Log-normal model for Stochastic volatility

Parametrization

The likelihood is

$$y_i|\ldots \sim N(c-\frac{1}{2}\sigma_i^2,\sigma_i^2)$$

where the mean depends on the variance, and c is an optional hyperparameter.

Link-function

The variance is linked to the linear predictor as η_i as:

$$\log(\sigma_i^2) = \eta_i$$

Hyperparameters

This likelihood has one hyperparmeter

$$\theta = c$$

and the prior is defined on θ . By default, c is fixed to c = 0.

Specification

• family="stochvolln"

Hyperparameter spesification and default values

 $\operatorname{\mathbf{doc}}$ The Log-Normal stochvol likelihood

hyper

```
theta
```

```
hyperid 82011
name offset
short.name c
output.name Mean offset for stochvolln
output.name.intern Mean offset for stochvolln
initial 0
fixed FALSE
prior normal
param 0 10
to.theta function(x) x
from.theta function(x) x
```

survival FALSE

discrete FALSE

link default log

pdf stochvolln

Example

```
n <- 1000
s < -0.5
rho <- 0.95
x <- s * as.numeric(scale(arima.sim(n, model = list(ar = rho))))</pre>
v <- exp(x) ## variance
cc <- 0.5 * mean(v)
y \leftarrow rnorm(n, mean = cc - 0.5 * v, sd = sqrt(v))
r \leftarrow inla(y -1 + f(time, model = "ar1",
                     hyper = list(rho = list(prior = "pc.cor1",
                                              param = c(0.9, 0.5)),
                                  prec = list(prior = "pc.prec",
                                               param = c(1, 0.01),
                                               initial = 0))),
          data = list(y = y, n = n, time = 1:n),
          family = "stochvolln",
          verbose = TRUE, safe = F, keep = T)
par(mfrow = c(3, 2))
plot(y, type = "l", main = "y")
plot(x, type = "l", main = "x and x.est")
lines(r$summary.linear.predictor$mean, col = "blue")
m <- inla.tmarginal(function(x) sqrt(1/x), r$marginals.hyperpar[["Precision for time"]])</pre>
plot(m, type = "1", lwd = 3, main = "sd")
abline(v=s)
m <- inla.smarginal(r$marginals.hyperpar[["Rho for time"]])</pre>
plot(m, type = "1", lwd = 3, main = "rho")
abline(v=rho)
m <- inla.smarginal(r$marginals.hyperpar[["Mean offset for stochvolln"]])</pre>
plot(m, type = "1", lwd = 3, main = "c")
abline(v=cc)
```