Title: 
Random Effects Regression in Multiple Independent Discrete Valued Time Series

Abstract:
This talk is concerned with regression modelling with random effects of multiple independent time series of counts in which there serial dependence varies across series. Given covariates, random effects on these covariates and a random process (latent or observation driven), the observed response has an exponential family distribution. The structure of these models is similar to that of longitudinal data models with random effects. However, in contrast to that setting, where there are many cases and few to moderate observations per case, the time series setting has many observations per series and a few to moderate number of series. In examples such as these there are multiple time series in which shared regression effects need to be tested for equality, use of random effects to capture between series regression variation can be useful and serial dependence can vary between series. Two types of models are considered. Both involve fixed and random effects regression but they differ in the specification of the serial dependence processes. Observation driven models use past values of the observed series to induce serial dependence. Parameter driven models use a latent unobserved process to induce dependence. For the observation driven class we present a simple and easily implementable approach to estimation of the mixed model based on adaptive Gaussian quadrature and the Laplace approximation used in conjunction with existing software for fitting observation driven models for univariate discrete valued time series. For the parameter driven class, very high dimensional integrals need to be estimated along with the lower dimensional random effects integrals. Two applications are discussed. The first, with Poisson responses, reassesses the impact on single vehicle nighttime fatalities of lowering the legal BAC limit for drivers in 17 US states. A second example, with binary responses, which arises from responses by a panel of listeners to changing musical features is also presented.