

Bayesian Sequential Learning and Decision Making in Bike-Sharing Systems

Abstract

Many shared transport systems have been developed in cities over the world to provide low-cost and ecofriendly alternative to traditional transportation means. However, there are many challenges in maintaining the overall system and one major concern for management is to ensure demand is satisfied for each stall at any given time. In this study, we develop an overall framework for addressing the station inventory management dynamically through a two-stage approach. In the first stage, we divide the day into discrete time intervals and utilize the Bayesian sequential learning model to predict the future demand of each bicycle stations and identify the redistribution needs over the network. We then solve the transportation model and provide vehicle routes for efficient management of rebalancing trucks. We illustrate the application of our proposed framework on the shared bike data from Seoul and show ways to incorporate covariates for future studies.

Keywords: Bike sharing, Bayesian Inference, Poisson-Gamma State Space Model, Sequential Learning, Decision Analysis