

# 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
- Required arguments:  $y$  (to be given in a format by using `inla.surv()` function )

## Hyperparameter spesification and default values

**hyper**

**theta**

**name** log precision

**short.name** prec

**initial** 2

**fixed** FALSE

**prior** loggamma

**param** 1 5e-05

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

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

**survival** TRUE

**discrete** FALSE

**link** default identity

**pdf** lognormal

## Example

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

```
n = 1000
x = runif(n)
eta = 1+x
y = exp(rnorm(n, mean = eta, sd = 1))
event = rep(1,n)
data = list(y=y, event=event, x=x)
formula = inla.surv(y, event) ~ 1 + x
r=inla(formula, family ="lognormal", data=data, verbose=T)
```

## Notes

- Lognormal model can be used for right censored, left censored, interval censored data.
- A general frame work to represent time is given by `inla.surv`
- If the observed times  $y$  are large/huge, then this can cause numerical overflow in the likelihood routines giving error messages like

```
file: smtp-taucs.c  hgid: 891deb69ae0c  date: Tue Nov 09 22:34:28 2010 +0100
Function: GMRFLib_build_sparse_matrix_TAUCS(), Line: 611, Thread: 0
Variable evaluates to NAN/INF. This does not make sense. Abort...
```

If you encounter this problem, try to scale the observatios, `time = time / max(time)` or similar, before running `inla()`.