Investigating Nonlinear Spatio-Temporal Modelling: Some Personal Review and Examples

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School of Physical and Mathematical Sciences

The wide availability of data observed over time and space, in particular through inexpensive geographical information systems, has stimulated many studies in a variety of disciplines such as economics, environmental science, political science, demography and geography. In these studies, specific statistical methods have been developed to deal with the spatial structure reflected in the distribution of the dependent variable; see e.g. Ripley (1981), Anselin (1988), Cressie (1993), Guyon (1995), Stein (1999), Diggle (2003), Arbia (2006) and LeSage & Pace (2009) for systematic reviews in spatial statistics and spatial econometrics. In this talk I will first review some developments in exploring the nonlinearity in spatial and spatio-temporal data, in particular the challenges we have faced and the work that we have recently done. For example, nonparametric methods have been very popular in the last couple of decades in time series econometrics, but no such development has taken place for spatial models. A rather obvious reason for this is the curse of dimensionality. We proposed an adaptive varying-coefficient spatio-temporal model to avoid this problem for data observed irregularly over space and regularly in time. It is capable of catching possible nonlinearity (both in space and in time) and nonstationarity (in space) by allowing the autoregressive coefficients to vary with both spatial location and an unknown index variable. An application of the methodology to a climatological data set in the North Sea illustrates that our adaptive coefficient model outperforms all other naive and linear forecasts, with the smallest overall mean predictive error. An outlook with nonlinear spatial econometric modelling is also provided.

Speaker Biography

Dr Zudi Lu, has been appointed Associate Professor/Reader (academic level D) in Statistics in the School of Mathematical Sciences at, The University of Adelaide, Australia, since July 2009. He received PhD degrees in Probability Theory and Statistics from the Chinese Academy of Sciences (CAS) in 1996. He joined the Institute of Systems Science (part of CAS) in 1997. On the formation of the Academy of Mathematics and Systems Science in 1999, he became a tenured Associate Professor. In 2003, he moved to the Department of Statistics at the London School of Economics, as a Leverhulme Research Officer (2003-2006), and then moved to Curtin University of Technology as a tenured Lecturer (academic level B) in Applied Statistics/Financial Mathematics. Zudi’s research interests are Nonlinear Time Series Modelling and Nonlinear Spatial-Temporal Modelling with applications in financial and environmental risk modelling.

Host: Prof. Pan Guangming, Division of Mathematical Sciences, School of Physical and Mathematical Sciences

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