Statistical Modeling for Complex Observation Data: Applications to Intelligent Transport System

Supervisor: Prajamitra Bhuyan

Research Group: Statistics and Data Science

Project description:

As the world becomes increasingly dominated by large-scale data-oriented complex systems, such as the Internet of Things, national transportation and cyber systems, the demand for automatic monitoring and mitigation for extreme and high-consequence events to enhance the safety, security and economic wellbeing of the smart cities is pressing. The effect of such events manifests in a number of ways, and novel statistical methodology and machine learning techniques are required to provide resilience to these systems. However, if the data used to train an algorithm contains biases against certain characteristics, then the resulting estimate will be biased. Using causal methods, we are aiming to ensure algorithmic fairness by taking into account different structural biases and compensating for them effectively. The `potential' outcome framework has been extensively studied in many causal inference settings.

The aim of this project to develop modeling framework to incorporate pre-intervention and post-intervention information based on the propensity score and outcome regression model. These methods are intended to assist in analysing the causal effect of various interventions on an intelligent transport system. In such applications, practitioners are interested to foresee the effect of an intervention on extreme quantiles of the outcome of interest.

There is an ample amount of literature on the estimation of quantile treatment effect in various application areas. However, the existing methods are not suitable for this purpose. In this project, we consider addressing this issue and propose a novel estimation method utilizing tools of causal inference and extreme value theory. It is also worth noting that we are obliged to assume that the outcomes of one unit are not affected by the treatment assignment of any other units. One possible direction of further studies could be using an improved design and defining several types of treatment effects and developing associated estimation methodologies for the setting where there may be clustered interference.

Further information:

How to apply

Entry requirements

Fees and funding