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Transportation Seminar

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Modeling the Transportation Systems of Today and Tomorrow: Integrated Framework and Applications

Transportation Network Companies (TNC) such as Uber and Lyft, car and bike sharing companies, on-demand transit services and the forthcoming Connected and Autonomous Vehicle (CAV) technologies coupled with the increasing availability of real-time traffic and transit information give travelers the opportunity to evaluate their multiple routing options and make better-informed decisions. The advent of real-time control and management technologies, and vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technologies provide opportunities to increase mobility, accessibility, throughput and safety in the entire transportation network. These advancements call for a comprehensive modeling of the transportation system as an integrated multi-modal network. Most of the existing transportation network modeling literature either focuses on the vehicular traffic network or the transit network. The full integration of the two major modes is usually limited to small hypothetical networks, which is not practical for large cities. At the large scale, the integration is performed in an ad-hoc fashion where separate models communicate with each other at designated outer iterations.

This talk will present a software framework POLARIS developed at Argonne National Laboratory that integrates activity-based demand models (ABM) with multimodal assignment and simulation. First, a flexible intermodal routing algorithm that provides time-dependent shortest paths for conventional modes such as passenger car and walk-to-transit, as well as any feasible intermodal combination such as park-and-ride, kiss-and-ride, taxi/TNC/CAV before/after transit, and so on. This will be followed by a preliminary study on heuristic methods to accelerate the convergence of the dynamic assignment model via mixing of prevailing and historical travel times to be used for pre-trip routing, as well as for en-route switching behaviors. Finally, several case studies will be introduced to demonstrate the framework's capabilities in terms of modeling the transportation systems of the future Smart Cities.

Dr. Ömer Verbas is a Computational Transportation Engineer in the Systems Modeling and Control Group in the Center for Transportation Research at Argonne National Laboratory. His primary research areas are in transportation network modeling; multimodal routing, assignment, and simulation; and transit network design and scheduling. He is actively working in the Transportation Network Modeling Committee (ADB30) on the Transportation Research Board of the National Research Council. He serves as a reviewer for several transportation-related academic journals. He completed his doctoral studies at Northwestern University in 2014 under the supervision of Prof. Hani S. Mahmassani with whom he also worked as a Post-Doctoral Research Fellow until the end of 2016. Prior joining the PhD program at Northwestern, he received his MS in Transportation Engineering from Istanbul Technical University, and his BS in Mechanical Engineering from Boğaziçi University in Istanbul, Turkey.