

Title: Modelling and Analysis of Telematics Data with Two Distinct Approaches

Abstract: Vehicle telematics provides granular data for dynamic driving risk assessment, but current methods often rely on aggregated metrics and do not fully exploit the rich time-series structure of trip-level data. In this presentation I will introduce two flexible approaches to analyze trip-level data and to evaluate trip-level and driver-level driving behaviors.

The first approach is to use continuous-time hidden Markov model (CTHMM) to model raw trip-level data without predefined thresholds on harsh driving events or assuming accident probabilities. The analysis relies solely on telematics data, requiring no traditional covariates. Using unsupervised anomaly detection based on pseudo-residuals, we identify deviations from normal driving patterns linked to accident risk. The model is validated with controlled and real-world datasets.

The second approach is to use wavelet transform to capture key driving patterns of trips which in turn are used to evaluate driving behaviors. By incorporating both frequency and severity of acceleration events, this approach enables to distinguish aggressive and inattentive driving from the normal driving behavior. Furthermore, the approach enhances interpretability, reduces misclassification, and provides a flexible foundation for telematics-based risk assessment.

This is joint work with Andrei Badescu, Sophia Chan, Jongtaek Lee.