

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

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

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 marginal 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

`doc` Thin-plate spline with iid noise

`hyper`

`theta1`

`hyperid 33001`

`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
  hyperid 33002
  name logit phi
  short.name phi
  prior pc
  param 0.5 0.5
  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 $\text{Prob}(\phi \leq u) = \alpha$. If $\alpha < 0$ or $\alpha > 1$, then it is set to a value close to the minimum value of α allowed.