Committee on Traffic Flow Theory and Characteristics (ACP50)

TFTC General Webinar Series : *2023*

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A Physics-Informed Machine Learning for Generalized Bathtub Model in Large-Scale Urban Networks

Mar. 17th (Fri) @ **11 AM** EDT

When will it be for me? → *Check it here*

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Abstract

Traffic management strategies contribute to alleviating urban traffic congestion by improving the efficiency of urban road networks. Network traffic flow models are vital to enhancing the efficacy of traffic management strategies by estimating traffic states and describing traffic dynamics. Despite having robust theoretical foundations, existing network traffic flow models struggle to model the complex and dynamic real-world traffic data - especially the variance and heterogeneity in large-scale urban networks. These challenges arise from both the inherent dynamics of traffic flows and external factors such as changes in travel demand and traffic control. Many studies used machine learning (ML) methods to estimate traffic states with high accuracy, but ML methods have limited interpretations since the relationship between the variables is not explicitly visible. To ease these limitations, we propose a hybrid physics-informed machine learning model with a generalized bathtub model (PIML-GBM), which leverages the interpretability of physical models and ML methods for their powerful modeling ability. This study tests the proposed PIML-GBM on mobile location data and a large-scale road network in Indianapolis, United States. The experimental results show that the proposed PIML-GBM model has superior accuracy and interpretability of traffic state estimation over existing algorithms.

Biography

Eunhan Ka is a Ph.D. student in the Lyles School of Civil Engineering at Purdue University (advisor: Dr. Satish V. Ukkusuri) since August 2020. His research interests are traffic dynamics modeling in large-scale urban areas from physics-informed machine learning, and cyber-physical systems of traffic road networks under connected and autonomous vehicles (CAVs) environment. Previously, he completed his BSc (2016) and MSc (2018) in Civil and Environmental Engineering at Seoul National University.