Proper Besag model for spatial effects

Parametrization

The proper version of the Besag model for random vector $\mathbf{x} = (x_1, \dots, x_n)$ is defined as

$$x_i|x_{-i}, \tau, \phi \sim \mathcal{N}\left(\frac{\phi}{1+\phi n_i} \sum_{i \sim j} x_j, \frac{1}{(1+\phi n_i)\tau}\right)$$
 (1)

where n_i is the number of neighbours of node $i, i \sim j$ indicates that the two nodes i and j are neighbours, $\phi > 0$ is as weight parameter and $\tau > 0$ is a "precision-like" (or scaling) parameter.

Hyperparameters

The precision parameter τ is represented as

$$\theta_1 = \log \tau$$

and the prior is defined on θ_1 .

The weight parameter ϕ is represented as

$$\theta_2 = \log \phi$$

and the prior is defined on θ_2 .

Specification

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

```
f(<whatever>,model="besagproper",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 log diagonal short.name diag prior loggamma

```
param 11
initial 1
fixed FALSE
to.theta function(x) log(x)
from.theta function(x) 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 besagproper
```

Structure of the graph file

OLD: We describe the required format for the graph file using a small example. Let the file gra.dat, relative to a small graph of only 5 elements, be

Line 1 declares the total number of nodes in the graph (5), then, in lines 2-6 each node is described. For example, line 4 states that node 3 has 4 neighbours and these are nodes 2, 4 and 5.

The graph file can either have nodes indexed from 1 to n, or from 0 to n-1. Note that in the latter case, node i seen from R corresponds to node i-1 in the 0-indexed graph.

Example

To be added

Notes

Add notes later?