Inference of Bivariate Long-memory Aggregate Time Series

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Abstract

Multivariate time-series data are increasingly collected, with the increasing deployment of affordable and sophisticated sensors. These multivariate time series are often of long memory, the inference of which can be rather complex. We consider the problem of modeling long-memory bivariate time series that are aggregates from an underlying long-memory continuous-time process. We show that with increasing aggregation, the resulting discrete-time process is asymptotically a zero-th order vector fractional Gaussian noise (VFGN) model with the Hurst parameters (H1, H2) equal to those of the underlying continuous-time processes. This result justifies modeling long-memory bivariate aggregate time series by the parsimonious VFGN(H1;H2). However, the VFGN(H1;H2) model parametrization changes drastically in the case of identical Hurst parameters. We derive the likelihood ratio test for testing the equality of the two Hurst parameters, within the framework of Whittle likelihood. The limiting properties of the proposed test statistic and of the Whittle likelihood estimation are derived, and their finite sample properties are studied by simulation. The efficacy of the proposed approach is demonstrated with a 2-dimensional robotic positional error time series, which shows that the proposed parsimonious model substantially outperforms a VAR(19) model. (This is a joint work with Kung-Sik Chan of the University of Iowa).