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Research Summary

Development of a Statistical Method for Predicting Human Driver Decisions

Yaoyan Vincent Tan, Michael Elliott, Carol Flannagan

ATLAS-2015-06

November 18, 2015

As autonomous vehicles begin to appear on the roads in greater numbers, there will be many challenges to ensure that they interoperate safely with vehicles that continue to be driven by humans. An autonomous vehicle will need to "know" what human drivers intend to do in various circumstances.

To help autonomous vehicles learn to anticipate behaviors of human-driven vehicles, researchers in this study developed a model for predicting whether or not a human driver intended to stop before making a left turn, by analyzing changes in the human-driven vehicle's speed as it approached an intersection. Data from 1,823 left turns performed by 108 drivers on various types of roads were obtained from a previous UMTRI study conducted between April 2009 and April 2010. Speed and distance from the intersection were measured ten times per second from 100 meters before the center of the intersection through the end of the turn maneuver.

The report covers the methods of statistical analysis employed by the researchers: principal component analysis and Bayesian additive regression trees. The performance of the prediction model as the driver approaches the intersection was evaluated using area under the receiver operating characteristic curve (AUC) and precision-recall curves. As expected, prediction performance improves as the driver approaches the intersection, but even at 25 meters from the center of the intersection, the model's performance is quite good.

The authors recommend further research to develop means of communicating predictions of driver behavior to autonomous vehicles nearby. Ideally, the entire model of prediction will include means by which information is passed back and forth between the autonomous vehicle and the human-driven vehicle so that both will be able to react safely based on an awareness of the distance and the speed of the other.