Proper/Non-intrinsic Besag model for spatial effects (variant 2)

Parametrization

The (2nd) proper version of the Besag model for random vector $\mathbf{x} = (x_1, \ldots, x_n)$ is defined with precision matrix[1]

$$\tau((1-\lambda)I + \lambda R) \tag{1}$$

where R is the (unit precision) precision matrix for the Besag model, τ is a precision parameter and $0 < \lambda < 1$.

Hyperparameters

The precision parameter τ is represented as

$$\theta_1 = \log \tau$$

and the prior is defined on θ_1. The λ parameter is represented as

$$\theta_2 = \log\left(\lambda/(1-\lambda)\right)$$

and the prior is defined on θ_2.

Specification

The model is specified inside the `f()` function as

```
f(<whatever>, model="besagproper2", graph=<graph>,
  hyper=<hyper>)
```

The neighbourhood structure of **x** is passed to the program through the `graph` argument. The structure of this file is described below.

Hyperparameter spesification and default values

hyper

theta1

name log precision
short.name prec
prior loggamma
param 1 5e-04
initial 2
fixed FALSE
to.theta `function(x) log(x)`
from.theta `function(x) exp(x)`

theta2

name logit lambda
short.name lambda
prior gaussian

[1] Brian G Leroux, Xingye Lei, and Norman Breslow. Estimation of disease rates in small areas: A new mixed model for spatial dependence. In Statistical Models in Epidemiology, the Environment, and Clinical Trials, pages 179191. Springer, 2000

param 0 0.45
initial 3
fixed FALSE
to.theta `function(x) log(x/(1-x))`
from.theta `function(x) exp(x)/(1+exp(x))`

constr FALSE

nrow.ncol FALSE

augmented FALSE

aug.factor 1

aug.constr

n.div.by

n.required TRUE

set.default.values TRUE

status experimental

pdf besagproper2

Example

```
graph.file = system.file("demodata/germany.graph", package="INLA")
g = inla.read.graph(graph.file)

## we will use replicated samples in our testing
nrep = 5

tau = 10.0
lambda = 0.3
R = -inla.graph2matrix(g)
diag(R) = g$nnbs
n = g$n
Q = tau * ( (1-lambda) * diag(n) + lambda * R)
y = c(inla.qsample(nrep, Q))

i = rep(1:g$n, nrep)
replicate = rep(1:nrep, each = g$n)
formula = y ~ f(i, model="besagproper2",  graph = g,
        replicate=replicate) - 1

r = inla(formula,
        data = data.frame(y, i, replicate),
        family = "gaussian",
        control.family = list(
                hyper = list(
                        prec = list(
                                initial = 10,
                                fixed=TRUE))))
```

Notes

None