MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

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Thursday, February 12, 2015
10:20 a.m. - 11:10 am
Refreshments 10:00 am
C405 Wells Hall

Parameter estimation for stochastic processes with memory, and applications in finance, climatology, and global food sustainablility

Abstract

Stochastic processes with long memory can be useful in a number of applied situations, from explanations for volatility persistence in financial econometrics, to long-range correlation interpretations for self-similarity in hydrological data, and recent applications in computer networking, financial derivatives, and paleoclimatology. Parameter estimation for such processes is an active are of research, with many open questions.

Our presentation starts with a partially observed system of two Ornstein-Uhlenbeck processes driven by fractional Gaussian noise, assuming that the latter's memory length is known. We appeal to the Malliavin calculus to prove that two distinct rates of mean reversion can be estimated consistently with asymptotic normality, based on continuous observation of a single path of one of the processes, thanks to a least-squares estimator, and explain what modifications are needed when the path is only observed in discrete time. In the latter case, we also mention work in progress to prove quantitative normal asymptotics by using sharp new tools from the Malliavin calculus. This is all joint work with Prof. Khalifa Es-sebaiy from the National School of Applied Sciences in Marrakech, Morocco.

This and many other works on parameter estimation for stochastic processes do not address the issue of estimating the memory length, a difficult problem when self-similarity and/or path regularity cannot be used as proxies. We present an overview of two empirical techniques for studying this problem: an application of calibration using option-pricing data in quantitative finance, and an application of Bayesian estimation in paleoclimatology. Time permitting, we will mention our related ongoing work to forecast society's ability to sustain the global food system to the year 2050, and its uncertainty. These works are joint with colleagues from statistics, mathematics, climatology, and agricultural economics.

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