Besag model for spatial effects

Parametrization

The besag model for random vector $\mathbf{x} = (x_1, \ldots, x_n)$ is defined as

$$x_i | x_j, i \neq j, \tau \sim \mathcal{N}(\frac{1}{n_i} \sum_{i \sim j} x_j, \frac{1}{n_i \tau}) \tag{1}$$

where n_i is the number of neighbours of node i, $i \sim j$ indicates that the two nodes i and j are neighbours.

Hyperparameters

The precision parameter τ is represented as

$$\theta_1 = \log \tau$$

and the prior is defined on θ_1.

Specification

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

```
f(<whatever>,model="besag",graph.file=<graph file name>,
  hyper=<hyper>, adjust.for.con.comp = TRUE)
```

The neighbourhood structure of $\mathbf{x}$ is passed to the program through the `graph.file` argument. The structure of this file is described below.

The option `adjust.for.con.comp` adjust the model if the graph has more than one connected compoment, and this adjustment can be disabled setting this option to FALSE.

Hyperparameter spesification and default values

hyper

    theta

        name log precision
        short.name prec
        prior loggamma
        param 1 5e-05
        initial 4
        fixed FALSE
        to.theta function(x) log(x)
        from.theta function(x) exp(x)

constr TRUE

nrow.ncol FALSE

augmented FALSE

aug.factor 1

aug.constr

n.div.by

n.required   TRUE

set.default.values   TRUE

pdf   besag

Structure of the graph file

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

```
5
1 1 2
2 2 1 3
3 3 2 4 5
4 1 3
5 1 3
```

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

For examples of application of this model see the `Bym`, `Munich`, `Zambia` or `Scotland` examples in Volume I.

Notes

The besag model intrinsic with rankdef 1.