STATISTICS SEMINAR

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Thursday, November 19, 2015
Dickens Hall, Room 207, 4:00-5:00 pm
Refreshments: Dickens 108, 3:30-4:00 pm

A Unified Approach to Testing Nonlinear Time Series Analysis

This paper proposes a unified approach to testing adequacy of nonlinear time series models. The proposed test can be applied to various nonlinear time series models, including conditional probability distribution models, Markov chain regime-switching models, conditional duration models, conditional intensity models, continuous-time jump diffusion models, continuous-time regression models, and conditional quantile and interval models. Our approach is built upon the fact that for many nonlinear time series models, model adequacy usually implies that a suitably transformed process is an independent and identically distributed (i.i.d.) sequence with some specified marginal distribution. Examples include the probability integral transform of an autoregressive conditional distribution model, the integrated hazard function of a conditional duration or intensity model, the time-change transform of a continuous-time regression model, and the binary transformation of an autoregressive conditional quantile or interval model. These transforms are, respectively, i.i.d. U[0,1], i.i.d. EXP(1), i.i.d. N(0,1) and i.i.d. Bernoulli(α) for some known $\alpha \in (0, 1)$ when the time series models are correctly specified. The transformed process may be called the generalized residuals of a time series model since they are generalizations of Cox and Snell's (1968) concept of generalized residuals to a time series context. The proposed test checks the joint hypothesis of generalized residuals via a frequency domain approach and has omnibus power against a wide range of model misspecifications. It has a convenient null asymptotic N(0,1) distribution and is robust to dependent persistence in the underlying time series process. A Monte Carlo simulation study illustrates the merits of the approach.

Key Words: Binary Transformation, Generalized Residual, Generalized Spectrum, Joint Testing, Probability Integral Transform, Integrated Hazard, Time Change, Nonlinear Time Series Models.