

# Box-Cox Gaussian (DISABLED, NOT YET COMPLETE)

## Parametrisation

The Gaussian distribution is

$$f(y) = \frac{\sqrt{s\tau}}{\sqrt{2\pi}} y^{\lambda-1} \exp\left(-\frac{1}{2}s(f_{\lambda,\mu}(y) - \mu)^2\right)$$

for continuously responses  $y > 0$  where

$\mu$ : is the the mean

$\tau$ : is the precision

$s$ : is a fixed scaling,  $s > 0$ .

and the Box-Cox transformation is

$$f_{\lambda,\mu}(y) = \frac{y^\lambda - 1}{\lambda} - \frac{\mu^\lambda - 1}{\lambda}$$

## Link-function

The mean and variance of  $y$  are given as

$$\mu \quad \text{and} \quad \sigma^2 = \frac{1}{s\tau}$$

and the mean is linked to the linear predictor by

$$\mu = \eta$$

## Hyperparameters

The precision is  $\tau$  and

$$\theta_1 = \log \tau$$

and the prior is defined on  $\theta_1$ .

The Box-Cox transformation-parameter  $\lambda$  is  $\theta_2 = \lambda$  and the prior is defined on  $\theta_2$ .

## Specification

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

The scalings have default value 1.

## Hyperparameter spesification and default values

**doc** The Box-Cox Gaussian likelihood

**hyper**

**theta1**

**hyperid** 65010

**name** log precision



```

short.name prec
output.name Precision for the Box-Cox Gaussian observations
output.name.intern Log precision for the Box-Cox Gaussian observations
initial 4
fixed FALSE
prior loggamma
param 1 5e-05
to.theta function(x) log(x)
from.theta function(x) exp(x)

theta2
  hyperid 65011
  name Box-Cox transformation parameter
  short.name lambda
  output.name NOT IN USE
  output.name.intern NOT IN USE
  initial 1
  fixed FALSE
  prior gaussian
  param 1 8
  to.theta function(x) x
  from.theta function(x) x

status disabled

survival FALSE

discrete FALSE

link default identity

pdf bcgaussian

```

## Example

```

n=100
a = 1
b = 1
z = rnorm(n)
eta = a + b*z
tau = 100
scale = exp(rnorm(n))
prec = scale*tau
y = rnorm(n, mean = eta, sd = 1/sqrt(prec))

data = list(y=y, z=z)
formula = y ~ 1+z
result = inla(formula, family = "gaussian", data = data,
  control.family = list(hyper = list(
    prec = list(
      prior = "loggamma",

```



```

                                param = c(1.0,0.01),
                                initial = 2))),
                                scale=scale, keep=TRUE)
summary(result)

## with an offset in the variance
var0 = 1.0 ## fixed offset
var1 = 2.0
v = var0 + var1
s = sqrt(v)
x = rnorm(n)
y = 1 + x + rnorm(n, sd = s)
rr = inla(y ~ x,
          data = data.frame(y, x),
          control.family = list(
            hyper = list(precoffset = list(initial = log(1/var0)))),
          verbose = TRUE)
summary(rr)
plot(rr$internal.marginals.hyperpar[[1]], type = "l", lwd=3)
abline(v = log(1.0/var1), lwd=3, col = "blue")

```

## Notes