# 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**
>
>> **hyperid** 83001
>> **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