# 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 $\tau$ and the proportion of the marginal variance explained by the spatial effect ($u$) is $\phi$.

## Hyperparameters

The hyperparameters are the margainal precision $\tau$ and the mixing parameter $\phi$. The marginal precision $\tau$ 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 $\phi$ 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 $\alpha$ allowed.