RW2DIID model for spatial effects

Parametrization

This model is a union of the RW2D model u^* and a iid model v^* , so that

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

where both u^* and v^* has a precision (hyper-)parameter. The length of x is 2n if the length of u^* (and v^*) is n. The RW2DIID model uses a different parameterisation of the hyperparameters where

$$x = \begin{pmatrix} \frac{1}{\sqrt{\tau}} \left(\sqrt{1 - \phi} \ v + \sqrt{\phi} \ u \right) \\ u \end{pmatrix}$$

where both u and v are *standardised* to have (generalised) variance equal to one. The *marginal* precision is then τ and the proportion of the marginal variance explained by the spatial effect (u) is ϕ .

Hyperparameters

The hyperparameters are the margainal precision τ and the mixing parameter ϕ . The marginal precision τ is represented as

$$\theta_1 = \log(\tau)$$

and the mixing parameter as

$$\theta_2 = \log\left(\frac{\phi}{1 - \phi}\right)$$

and the prior is defined on $\theta = (\theta_1, \theta_2)$.

Specification

The rw2diid model is specified inside the f() function as

```
f(<whatever>, model="rw2didd", nrow=<nrow>, ncol=<ncol>,
    hyper=<hyper>)
```

Hyperparameter spesification and default values

hyper

```
theta1
```

```
name log precision
short.name prec
prior pc.prec
param 1 0.01
initial 4
fixed FALSE
to.theta function(x) log(x)
from.theta function(x) exp(x)
```

theta2

name logit phi

```
short.name phi
         prior pc
         param 0.5 -1
         initial 3
         fixed FALSE
         to.theta function(x) log(x/(1-x))
         from.theta function(x) \exp(x)/(1+\exp(x))
constr TRUE
nrow.ncol TRUE
augmented TRUE
aug.factor 2
aug.constr 2
n.div.by
n.required FALSE
set.default.values TRUE
status experimental
pdf rw2diid
```

Example

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 for the standardised RW2D part of the model.

The generic PC-prior for ϕ is available as prior="pc" and parameters param="c(u, alpha)", where $\operatorname{Prob}(\phi \leq u) = \alpha$. If $\alpha < 0$ or $\alpha > 1$, then it is set to a value close to the minimum value of α allowed.