THE UNIVERSITY   OF HONG KONG

DEPARTMENT OF CIVIL ENGINEERING

SEMINAR

Car-following Modelling in Smart Transportation

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Date: June 8, 2023 (Thursday)
Time: 10:00 a.m. - 11:00 a.m.
Venue: Room 612B, 6/F Haking Wong Building, The University of Hong Kong

Abstract

Car-following behaviour is a common phenomenon in road transport. The modelling of ca-following behaviour contributes significantly to the understanding of traffic flow and urban congestion. The rise of Adaptive Cruise Control (ACC) in smart transportation posts new challenges for the modelling of car-following. Most existing studies modelled the car-following (CF) behaviour of ACC vehicles using conventional CF models which were originally built for human-driving vehicles (HVs) and calibrated with HV data. To address the research gap, this study proposes a learnable CF model by resorting to Long Short-Term Memory (LSTM) for ACC systems, which utilizes the ACC data for model construction and offers extraordinary adaptability and accuracy compared to conventional CF models. Nevertheless, the applicability of the LSTM CF model is hindered by the scarce ACC data problem, as training the model requires a large amount of data. To further address the ACC data scarcity problem, a transfer learning strategy for the LSTM model is developed, leveraging on the large-scale open-source HV data and the similar driving patterns hidden in HV and ACC-equipped vehicles. In the transfer learning based LSTM model, a unified framework incorporating an alignment layer is developed to transfer the useful knowledge from HV data and meanwhile calibrating the CF model with ACC data. Further, microscopic simulations are performed to verify the applicability of the transfer learning based LSTM CF model. In all, this study develops and verifies a data-driven learning-based model for the car-following behaviour of ACC vehicles. The outcome of the project contributes to a more solid understanding of the car-following behaviour and the mobility impact of ACC vehicles.

About the Speaker

Dr. Zhu, Feng is an Assistant Professor in the School of Civil and Environmental Engineering at Nanyang Technological University, Singapore. He received his Ph.D. from Purdue University in 2016, M.Phil from Hong Kong University of Science and Technology in 2011, and B.E. from Sun Yat-Sen University in 2009. Dr Zhu's research interest is in the area of urban mobility, connected automated vehicles and data analytics. His research work has been published in various international SCI journals such as Transportation Research Part B, Transportation Research Part C, Transportation Research Part A, Computer-Aided Civil and Infrastructure Engineering, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Vehicular Technology, etc. Dr Zhu's research receives funding awards (over S$2 million in total) from various agencies and institutions including the Ministry of Education in Singapore, the Land Transport Authority, the Urban Redevelopment Authority, and the Surbana Jurong-NTU Corporate Lab.

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