1106-62-878 **Zhengyi Zhou*** (zz254@cornell.edu), **David S. Matteson**, **Dawn B. Woodard**, **Shane G. Henderson** and **Athanasios C. Micheas**. *A Spatio-Temporal Point Process Model for Ambulance Demand.*

Ambulance demand estimation at fine time and location scales is critical for fleet management and dynamic deployment. We estimate the spatial distribution of ambulance demand in Toronto, Canada, as it changes over discrete 2-hour intervals. This large-scale dataset is sparse at the desired temporal resolutions and exhibits location-specific temporal dependencies. We address these challenges by introducing a novel characterization of time-varying Gaussian mixture models. We fix the mixture component distributions across all time periods to overcome data sparsity and accurately describe Toronto's spatial structure, while representing the complex spatio-temporal dynamics through time-varying mixture weights. We constrain the mixture weights to capture weekly seasonality, and apply autoregressive priors on the mixture weights to represent location-specific serial dependence and daily seasonality. While we can use a fixed number of mixture components, we also extend to estimate the number of components using birth-and-death Markov chain Monte Carlo. The proposed model gives higher statistical predictive accuracy and reduces the error in predicting the industry's operational performance by as much as two-thirds compared to a typical industry practice. (Received September 08, 2014)