Box-Cox Gaussian (DISABLED, NOT YET COMPLETE)

Parametrisation

The Gaussian distribution is

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

for continuously responses y > 0 where

 μ : is the mean

 τ : 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

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

and the mean is linked to the linear predictor by

$$\mu = \eta$$

Hyperparameters

The precision is τ and

$$\theta_1 = \log \tau$$

and the prior is defined on θ_1 .

The Box-Cox transformation-parameter λ is $\theta_2 = \lambda$ and the prior is defined on θ_2 .

Specification

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

The scalings have default value 1.

Hyperparameter spesification and default values

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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
\mathbf{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 = "1", lwd=3)
abline(v = log(1.0/var1), lwd=3, col = "blue")
```

Notes