CENTER FOR CONNECTED AND AUTOMATED TRANSPORTATION

Project Title	Investigation into U.S. Real World Lane Change Behavior for Automated Freeway Driving	
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Most relevant CCAT research thrusts (choose all applicable)	__X__ Enabling Technology _____ Planning and Policy __X__ Human Factors _____ Infrastructure Design and Management __X__ Control and Operations __X__ Models and Implementation	
Funding Request		
Matching Funds and Source (if any)	Ford $199,247	
Total Project Cost	$199,247	
Contract Number	69A3551747105	
Project start/end dates	05/01/ 2016 – 05/31/2018	
Project Abstract	This study aims to develop models of how and when lane changes are currently performed in naturalistic driving conditions, which helps the development of automated lane change functions. The discretionary lane change events across one lane on freeway were extracted from UMTRI's IVBSS field-operational-test naturalistic driving database. Naturalistic driving data, radar sensor data, and video clips were three main sources of data that supported the modeling. Based on the number of surrounding vehicles and their positions, seven taxonomies of lane change scenarios were created. There were 6,113 (3,250 for left, 2,863 for right) lane changes with the duration between two and ten seconds selected as the observations for factor evaluation and lane-change trajectory modeling. In general, lane changes toward the left took 5.6 s to complete and 6.1 s toward the right. The lane change taxonomy, use of turn signals, and the lane index the host vehicle was located had impact to the duration. Considering the lane change taxonomy, the computational models were able to predict the lateral offset at the start, end or any time during a lane change, given the lane change duration and inter-lane change distance were known. This research also characterized the circumstances that drivers intended to make a lane change. Linear logistic regression models were created to distinguish the lane change cases and no-lane change controls using	

	selected classifiers. Candidate classifiers included the range, relative velocity, and inverse TTC to any of the surrounding vehicles. Classification performance is described by a confusion matrix for a given cut-point or decision threshold, i.e., the threshold that maximizes prediction accuracy. Six classification models were successfully created for scenarios with different surrounding vehicles. These models are able to identify sensor variables that can help inform an autonomous system of when a driver might start a lane change as distinct from when the driver would not start a lane change. The final report for this project will not be publicly available.
High-level implementation plan	The proposed work supports an entrance-to-exit automated freeway driving feature that might be offered in the 2022 timeframe (with entrance and exit performed manually).
Project Metrics	
Web Links:	ccat.umtri.umich.edu