**Workshop Proposal**

- **Title:**

  The 3rd Workshop on Safety Testing and Validation of Connected and Automated Vehicles

- **Contents:**

  - **Motivation and objectives.**
    
    Driven by the rapid development of connected and automated vehicle (CAV) technologies, we are on the cusp of a new revolution in transportation on a scale not seen since the introduction of automobiles a century ago. Around 2015, a few companies had announced that there would be mass production of autonomous vehicles around 2020. So far, the reality has not lived up to expectations, and no Level 4 autonomous vehicles are commercially available. The reason for this is multifold. But above all, the safety performance of CAVs is still below that of human drivers.

    One area that is the focus of much research and effort is the safety assurance of CAV. Current safety standards for human-driven vehicles, such as Federal Motor Vehicle Safety Standards and ISO 26262, only cover automobile safety-critical components, systems, and design features, without consideration of driver performance in completing the entire dynamic driving task. To date, there are no consensus or standard procedures on how to holistically test and evaluate the safety of CAVs. Although the problem of CAV testing has been investigated extensively by various CAV developers, government agencies, professional organizations, as well as academic institutions, standardize and consensus-based theories, methods, and best practices to support such testing and evaluation are still being developed.

    This workshop focuses on sharing the state-of-the-art theories, methods, algorithms, metrics, datasets, simulations, and field implementation of safety performance testing and validation of CAVs, and identifies challenges as well as research needs, aiming to encourage cross-disciplinary cooperation and facilitate the development and deployment of CAVs.
Relevance to the ITS community.
Safety is a critical component of CAV and has raised various attentions across the ITS community from the industry, the academia, and government sectors.

This is the third workshop on this topic. The first workshop of this series was held at IEEE Intelligent Transportation System Conference (ITSC) 2022 (see official workshop website) online with six invited speakers and a total number of 70 attendees. The second workshop is also our first in-person occurrence and is expected to occur at IEEE Intelligent Vehicle Symposium (IV) 2023 at Anchorage, Alaska, U.S.A. on June 4th, 2023 (see official workshop website). We have secured 4 invited speakers and other two with pending decisions. We have also attracted five high-quality paper submissions to the workshop.

For this proposed 3rd workshop of this series, we plan to expand this workshop to a full-day event at ITSC 2023 with invited talks, panel discussions, and paper sessions. We have also expanded our group of organizers with new members coming from the industry and the academia. We have been and will continue embracing the intellectual and background diversity. Our previous invited speakers have spanned over well-established senior researchers and early-career rising stars from traditionally under-represented groups. We also appreciate the cross-disciplinary nature of the CAV safety topic with speakers and attendees coming from civil engineering, computer science, system control, robotics, and marine engineering disciplines.

Topics of interest.
- Methodological frameworks for safety testing and validation
- Advanced data engines for large-scale, high-resolution, and rich-context data collection
- Naturalistic driving environment modeling with statistical realism
- Testing scenario extraction and generation
- Adversarial testing and validation frameworks, adversarial attacks, and falsification of CAV sub-modules (e.g., perception, decision-making, communication, and control)
- Field implementation, simulation, and multi-fidelity (sim-to-real) frameworks for safety testing and validation
- Formal methods and runtime verification of CAV
- Metrics, ontologies, specifications, regulations, and standards for CAV safety
- Ethics, equity, and unbiasedness in safety testing

Dedicated website.
To be provided upon proposal acceptance.

