High Dimensional Nonstationary Time Series

IRTG 1792 Short Course

Wei Biao Wu

I. Online Estimation of Covariance Matrices

For statistical inference of means of stationary processes, one needs to estimate their time-average variance constants (TAVC) or long-run variances. For a stationary process, its TAVC is the sum of all its covariances and it is a multiple of the spectral density at zero. The classical TAVC estimate which is based on batched means does not allow recursive updates and the required memory complexity is O(n). We propose a faster algorithm which recursively computes the TAVC, thus having memory complexity of order O(1) and the computational complexity scales linearly in n. Under short-range dependence conditions, we establish moment and almost sure convergence of the recursive TAVC estimate. Convergence rates are also obtained. Our one-pass algorithm is applied to stochastic gradient descent algorithms which is widely used in statistical machine learning and its solutions can be computed online or recursively.

Wei Biao Wu received the Ph.D. degree in statistics in 2001 from The University of Michigan, Ann Arbor. He is currently Professor of Statistics at The University of Chicago. His research interests include probability theory, statistics, financial time series and econometrics. He is currently interested in developing asymptotic theory for high-dimensional time series. He has received the National Science Foundation Career Award (2004) and The Tjalling C. Koopmans Econometric Theory Prize (2009). His research is supported by National Science Foundation research grants.

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