Bym model for spatial effects

Parametrization

This model is simply a union of the besag model u and a iid model v, so that

$$x = \begin{pmatrix} v + u \\ u \end{pmatrix}$$

Note that the length of x is $2n$ if the length of u (and v) is n. The benefite is that this allows to get the posterior marginals of the sum of the spatial and iid model; otherwise it offers no advantages.

Hyperparameters

The hyperparameters are the precision τ_1 of the iid model (v) and the precision τ_2 of the besag model (u). The precision parameters are represented as

$$\theta = (\theta_1, \theta_2) = (\log \tau_1, \log \tau_2)$$

and the prior is defined on θ.

Specification

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

```
f(<whatever>,model="bym",graph=<graph>,
  hyper=<hyper>, adjust.for.con.comp = TRUE,
  scale.model = FALSE)
```

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

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`. This means that `constr=TRUE` is interpreted as a sum-to-zero constraint on *each* connected component and the `rankdef` parameter is set accordingly.

The logical option `scale.model` determine if the besag-model-part of the model u should be scaled to have an average variance (the diagonal of the generalized inverse) equal to 1. This makes prior spesification much easier. Default is `FALSE` so that the model is not scaled.

Hyperparameter spesification and default values

hyper

theta1

name log unstructured precision
short.name prec.unstruct
prior loggamma
param 1 5e-04
initial 4
fixed FALSE
to.theta `function(x) log(x)`
from.theta `function(x) exp(x)`

theta2

name log spatial precision

short.name prec.spatial
prior loggamma
param 1 5e-04
initial 4
fixed FALSE
to.theta `function(x) log(x)`
from.theta `function(x) exp(x)`

constr TRUE

nrow.ncol FALSE

augmented TRUE

aug.factor 2

aug.constr 2

n.div.by

n.required TRUE

set.default.values TRUE

pdf bym

Example

For examples of application of this model see the `Bym` example in Volume I.

Notes

The term $\frac{1}{2}\log(|R|^*)$ of the normalisation constant is not computed, hence you need to add this part to the log marginal likelihood estimate, if you need it. Here R is the precision matrix with a unit precision parameter for the Besag part of the model.