Format: Full day/half day/other (provide details)
Full day with invited speakers, panel discussions, and paper sessions.
Organizers (names, affiliations, emails, and short bio):

Bowen Weng, Transportation Research Center Inc.
Email: Bowen.Weng.CTR@DOT.GOV
Bio: Bowen Weng is a technical specialist at Transportation Research Center (TRC) Inc. on assignment to National Highway Traffic Safety Administration (NHTSA), where he leads the research and technical development of projects related to safety testing and performance evaluation of Automated Driving Systems (ADS). Mr. Weng received his M.S. in Electrical and Computer Engineering in 2016 from Case Western Reserve University, Cleveland, USA. He is also a Ph.D. candidate at The Ohio State University, Columbus, USA. His research interests centre around the safety of cyber-physical systems including its leading perspective (i.e., safe system design) and the lagging prospect (i.e., safety testing and evaluation). The current primary applications of interests include the intelligent transportation system and the dynamic locomotion of legged robots. Mr. Weng leads the subcommittee under ASTM Committee F45 on Robotics, Automation, and Autonomous Systems for legged robot safety testing standards development. Mr. Weng is the organizer of the IEEE-ITSC 2022 and IEEE-IV 2023 workshops on “Safety Testing and Validation of Connected and Automated Vehicles” and the Associated Editor of IEEE-IV 2023. Mr Weng has authored and co-authored about 20 papers published in international journals and conferences including IEEE T-RO, IEEE Trans-ITS, IEEE T-IV, and IEEE RA-L.

Shuo Feng, Tsinghua University
Email: fshuo@tsinghua.edu.cn
Bio: Dr. Shuo Feng is an Assistant Professor in the Department of Automation at Tsinghua University, China, where he received his bachelor’s and Ph.D. degrees in 2014 and 2019, respectively. He was a visiting scholar from 2017 to 2019 and a postdoctoral research fellow from 2019 to 2021 in the Department of Civil and Environmental Engineering at the University of Michigan, Ann Arbor. After that, he joined the University of Michigan Transportation Research Institute (UMTRI) as an Assistant Research Scientist. His research interests lie in developing and validating safety-critical machine learning, particularly for connected and automated vehicles. Dr. Feng has published more than 30 articles in refereed journals including Nature, Nature Communications, and IEEE Transactions on Intelligent Transportation Systems. He has served as a member of the SAE On-Road Automated Driving (ORAD) Verification & Validation task force and workshop organizer of the IEEE-IV (2021, 2023), ICML (2021), and IEEE-ITSC (2022). He has also served as the associate editor of IEEE Transactions on Intelligent Vehicles and academic editor of Automotive Innovation. He has been the recipient of the “Best Ph.D. Dissertation Award” from the IEEE Intelligent Transportation Systems Society (ITSS) in 2020 and the Intelligent Transportation Systems Outstanding Paper Award from the INFORMS Transportation Science and Logistics society in 2021.
Henry Liu, University of Michigan, Ann Arbor
Email: henryliu@umich.edu
Bio: Professor Henry Liu is a tenured professor in the Department of Civil and Environmental Engineering and the Director of Mcity at the University of Michigan, Ann Arbor. He is also a Research Professor at the University of Michigan Transportation Research Institute and the Director for the Center for Connected and Automated Transportation (USDOT Region 5 University Transportation Center). From August 2017 to August 2019, Prof. Liu served as the Chief Scientist on Smart Transportation for DiDi Global, Inc., one of the leading mobility service providers in the world. While he was with DiDi, he established and led the Urban Transportation Business Unit. Prior to joining the University of Michigan, Prof. Liu was an Associate Professor of Civil Engineering at the University of Minnesota, Twin Cities. Prof. Liu received his Ph.D. degree in Civil and Environmental Engineering from the University of Wisconsin at Madison in 2000 and his bachelor's degree in Automotive Engineering from Tsinghua University in China in 1993. Prof. Liu conducts interdisciplinary research at the interface of transportation engineering, automotive engineering, and artificial intelligence. Specifically, his scholarly interests concern traffic flow monitoring, modeling, and control, as well as testing and evaluation of connected and automated vehicles. He has published more than 120 refereed journal papers. Professor Liu has nurtured a new generation of scholars, and some of his PhD students and postdocs have joined first class universities such as Columbia University, Purdue University, RPI, etc. Prof. Liu is the managing editor of Journal of Intelligent Transportation Systems.

