

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="weibull.surv"** 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 -2

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

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weibullsurv

doc The Weibull likelihood (survival)

hyper

theta

hyperid 79101

name log alpha

short.name alpha

initial -2

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)

theta2

hyperid 79102

name beta1

short.name beta1

initial -7

fixed FALSE

prior normal

param -4 100

to.theta function(x) x

from.theta function(x) x

theta3

hyperid 79103

name beta2

short.name beta2

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta4

hyperid 79104

name beta3

short.name beta3

initial 0

fixed FALSE

prior normal

param 0 100

to.theta function(x) x

from.theta function(x) x

theta5

```

    hyperid 79105
    name beta4
    short.name beta4
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta6
    hyperid 79106
    name beta5
    short.name beta5
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta7
    hyperid 79107
    name beta6
    short.name beta6
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta8
    hyperid 79108
    name beta7
    short.name beta7
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
theta9
    hyperid 79109
    name beta8
    short.name beta8
    initial 0
    fixed FALSE

```

```

    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
  theta10
    hyperid 79110
    name beta9
    short.name beta9
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) x
  theta11
    hyperid 79111
    name beta10
    short.name beta10
    initial 0
    fixed FALSE
    prior normal
    param 0 100
    to.theta function(x) x
    from.theta function(x) 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.