# 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

**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 $\phi$ 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.