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Is pleased to announce

**Modeling Truck Safety Critical Events:**

**Efficient Bayesian Hierarchical Statistical and Reliability Models**

An Oral Comprehensive Exam

**Background:**Road injury is the eighth leading cause of death globally and kills more than a million people each year. With the development of modern in-vehicle monitoring technology, more naturalistic driving studies (NDS) that collect real-time driver, location, and vehicle information are available researchers. These NDS datasets are high resolution, large volume, and representative of real-world driving status, which create both an opportunity and challenge to researchers.

**Objective:** 1) To examine the association between truck crashes and safety critical events using a Bayesian Gamma-Poisson regression; 2) To construct three scalable Bayesian hierarchical models to identify potential risk factors for Safety Critical Events; 3) To propose an innovative reliability model that accounts for both within shift cumulative driving time and between-trip rest time.

**Methods:** This analysis will use a commercial truck NDS dataset containing more than 1.4 billion real-time location, speed, vehicle and driver characteristics. High-resolution weather and road geometry data will be extracted from online application programming interface and fused back to NDS data. These real-time data will be aggregated to short trips and long shifts. A Bayesian Gamma-Poisson model will be used to examine the association between truck safety critical events and truck crashes. Bayesian hierarchical logistic and Poisson models, as well as non-homogeneous Poisson process, will be used to quantify the association between driver features, cumulative driving time, weather, road geometry and truck safety critical events. Hamiltonian Monte Carlo with energy conserving subsampling will be used to estimate these hierarchical models with over 1,000 random effects. To further account for the rests between trips, a jump-point power law process will be proposed and applied to this dataset.

**Implications:** Results from this analysis will help illustrate the effects of driver, fatigue, weather, and road features on safety critical events among truck drivers and further shed light on truck routing and scheduling. Besides, the analysis framework, as well as an associated R package to be developed, will serve as a pattern and toolkit to analyze NDS datasets from other studies.

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**Monday, October 7, 2019 – 10:00 AM – 12:00 PM**

Salus Room – Room 1412D (1st Floor)