta9
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
  theta11
    hyperid 78011
    name beta10
    short.name beta10
    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 identity
  pdf lognormal

```

## Example

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

```

n = 300
x = c(scale(runif(n)))
eta = 1+2.2*x
y = exp(rnorm(n, mean = eta, sd = 1))
data = list(y=y, event=rep(1, n), x=x)
formula = inla.surv(y, event) ~ 1 + x
r=inla(formula, family ="lognormalsurv", data=data)
summary(r)

data = data.frame(y, x)
formula = y ~ 1 + x
r=inla(formula, family ="lognormal", data=data)
summary(r)

```

## Notes

- lognormalsurv can be used for right censored, left censored, interval censored data. A general framework to represent time is given by `inla.surv`. If the observed times  $y$  are large/huge, then this can cause numerical overflow, and if you encounter this problem, try to scale the observations, like `time = time / max(time)`.