Title: AI empowered technology for Vulnerable Road Users
Co-Hosted by AI in Transportation Committee Transportation & Development Institute, ASCE

AI and machine learning (ML) have played a significant role in digital transformation and intelligent robotics in transportation. Advances in computer vision have further accelerated the real-time perception and cognition of the environment and improved the safety of roads and mobility. However, the high demand for self-driving has narrowed our focus to in-vehicle technology. “Walking” is one of the most essential activities in daily life, but AI modeling and simulation in vulnerable road users accessibility and wayfinding has been limited.

Current free mapping fails to incorporate detailed safety and accessibility information for vulnerable road users. Due to imbalance of vulnerable road users data from deluge to drought, city engineers have struggled to 1) find ways to store, analyze, and preserve digital information; and 2) process and provide the personalized wayfinding information to individual users without raising privacy concerns.

The main goal of this special session is to build predictive digital twin of vulnerable road users network through innovative sensing by transferring new sensory knowledge to route guidance that are custom-tailored to an individual's unique needs and capabilities. Advanced modeling and simulation, proactive safety and mobility analytics for vulnerable road users (VRU) will be presented.
1. Proactive Safety and Mobility Analytics for VRU

The advancement in artificial intelligence (AI) has presented tremendous opportunities in advancing safety and mobility analytics for vulnerable road users (VRUs). Advances in communication, sensing, and data processing technologies have led to tremendous enhancement in volume, variety, and acquisition rate of VRU-related data. This special session aims to provide a forum to discuss research progress and practices in safety and mobility analytics for VRUs empowered by advances in AI and big data. Specific topics of interest include, but are not limited to:

1. **Automated infrastructure data collection**: AI can be used to automatically collect data related to VRU infrastructure, such as the location and characteristics of crosswalks, sidewalks, and bike lanes. This data can then be used to identify areas that require improvements and prioritize the development of new infrastructure.

2. **VRU detection and tracking**: AI models can be trained to detect and track VRUs in real-time using cameras and other sensors. This can provide valuable data on their movement and behavior, which can be used to develop better safety and mobility strategies.

3. **Proactive safety analysis**: AI can be used to predict the behavior of VRUs based on historical data, such as their preferred routes, gap acceptance, street crossing choice, etc. This can help in proactively identifying high-risk areas and taking preventive measures to avoid crashes.
4. Personalized mobility solutions: AI can help in providing personalized mobility solutions for VRUs. For example, AI-powered navigation apps can provide customized route recommendations based on the user's mobility preferences and safety concerns, such as avoiding high-risk areas or routes with limited infrastructure.

2. Advanced Modeling and Simulation for VRU

Advancements in imaging, sensor and computational capabilities along with artificial intelligence provides a space to develop simulation models that can capture VRU decisions and behaviors. A digital twin simulation model is at its core a real-time data driven model, thus, indicating data attrition and efficient computation crucial for such models.

1. Digital Twin for Predictive Algorithms: A digital twin simulation model for VRUs can be used to provide better prediction of inter model traveling options. With assimilation of available historic and real time infrastructure, transit and vehicle data, a digital twin model can that includes information of state multiple modes in a traffic network can be developed. Such a model can be used to develop predictive models that provide VRUs transportation option that includes more than one mode and minor details such as best are to park, parking garage status, nearest bike share station, nearest EV charging stop, pedestrian friendly path index of a roadway section etc. Digital twin simulations can be used to train ML/AI algorithms with reinforcement learning for realistic field situations.

2. Digital Twin for Signal Optimization for VRUs: Digital twin simulations can also be used to train signal timing optimization algorithms that prioritize safety of VRUs leveraging advancements in video data processing and edge computing capabilities.
3. Virtual Reality or VRU/Hardware in the loop simulations: VRU/Hardware-in-the-loop simulations or virtual reality scenarios where either VRUs or the sensors used by VRUs inside a virtual reality/simulation, can be studied for its performance. This kind of simulation may be used to study perception, vision, stress, calorie burn, heart rate etc. of pedestrians or bike users while traveling in different environment.

- Organizers (names, affiliations, emails, and short bio):
  - Lili Du, Associate Professor, University of Florida
    Dr. Du chairs the ASCE Transportation & Development Institute AI in Transportation Committee. She is also the chair of the TRB AEP40–4 Subcommittee on Emerging Technologies in Network Modeling and member of ASCE CAV Impact Committee. She has been the principal investigator of multiple NSF founded projects, including the prestigious CAREER award on Integrated Online Coordinated Routing and Decentralized Control for Connected Vehicle Systems. She is an editorial board editor of Transportation Research Part B: Methodological; and an associate editor of IEEE Transactions on ITS.
  - Hyoshin Park, Assistant Professor (Associate 7/1/2023), North Carolina A&T State University
    Dr. Park is the editor of IEEE Transactions on Intelligent Transportation Systems. He served on different research projects panels such as NCHRP, NSF CIVIC, SCC, CPS, SBIR/STTR, and DOE programs. He serves as a Committee Member of ASCE Transportation & Development Institute AI in Transportation Committee. Dr. Park is an advisory member of the USDOT ITS, Joint Program Office for Professional Capacity Building. He serves on the Program Committee for International Conference on Machine Learning (ICML) and ACM SIG Knowledge Discovery and Data Mining Conference.
  - Hong Yang, Associate Professor, Old Dominion University
    Dr. Yang is currently serving as the handling editor of Transportation Research Record: Journal of Transportation Research Board (TRB), active committee member of TRB Standing Committee on Public Transportation Planning & Development (AP025), and active reviewer for 20+ journals. He has been the PI/Co-PI that led research sponsored by both federal and state agencies (e.g., FHWA, NCHRP/NAS, and VTRC/VDOT), as well as industrial partners. Recently he has served as the PI at ODU that contributed to FHWA’s CARMA XiL Simulation Platform by developing the co-simulation and high-definition map for cooperative driving automation (CDA) research, and Co-PI for the NCHRP IDEA program for developing an automatic intersection marking data collection system. Dr. Yang has served as co-organizer and associate editor for Special Session of Smart and Proactive Traffic Safety Management in Smart Cities and Rural Areas at 23rd IEEE International Conference on Intelligent Transportation Systems (ITSC 2020), and Special Session of Big Data and Emerging Technologies for Traffic Safety Improvement at 22nd IEEE ITSC 2019.
  - Kun Xie, Assistant Professor, Old Dominion University
    Dr. Xie is recognized by prestigious awards such as IEEE ITSS Best Dissertation Award, CUTC Milton Pikarsky Memorial Award and Transportation Research Board
(TRB) Best Paper Award for his research outcomes. He is recently nominated for Virginia Outstanding Faculty Awards (Rising Star). He serves on project panels for NCHRP/BTSCRIP programs and as a proposal/scholarship referee for C2SMART and METRANS University Transportation Centers (UTCs) and Council of UTCs. He has chaired a special session—Big Data and Emerging Technologies for Traffic Safety Improvement at the IEEE ITSC 2019, which is a flagship transportation conference. He serves as an Associate Editor for Frontiers in Future Transportation (Transport Safety Section) and as an Editorial Board Member for Transportation Safety and Environment.

- Abhilasha Saroj, Postdoctoral Research Associate at ORNL