MODELING HUMAN-AUTOMATION INTERACTION: EVALUATING DRIVER RESPONSE TO ADAPTIVE CRUISE CONTROL FAILURES

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ABSTRACT
Drivers are required to monitor multiple critical variables in a dynamic, uncertain environment. Technology that automates vehicle control relieves drivers of the demand of moment-to-moment control but imposes attentional demands associated with the need to monitor the status and behavior of the automation. Adaptive cruise control (ACC) is such a system – it automates headway maintenance but because ACC operates effectively in only a subset of driving situations, drivers must monitor the system and intervene periodically. However, the dynamics of the driving domain create a variety of situations of use of the ACC system that are not predictable by the driver. This incomplete knowledge of how the system will interact with driving situations can lead to improper use of ACC. A modeling analysis of driver-ACC algorithm interaction is presented. The driver is modeled as a function of their understanding of ACC and consequent response strategies in failure situations; the ACC is modeled according to longitudinal control algorithms. Model analyses for an ACC failure are presented to illustrate the benefits of the described modeling approach. Analyses reveal situations in which a driver's inadequate understanding of the ACC's function and operating capabilities leads to imminent collision. Such situations indicate the need to properly inform drivers of the ACC's behavior.