How to fit a model when you know it is wrong?

Howell Tong  
howell.tong@gmail.com  
London School of Economics, United Kingdom

This talk is based on joint work with Professor Yingcun Xia of the National University of Singapore.

Using a time series model to approximate an observed time series has a long history. However, with regard to this objective, conventional likelihood-based methods for discrete-time dynamical models are frequently found to be wanting. In fact, they are characteristically misguided in at least two respects: (i) assuming that there is a true model; (ii) evaluating the efficacy of the estimation as if the postulated model is true. There are numerous examples of models, when fitted by conventional methods, that fail to capture some of the most basic global features of the data, such as cycles with good matching periods, singularities of spectral density functions (especially at the origin) and others. Since almost all models are wrong but some are useful if they are fitted properly, the practical issue becomes one of how to best fit a wrong model to data. Our primary aim is to match the joint probability distribution of the observable time series, including long-term features of the dynamics that underpin the data, such as cycles, long memory and others, rather than short term prediction. In this talk, we develop a non-likelihood approach to empirical time series analysis to address these challenges and to aim at achieving better feature matching. Numerical results, based on both simulations and real data, suggest that the proposed approach has several advantages over the conventional methods, especially when the time series is short or with strong cyclical fluctuations.