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="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`
output.name `alpha parameter for weibull`
output.name.intern `alpha_intern for weibull`
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

pdf weibull

weibullsurv

doc The Weibull likelihood (survival)

hyper

theta

hyperid 79101

name log alpha

short.name alpha

output.name alpha parameter for weibullsurv

output.name.intern alpha_intern for weibullsurv

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

output.name beta1 for Weibull-Cure

output.name.intern beta1 for Weibull-Cure

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

output.name beta2 for Weibull-Cure

output.name.intern beta2 for Weibull-Cure

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
    output.name beta3 for Weibull-Cure
    output.name.intern beta3 for Weibull-Cure
    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
    output.name beta4 for Weibull-Cure
    output.name.intern beta4 for Weibull-Cure
    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
    output.name beta5 for Weibull-Cure
    output.name.intern beta5 for Weibull-Cure
    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
    output.name beta6 for Weibull-Cure
    output.name.intern beta6 for Weibull-Cure
    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
output.name beta7 for Weibull-Cure
output.name.intern beta7 for Weibull-Cure
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
output.name beta8 for Weibull-Cure
output.name.intern beta8 for Weibull-Cure
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
output.name beta9 for Weibull-Cure
output.name.intern beta9 for Weibull-Cure
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
output.name beta10 for Weibull-Cure
output.name.intern beta10 for Weibull-Cure

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