Scott Schnelle, Waymo
Email: scott schnelle@waymo.com
Bio: Dr. Scott Schnelle is a Safety Best Practice Specialist within the Safety Research and Best Practices team at Waymo. Dr. Schnelle engages in external standards development organizations as well as leads research related to ADS safety methodologies, risk assessment, safety metrics, and scenario based testing. Dr. Schnelle received his Ph.D. in Mechanical Engineering from The Ohio State University.

Linda Capito, The Ohio State University
Email: capitoruiz.1@osu.edu
Bio: Linda Capito (Graduate Student Member, IEEE) received the M.S. degree in Electrical and Computer Engineering from The Ohio State University, where she is currently a Ph.D. candidate. She has published research on various topics involving risk assessment, safety validation and verification of autonomous systems, computer vision, reinforcement learning, and control theory. Her main research is focused on developing risk assessment techniques for automated-driving assistance systems (ADAS) to discover system and environmental configurations that may lead to collisions and other vehicular hazards. She was a Fulbright Fellow from 2017-2019 and is currently a Presidential Fellow at Ohio State University.

Alfred Chen, The University of California, Irvine
Email: alfchen@uci.edu
Bio: Alfred Chen is an Assistant Professor of Computer Science at University of California, Irvine. His research interest spans AI security, systems security, and network security. His most recent research focuses are AI systems security in...
autonomous vehicles and intelligent transportation. His works have high impacts in both academic and industry with 30+ research papers in top-tier venues across security, mobile systems, transportation, software engineering, and machine learning; a nationwide USDHS US-CERT alert, multiple CVEs; 50+ news coverage by major media such as Forbes, Fortune, and BBC; and vulnerability report acknowledgments from USDOT, Apple, Microsoft, etc. Recently, his research triggered 30+ autonomous driving companies and the V2X standardization workgroup to start security vulnerability investigations; some confirmed to work on fixes. He co-founded the ISOC Symposium on Vehicle Security and Privacy (VehicleSec), and co-created DEF CON's first autonomous driving-themed hacking competition. He received various awards such as NSF CAREER Award, ProQuest Distinguished Dissertation Award, and UCI Chancellor's Award for mentoring. Chen received Ph.D. from University of Michigan in 2018.

The workshop is also co-sponsored by Transportation Research Center Inc. (https://www.trcpg.com), MCity (https://mcity.umich.edu), and Center for Connected and Automated Transportation (https://ccat.umtri.umich.edu).

- Potential contributors to the workshop (names, affiliations, contact information, abstracts (if available):
  - Matthias Althoff, Associate professor, Department of Computer Science, Technische Universität München, althoff@tum.de. Using online verification to prevent autonomous vehicles from causing accidents.
  - David LeBlanc, Associate Research Scientist, University of Michigan Transportation Research Institute, leblanc@umich.edu. Evaluation of automated driving systems safety assessment procedures.
  - Li Li, Associate Professor, Department of Automation, Tsinghua University, li-li@tsinghua.edu.cn. Parallel testing of vehicle intelligence via virtual-real interaction.
  - Raquel Urtasun, Professor, Department of Computer Science, University of Toronto, urtasun@cs.toronto.edu. AdvSim: Generating safety-critical scenarios for self-driving vehicles.

- Intended audience and expected attendance for the workshop (including a clear statement how interaction between presenters and attendance will be fostered):

We expect the workshop to be a central hub that connects researchers in the CAV safety topic from various disciplines. We plan to invite about 6 speakers to give invited talks with Q&A sessions after each presentation. If the ITSC 2023 workshop committee allows, we can also provide virtual access to the workshop online for remote attendees.

- Invited speakers (if any):
  To be provided upon proposal acceptance.

- Materials and equipment needed for the workshop:
  Tables, chairs, projector/large display for presentation, poster stands.

- Contact details of the proposers (email, postal address, etc):
See our organizers list for details. The point of contact is Bowen Weng (bowen.weng.ctr@dot.gov) 10820 OH-347, East Liberty, OH, United States, 43319