

Statistics, Optimization and Deep Learning in the ride-sharing Industry

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Abstract: In this talk, we introduce some fundamental questions people from ride-sharing industries are interested in. Firstly, we introduce a novel class of equilibrium metrics (EMs) to quantify spatio-temporal equilibrium of dynamic supply-demand networks defined on the same graph. The two key components of EMs are to formulate the spatio-temporal equilibrium problem as an unbalanced optimal transport problem and to develop an efficient linear programming algorithm to solve such transport problem. On the other hand, prediction of customer demands from each original location to a destination helps ride-sharing platforms to better understand their market mechanism. However, most existing prediction methods ignore the network structure of OD flow data and fail to utilize the topological dependencies among related OD pairs. In this paper, we propose a spatial-temporal origin-destination (STOD) model, with a novel convolutional neural network (CNN) filter to learn the spatial features of OD pairs from a graph perspective and an attention structure to capture their long-term periodicity.