

Weibull

Parametrisation

The Weibull distribution is (**variant=0**)

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

and (**variant=1**)

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

where

α : shape parameter.

Link-function

The parameter λ is linked to the linear predictor as:

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

Hyperparameters

The α parameter is represented as

$$\alpha = \exp(S\theta)$$

and the prior is defined on θ . The constant S currently set to 0.1 to avoid numerical instabilities in the optimization, since small changes of α can make a huge difference.

Specification

- family = **weibull** for regression and family = **weibullsurv** for survival
- Required arguments: y (to be given using **inla.surv()** for survival models), and **variant=0** (default) or 1 to define the parameterisation.

Hyperparameter spesification and default values

weibull

doc The Weibull likelihood

hyper

theta

hyperid 79001

name log alpha

short.name alpha

initial 0.1

fixed FALSE

prior pc.alphaw

param 5

to.theta function(x, sc = 0.1) log(x) / sc

from.theta function(x, sc = 0.1) exp(sc * x)

survival FALSE

discrete FALSE

link default log neglog quantile

pdf weibull

weibullsurv

```
doc The Weibull likelihood (survival)
hyper
  theta
    hyperid 79101
    name log alpha
    short.name alpha
    initial 0.1
    fixed FALSE
    prior pc.alphaw
    param 5
    to.theta function(x, sc = 0.1) log(x) / sc
    from.theta function(x, sc = 0.1) exp(sc * x)
survival TRUE
discrete FALSE
link default log neglog quantile
pdf weibull
```

Example

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

```
n = 1000
alpha = 1.1
beta = 2.2
x = c(scale(runif(n)))
eta = 1+beta*x
lambda = exp(eta)

for(variant in 0:1) {
  y = rweibull(n,
              shape= alpha,
              scale= if (variant == 0)
                    lambda^(-1/alpha)
              else
                    1/lambda)

  print(paste("VARIANT=", variant))
  event = rep(1,n)
  data = list(y=y, event=event, x=x)

  formula=inla.surv(y,event)~ x
  r=inla(formula,
        family ="weibullsurv",
        data=data,
        control.family = list(list(variant = variant)))
  print("SURV")
  print(summary(r))
}
```

```

formula= y ~ x
r=inla(formula,
      family ="weibull",
      data=data,
      control.family = list(list(variant = variant)))
print("REGRESSION")
print(summary(r))
}

```

Notes

- Weibullsurv model can be used for right censored, left censored, interval censored data. If the observed times y are large/huge, then this can cause numerical overflow in the likelihood routine. If you encounter this problem, try to scale the observations, `time = time / max(time)` or similar.