

Code for “Bayesian inference with stochastic volatility models using continuous superpositions of non-Gaussian Ornstein-Uhlenbeck processes”

May 20, 2009

The Matlab M-file `MCMC_contOU.m` contains code to run the samplers described in the paper (including both dependent and independent thinning). The code uses the Matlab m file `randraw.m` was written by Alex Bar Guy & Alexander Podgaetsky which is available from Matlab Central. There are two data sets which both refer to the Standard and Poors 500 stock index. The first is `ret2.mat`, which covers September 26, 1980 to June 6, 2000 and the second is `retstar.mat`, which covers April 28, 1989 to February 26, 2009. The code is available for academic use only and any problems should be reported to Dr Jim Griffin (J.E.Griffin-28@kent.ac.uk).

```
[output] = MCMC_contOU(data, dep, burnin, numbofits, every, samplersd)
```

The code outputs average acceptance rates for various parameters whilst the code is running which can be used to adjust variances of random walk proposals to acceptable level.

Outputs

- `output` is Matlab structure containing `numbofits` samples from the posterior distribution of some parameters of the model: ν (nu), γ (gamma), α (alpha), ϕ (phi), μ (mu), β (beta), ρ (rho), b (bJump) and σ_j^2 (SigmasqJump). The other elements of `output` are:

`sigmasqn` is a T by `numbofits` dimensional matrix where the i -th column is the draw of $\sigma_1^2, \sigma_2^2, \dots, \sigma_T^2$ for i -th recorded iteration.

`jump1` is a T by `numbofits` dimensional matrix where the (i, j) -th represents whether there is a jump (`jump1(i, j)=1`) or not (`jump1(i, j)=0`) in period $((j-1)\Delta, j\Delta)$ for i -th recorded iteration.

`jump2` is a T by `numbofits` dimensional matrix where the (i, j) -th is the size of the jump in period $((j-1)\Delta, j\Delta)$ for i -th recorded iteration.

`loglike` - the log-likelihood of the model $-\sum_{n=1}^T \log(\sigma_n^2) - \sum_{n=1}^T (y_n - \mu - \beta\sigma_n^2 - \rho(z_n - \bar{z}))^2 / (2\sigma_n^2)$.

Inputs

- `data` - the observed returns y_1, y_2, \dots, y_T .
- `dep` - the updating of ν and λ : dependent thinning (`dep=2`) and retrospective sampling (`dep=1`).
- `burnin` - the burn-in length
- `numbofits` - the number of iterations to be recorded.
- `every` - the level of thinning. The total number of iterations is `burnin+numbofits*every`.
- `samplersd` - a 5-dimensional vector with the standard deviation of the random walk updates for the following parameters: $J_i, \lambda_i, \nu, \alpha, \tau_i$ (see the paper for details about tuning).

Example

```
load 'retstar.mat'
samplersd = [4 4 0.012 1.8 600];
[output] = MCMC_contOU(retstar, 2, 5000, 5000, 40, samplersd);
```

The output from the chain can be plotted in the following way. The command

```
plot(output.nu)
```

will show a trace plot of ν .