Weibull

Parametrisation

The Weibull distribution is (`variant=0`)

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

and (`variant=1`)

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

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 loggamma
param 0.4 0.26
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

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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 observatios, `time = time / max(time)` or similar.