

# Student- $t$ model for Stochastic volatility

## Parametrization

The Student- $t$  likelihood for stochastic volatility models is defined as:

$$\pi(y|\eta) = \sigma\epsilon$$

where

$$\epsilon \sim T_\nu$$

and  $T_\nu$  is a Student- $t$  distribution with  $\nu$  degrees of freedom *standardised* to that is has mean 0 and variance 1 for any value of  $\nu$ .

## Link-function

The squared scale parameter  $\sigma$  is linked to the linear predictor  $\eta$  as:

$$\sigma^2 = \exp(\eta)$$

## Hyperparameters

The degrees of freedom  $\nu$  is represented as

$$\theta = \log(\nu - 2)$$

and the prior is defined on  $\theta$

## Specification

- family = `stochvol.t`
- Required argument:  $y$ .

## Hyperparameter spesification and default values

**hyper**

**theta**

**name** log degrees of freedom

**short.name** dof

**initial** 4

**fixed** FALSE

**prior** loggamma

**param** 1 0.5

**to.theta** function(x) log(x-2)

**from.theta** function(x) 2+exp(x)

**survival** FALSE

**discrete** FALSE

**link** default log

**pdf** stochvolt

## Example

In the following example we specify the likelihood for the stochastic volatility model to be Student- $t$

```
n=1000
x = 0.1 * arima.sim(n = n, model = list(ar = 0.9))
y=exp(x/2)*rt(n,df=6)
time=1:n
data=data.frame(y,time)

formula=y~f(time, model="ar1")+1
result=inla(formula,family="stochvol.t",data=data)
## sometimes we need to add
## control.inla = list(cmin = 1e-2)
## to make it converge
hyper=inla.hyperpar(result)
```

## Notes

None