

# Exponential power likelihood

## Parameterisation

The exponential power distribution is

$$f(y) = \exp\left(-\left(\frac{|y - \mu|}{\sigma\alpha(\beta)}\right)^\beta\right) \frac{\beta}{2\sigma\alpha(\beta)\Gamma(1/\beta)}$$

for continuously responses  $y$  where

$\mu$ : is the the mean

$\sigma$ : is the standard deviation

and  $\alpha(\beta) = \sqrt{\Gamma(1/\beta)/\Gamma(3/\beta)}$ .

## Link-function

The mean is given by the linear predictor  $\eta$  from the formula

$$\text{link}(\mu) = \eta$$

where the default is the *identity*-link. The precision  $\tau$  is given as  $\tau = 1/\sigma^2$ .

## Hyperparameters

The two hyperparameters in the model are

$$\theta_1 = \log(\tau)$$

and

$$\beta = 1 + \exp(\theta_2)$$

and the priors are given on  $(\theta_1, \theta_2)$ .

## Specification

- `family="exppower"`
- Required arguments:
- Required arguments:  $y$  and  $s$  (argument `scale`)

The scalings have default value 1.

## Hyperparameter spesification and default values

`family="exppower"`

`doc` The exponential power likelihoood

`hyper`

`theta1`

`hyperid 65021`

`name log precision`

```

short.name prec
output.name NOT IN USE
output.name.intern NOT IN USE
initial 4
fixed FALSE
prior loggamma
param 1 5e-05
to.theta function(x) log(x)
from.theta function(x) exp(x)
theta2
  hyperid 65022
  name power
  short.name beta
  output.name NOT IN USE
  output.name.intern NOT IN USE
  initial 0
  fixed FALSE
  prior gaussian
  param 0 100
  to.theta function(x) log(x-1)
  from.theta function(x) 1+exp(x)

status experimental

survival FALSE

discrete FALSE

link default identity quantile

pdf exppower

```

## Example

```

library(gnorm)
n <- 10^4
x <- rnorm(n)
sigma <- 2.0
beta <- 1.5
alpha <- sqrt(gamma(1/beta)/gamma(3/beta)) * sigma
y <- 1 + x + rgnorm(n, alpha = alpha, beta = beta)
r <- inla(y ~ 1 + x,
  data = data.frame(y, x),
  family = "exppower",
  control.compute = list(cpo = TRUE),
  control.fixed = list(prec.intercept = 1),
  control.inla = list(cmin = 0))
summary(r)

n <- 10^5

```

```

x <- rnorm(n)
sigma <- 2.0
beta <- 1.5
alpha <- sqrt(gamma(1/beta)/gamma(3/beta)) * sigma
## this is the lin.pred for the quantile
eta.q <- 1 + x
quantile <- 0.9
## this is the mu/mean/median-parameter in the qgnorm
mu <- eta.q - qgnorm(quantile, alpha = alpha, beta = beta)
y <- rgnorm(n, mu = mu, alpha = alpha, beta = beta)
rr <- inla(y ~ 1 + x,
          data = data.frame(y, x),
          family = "exppower",
          control.compute = list(cpo = TRUE),
          control.family = list(control.link = list(model = "quantile",
                                                    quantile = quantile)),
          control.fixed = list(prec.intercept = 1),
          control.inla = list(cmin = 0))
summary(r)

```

## Notes