

学术报告会

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A Game Theoretic Approach for Road Pricing: Case Study of Singapore

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Abstract:

Traffic congestion causes efficiency loss, air pollution and wasteful energy consumption. It is also not easy to increase the road capacity due to space limitation and budget constraint for modern cities like Singapore, Hong Kong, Shanghai, Beijing, etc. The Electronic Road Pricing system in Singapore puts ERP gantries around the island in order to maintain an optimal speed range. In this talk, we first presents a new variant of standard fictitious play called average strategy fictitious play (ASFP) for large scale repeated congestion games, where only a weighted running average of all other players' actions is assumed to be broadcasted by the system supervisor to each player. It reduces the burden of both information gathering and information processing for each player. We prove that there exists at least one pure strategy Nash equilibrium for the congestion game under investigation, and the players' actions generated by ASFP with inertia (players' reluctance to change their previous actions) converge to a Nash equilibrium almost surely. The results are applied in road pricing design to achieve socially beneficial trip timing. In order to avoid broadcasting by the system supervisor, a consensus protocol is further introduced to estimate the number of players selecting each resource. Simulation results are provided based on the real traffic data for the Singapore case study.

Biography:

Dr. Nan Xiao received the B.E. and M.E. degrees in Electrical Engineering and Automation from Tianjin University, China in 2005 and 2007, respectively, and the Ph.D. degree in Electrical and Electronic Engineering from Nanyang Technological University, Singapore in 2012. Currently, he is a postdoctoral associate in the Singapore MIT Alliance for Research and Technology Centre working on the Future Urban Mobility IRG research program. Prior to that, he was a research associate and then a research fellow in the school of Electrical and Electronic Engineering, Nanyang Technological University. His research interests include networked control, robust and stochastic control, game theory and cooperative control, and intelligent transport systems.