

# Weibull

## Parametrisation

The Weibull distribution is

$$\text{Prob}(y) = \alpha y^{\alpha-1} \lambda \exp(-\lambda y^\alpha), \quad \alpha > 0, \quad \lambda > 0$$

where

$\alpha$ : shape parameter.

In survival analysis, models are generally specified through the hazard function. For Weibull model the hazard function is:

$$h(y) = \alpha y^{\alpha-1} \lambda$$

## Link-function

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

$$\lambda = \exp(\eta)$$

## Hyperparameters

The  $\alpha$  parameter is represented as

$$\theta = \log \alpha$$

and the prior is defined on  $\theta$ .

## Specification

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

## Hyperparameter spesification and default values

**hyper**

**theta**

```
name  log alpha
short.name  a
initial  0
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

**pdf** weibull

## Example

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

```
n = 1000
alpha = 2
beta = 2
x = runif(n)
eta = 1+beta*x
lambda = exp(eta)
y = rweibull(n, shape= alpha, scale= lambda^(1/-alpha))
event = rep(1,n)
data = list(y=y, event=event, x=x)
formula=inla.surv(y,event)~ x
model=inla(formula, family ="weibull", data=data, verbose=T)
```

## Notes

- Weibull 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()`.