On ride-pooling and traffic congestion

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Abstract:

Ridesourcing platforms, such as Uber, Lyft and Didi, are now launching commercial on-demand ride-pooling programs that enable their affiliated drivers to serve two or more passengers in one ride. It is generally expected that successful design of ride-pooling programs can reduce the required vehicle fleet size, and achieve various societally beneficial objectives, such as alleviating traffic congestion. The reduction in traffic congestion can in turn save travel time for both ridesourcing passengers and normal private car users. However, it is still unclear to what extent the implementation of ride-pooling affects traffic congestion and riders' travel time. To this end, this talk introduces a model to describe the ridesourcing markets with congestion effects, which are explicitly characterized by a macroscopic fundamental diagram. This study compares the time cost (sum of travel time and waiting time) of ridesourcing passengers and normal private car users (background traffic) in the ridesourcing markets without ride-pooling (each vehicle serves one passenger) and with ride-pooling (each vehicle serves one or more passengers). It is found that a win-win situation can be achieved under some scenarios such that the implementation of on-demand ride-pooling reduces the time cost for both ridesourcing passengers and private car users. Furthermore, we find that the matching window is a key decision variable the platform leverages to affect the stationary equilibrium state. As the matching window increases, passengers are expected to wait for longer time, but the pool-matching probability (the proportion of passengers who are pool-matched) increases, which further alleviates traffic congestion and in turn reduces passengers' travel time. It is interesting to conclude that there is a globally optimal matching window for achieving the minimum time cost for ridesourcing passengers in the normal flow regime.

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