Title: Maximizing the Probability of Arriving on Time or Early

Speaker: Dr. Cao Zhiguang

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Start Time: 10.30 a.m.
End Time: 12.00 p.m.

Venue: Executive Room Block E1-07-21, Faculty of Engineering

Abstract:

In many scenarios of routing planning, people need to arrive at the destination on time or early with the maximum chance, such as attending an important business meeting, fire rescue, organ delivery and catching up a flight. They all can be described by the probability tail (PT) model based stochastic shortest path (SSP) problem, which aims at maximizing the probability of arriving at the destination before a deadline. This model is promising as it integrates travel time, risk (the variance of travel time) and deadline.

However, existent solutions to the PT model based SSP problem suffer from several strong assumptions: Gaussian distribution of travel time for each road link, independence among travel time on different road links and so on, which may not hold in real traffic. To address these issues, 1) a data-driven approach was proposed by transforming the original problem as a cardinality minimization problem, which avoided those undesirable assumptions, and provided a new perspective to view the problem; 2) a framework was designed to improve the computation efficiency, which leveraged the partial Lagrange multiplier method and the total unimodularity characteristic; 3) a practical Q-learning method was designed to further improve the accuracy of finding the real optimal path, which maximized the expected reward regarding whether the vehicle can arrive on time or early; 4) a decentralized multiagent-based approach was devised to increase the chances of arriving on time or early for multiple cooperative vehicles, which formulated the route assignment to vehicle agents at each road intersection as a quadratic integer programming problem. It is worth mentioning that some of the above algorithms have been implemented into the navigation system of BMW i3.
Biography:

Dr. Cao Zhiguang has been collaborating with the BMW Group for 5 years. He is currently a Research Fellow with the BMW@NTU Future Mobility Research Lab, Energy Research Institute @ NTU, Singapore. He is also the team leader of intelligent mobility, with 2 PhD students, 3 Master students, 1 Project Officer and 4 undergraduate students. His research concentrates on the stochastic shortest path problems for vehicles, and the projects he is working on with BMW Group include: stochastic vehicle routing, cooperative vehicle routing, intelligent parking, traffic incident impact prediction, and Point-of-Interest recommendation for drivers.

Dr. Cao received his Ph.D. degree from the Interdisciplinary Graduate School and the School of Computer Science and Engineering, Nanyang Technological University (NTU) in 2016; and Master degree in Signal Processing from the School of Electrical and Electronic Engineering, NTU in 2012. He received the Bachelor degree in Automation from Guangdong University of Technology in 2009.

Dr. Cao has published 12 journal/conference papers and applied 2 German patents on his research field. The journals include IEEE-TITS, IEEE-TVT, IEEE-TETCI, IEEE-ITSM, and ACM-TIST. The conferences include AAAI (Top-tier conference in AI), ITSc and so on. He also served as reviewers for several high-rank journals, such as IEEE-TITS, IEEE WCM, and Neurocomputing.