

# LogLogistic

## Parametrisation

The LogLogistic distribution has cumulative distribution function

$$F(y) = \frac{1}{1 + (y/\beta)^{-\alpha}}$$

where

$\alpha > 0$  is the shape parameter.

$\beta > 0$  is the scale parameter.

## Link-function

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

$$\beta = \exp(\eta)$$

## Hyperparameters

The  $\alpha$  parameter is represented as

$$\theta = \log \alpha$$

and the prior is defined on  $\theta$ .

## Specification

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

## Hyperparameter spesification and default values

**hyper**

**theta**

```
hyperid 80001
name log alpha
short.name alpha
initial 1
fixed FALSE
prior loggamma
param 25 25
to.theta function(x) log(x)
from.theta function(x) exp(x)
```

**survival** TRUE

**discrete** FALSE

**link** default log neglog

**pdf** loglogistic

## Example

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

```
rloglogistic = function(n, beta, alpha = 1)
{
  p = runif(n)
  return (beta* (((1-p)/p)^(-1/alpha)))
}

n = 1000
alpha = 2
x = runif(n)
eta = 1+x
beta = exp(eta)
y = rloglogistic(n, beta = beta, alpha = alpha)
event = rep(1,n)
data = list(y=y, event=event, x=x)
formula=inla.surv(y,event) ~ x
r=inla(formula, family ="loglogistic", data=data, verbose=T)
```

## Notes

- Loglogistic 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()`.