A Statistical and Machine Learning Approach to Assess Contextual Complexity of the Driving Environment Using Autonomous Vehicle Data

Technology Transfer Activities

by

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1 Outputs

At the end of the study, the research goals were accomplished. This project has generated the following products:

One Ph.D. Dissertation was completed.

Bendigeri, Vijay, "Using Safety Performance Models, Autonomous Vehicle Data, and Machine Learning to Develop Contextual Complexity Criteria to Establish a Standardized Process for On-Road Evaluation of Medically At-Risk Drivers Considering Static and Dynamic Factors of the Roadway Environment" (2022). Ph.D. Dissertation, Clemson University, U.S.A., 2983

One conference paper was published and presented.

Bendigeri, V. G., Zou, F., Ogle, J. H., & Kusram, K. Roadway Contextual Risk Assessment Using Dynamic Traffic Conditions Data Obtained from Autonomous Vehicles. ASCE International Conference on Computing in Civil Engineering 2021. DOI: https://doi.org/10.1061/9780784483893.070 Presented on September 12–14, 2021, Orlando, Florida, USA

One student poster was presented and awarded.

Fengjiao Zou presented "Roadway Contextual Risk Assessment Using Dynamic Traffic Conditions Data Obtained from Autonomous Vehicles", at the 3-minute poster presentation competition hosted by Clemson IEEE ITSS student chapter. She was the 2nd place best poster winner, April 2021

One Seminar was conducted.

Dr. Vijay Bendigeri and Dr. Jennifer Ogle conducted a seminar on “A Data Driven Process to Evaluate and Quantify Routes for On-Road Evaluation” at the 46th annual conference of The Association for Driver Rehabilitation Specialists on October 1st in Charlotte, NC. The authors educated clinicians and occupational therapists on how emerging technologies can be leveraged to enhance validity and reliability of on-road driving tests.

2 Outcomes

The research has produced the following critical outcomes.

The field of transportation engineering has an opportunity to positively impact medical community, specifically the clinicians who evaluate, train, and rehabilitate at-risk drivers. Dr. Vijay Bendigeri and Dr. Jennifer Ogle conducted a seminar on “A Data Driven Process to Evaluate and Quantify Routes for On-Road Evaluation” at the 46th annual conference of The Association for Driver Rehabilitation Specialists on October 1st in Charlotte, NC. The authors educated clinicians and occupational therapists on how emerging technologies can be leveraged to enhance validity and reliability of on-road driving tests. The knowledge and insights gained from the research study

would enable the occupational therapists and driving rehabilitation specialists evaluate their routes to ensure most critical roadway components from transportation engineering perspective are considered for on-road evaluation. The knowledge and tools obtained from this research outcome is anticipated to revolutionize the process in which on-road driving assessments are designed and evaluated by the clinicians who assess medically at-risk drivers.

3 Impacts

Identifying and predicting high-risk environments in real-time can significantly benefit safety research, driver education, auto-insurance risk assessment, autonomous vehicle route planning, and many more. For example, this research could allow Driving Rehabilitation Specialists (DRSs) to score the dynamic complexity during training and testing to ensure that the driver is competent at all situational levels. The methodology this project developed utilizing the autonomous vehicle open datasets could aid DRSs to measure and classify the contextual complexity of the routes used for on-road driving evaluations for medically-at-risk drivers considering the dynamic variables. Open-source Waymo autonomous vehicle data was used to measure dynamic characteristics (object density, proximity, velocity, etc.) and develop a model.

The field of transportation engineering has an opportunity to positively impact the medical community, specifically the clinicians who evaluate, train, and rehabilitate at-risk drivers. The on-road driving evaluation is the gold standard for testing and rehabilitating medically at-risk drivers. The product of this research could build foundational work to build tools and methodology to measure the roadway context to enhance the consistency and validity of the on-road assessment procedures. The Seminar presented at the 46th annual conference of The Association of Driving Rehabilitation Specialists in Charlotte, NC, received tremendous positive feedback. The authors demonstrated how emerging technologies can be leveraged to enhance the validity and reliability of on-road driving assessment of medically at-risk drivers seeking therapy. The Seminar showed how engineers and medical professionals could work together to improve the lives and safety of at-risk patients.

The knowledge and insights gained from the research study would enable occupational therapists and driving rehabilitation specialists to evaluate their routes to ensure most critical roadway components from a transportation engineering perspective are considered for on-road evaluation. The knowledge and tools obtained from this research outcome is anticipated to revolutionize the process in which on-road driving assessments are designed and evaluated by the clinicians who assess medically at-risk drivers.