We Are on the Way: Analysis of On-Demand Ride-Hailing Systems

by

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Abstract: Recently, there has been a rapid rise of on-demand ride-hailing platforms, such as Uber and Didi, which allow passengers with smartphones to submit trip requests and match them to drivers based on their locations and drivers' availability. With the rapid rise, there have been questions about how such a new matching mechanism will affect the efficiency of the transportation system, in particular, whether it will help reduce passenger's average waiting time compared to that under a traditional street hailing system.

In this paper, we address this question by building a stylized model of a circular road and comparing the average waiting times of passengers under various matching mechanisms. After identifying key tradeoffs between different mechanisms, we find that surprisingly, the on-demand matching mechanism could result in higher or lower efficiency than the traditional street hailing mechanism, depending on the parameters of the system. To overcome the disadvantage of both systems, we further propose adding response caps to the on-demand hailing mechanism, and develop a heuristic method to calculate a near-optimal cap. We also test our model using more complex road networks and show that our key observations still exist. (Joint work with Guiyun Feng and Guangwen Kong)

Bio: Dr. Zizhuo Wang is an Assistant Professor from the Department of Industrial and Systems Engineering (ISyE) at the University of Minnesota. He received his PhD in Operations Research from Stanford University in 2012. Prior to that, he graduated from Department of Mathematical Sciences in Tsinghua University in 2007 and obtained his M.S. in Mathematical Finance in 2011 from Stanford University. His research interests mainly focus on optimization and stochastic modeling, especially with applications to pricing and revenue management. He has published several papers in top journal in the field of operations research, including Operations Research, Management Science, Manufacturing and Service Operations Management (MSOM), Mathematics of Operations Research, Mathematical Programming, SIAM Journal on Optimization, etc. He is also the co-founder and CTO for Cardinal Operations (杉数科技), which provides data to decision solutions to retail/logistics industries.