Ride-Hailing Networks with Strategic Drivers: 
The Impact of Platform Control Capabilities on Performance

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Abstract:

This work is motivated by the emergence of ride-hailing platforms such as Uber, Lyft and Gett that match demand (passengers) with service capacity (drivers) over a geographically dispersed network. This matching problem is complicated by two challenges. (i) There are significant demand imbalances in the network. (ii) Drivers are self-interested and behave strategically in deciding whether to join, and if so, how to reposition (route) themselves when not transporting passengers.

To address these challenges we study the value of two operational controls, demand-side admission control and supply-side repositioning control, on the performance of a revenue-maximizing ride-hailing platform. Considering a fluid model of a two-location network in a game-theoretic framework, we characterize the system equilibrium under three operating regimes, ranging from minimal control to centralized admission and repositioning control. These results contribute novel insights on the interplay between the platform's admission control and the drivers’ strategic routing decisions.

We also quantify the impact of control capabilities on the platform revenue, the capacity and the per-driver profits. The value of control is largest at moderate utilization and increases with demand imbalances.

(Joint work with Costis Maglaras and Zhe Liu)