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 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

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))
```

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.