

An R Framework for Simulation and Inference of Stochastic Processes

Stefano Maria Iacus¹

¹ *Department of Economics, Management and Quantitative Methods, University of Milan.*
stefano.iacus@unimi.it

We present an R computational framework aimed at simplify the use of stochastic processes in applications, including but not limited to, finance. The YUIMA framework [1, 8] can easily handle stochastic processes which range from simple SDEs to fractional Brownian motion driven or Lévy driven SDEs as well as pure jump Lévy processes, point processes (like Poisson, Hawkes, etc) or continuous counterparts of ARMA and Garch processes, namely CARMA [5] and COGARCH [6] models. Models in YUIMA are specified in a flexible and mathematically sound way. Inference is based on quasi-maximum likelihood approach. Other tools like asymptotic expansion formulas based on Malliavin calculus, AIC/BIC, hypotheses testing [3], change point estimation [7], LASSO model selection [2] are available as well. Recently, a GUI has been added to this framework to simplify further the usage of this framework. This GUI also include modules for basic option pricing. In this talk we will also present some numerical issues behind simulation and inference for stochastic processes of the above types [4].

References

- [1] Brouste, A., Fukasawa, M., Hino, H., Iacus, S.M., Kamatani, K., Koike, Y., Nomura, R., Shimizu, Y., Uchida, M., Yoshida, N., *The YUIMA Project: a Computational Framework for Simulation and Inference of Stochastic Differential Equations*, Journal of Statistical Software, 57:4 (2014), 1–51.
- [2] De Gregorio, A., Iacus, S.M., *Adaptive LASSO-type estimation for ergodic diffusion processes*, Econometric Theory, 28 (2012), 1–23.
- [3] De Gregorio, A., Iacus, S.M., *On a family of test statistics for discretely observed diffusion processes*, Journal of Multivariate Analysis, 122 (2013), 292–316.
- [4] Iacus, S.M. *Simulation and Inference for Stochastic Differential Equations: with R examples*, (2008), Springer Series in Statistics, Springer NY.
- [5] Iacus, S.M., Mercuri, L., *Implementation of Lévy CARMA model in Yuima package*, Computational Statistics, (2015), 1-31
- [6] Iacus, S.M., Mercuri, L., Roji, E., *COGARCH(p,q): Simulation and Inference with yuima Package*, Journal of Statistical Software, 80(4) (2017),1-35.
- [7] Iacus, S.M., Yoshida, N., *Estimation for the change point of the volatility in a stochastic differential equation*, Stochastic Processes and Their Applications, 122(2012), 1068–1092.
- [8] Iacus, S.M., Yoshida, N., *Simulation and Inference for Stochastic Processes with YUIMA*, (2018), Springer, New York.