

# Exponential

## Parametrisation

The Exponential distribution is

$$\text{Prob}(y) = \lambda \exp(-\lambda y) \quad \lambda > 0$$

for responses  $y > 0$ .

In survival analysis, models are generally specified through the hazard function. For exponential model, the baseline hazard is constant over time and the hazard function is:

$$h(y) = \lambda$$

## Link-function

The parameter  $\lambda$  is linked to the linear predictor as:

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

## Hyperparameters

None.

## Specification

- `family="exponential"` for regression models and `family="exponential.surv"` for survival models.
- Required arguments:  $y$  (to be given in a format by using `inla.surv()` for survival models )

## Hyperparameter spesification and default values

`doc` The Exponential likelihood

`hyper`

`survival` FALSE

`discrete` FALSE

`link` default log

`pdf` exponential

## Example

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

```
n = 1000
x = rnorm(n, sd = 0.5)
lambda = exp(1+x)
y = rexp(n, rate=lambda)
event = rep(1,n)
data = list(y=y, event=event, x=x)
formula = inla.surv(y,event) ~ x
model = inla(formula, family = "exponential.surv", data=data)
```

```

summary(model)

formula = y ~ x
model = inla(formula, family ="exponential", data=data)
summary(model)


n = 1000
x = rnorm(n, sd = 0.5)
lambda = 1/exp(1+x)
yy = rexp(n, rate=lambda)
ys <- rexp(n, rate = exp(1))
y <- pmin(yy, ys)
event <- as.numeric(ys > yy)

data = list(y=y, event=event, x=x)
summary(inla(inla.surv(y,event) ~ x,
                 family ="exponential.surv",
                 control.family = list(link = list(model = "neglog")),
                 data=data))

library(survival)
summary(survreg(Surv(y, event) ~ x, data=data, dist="exponential"))

```

Notes