Cognitive and Autonomous Test Vehicle (CAT Vehicle) Program/Electrical and Computer Engineering Research Experiences for Undergraduates (ECE REU)

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Intelligent Semantic Mappings of Dashcams and Data

ABSTRACT: The goal of this project is to automate the creation of real-world data sets that can be used in autonomous vehicles and machine learning applications. The project involves pairing and synchronizing dash camera videos with CAN bus data gathered from a car and using that to label the dash camera videos with semantic information. With the synchronized videos and CAN bus data, it is possible to identify video clips with meaningful events such as active cruise control, following a lead vehicle, cars passing in front of the vehicle, turns, etc. Currently, no data set like this exists, so this project will fill this need. These clips can be used for training models to recognize events and estimate CAN bus variables using the dash camera footage alone.

Sara Roman

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Partners: Isaac Wasserman and Audrey Wiseman

Spatial Localization Using CAN Data

ABSTRACT: The goal of the methods described in this paper is to estimate a vehicle's position with respect to its starting point, using only the vehicle operation data provided by the CAN bus. This bus produces time stamped messages that include encoded information about wheel angle, wheel RPM, speed, and other information sent between attached components. Using GPS data captured concurrently with recorded CAN bus data, we will train two architecturally distinct machine learning models to produce longitude and latitude delta estimates that can be combined with given starting coordinates to produce absolute coordinates throughout the drive. We hope to address whether the CAN bus provides sufficient information to accurately estimate the position of a vehicle. Additionally, we will explore the ability of machine learning methods to perform this estimation without decoding the CAN data. We also describe the implementation of a handcrafted kinematic model for location estimation for use as a baseline. Successful machine learning methods should outperform the kinematic model.

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Partner: Anna Vander Kamp

Creating an SQL Database to Query Autonomous Vehicle Test Drive Data

ABSTRACT: Dash cam videos and CAN bus data from test drives provide a multitude of valuable information for research in the field of autonomous vehicles. However, the large volume of data can be cumbersome to access due to limited organization and a lack of searchable indexes. This work provides an SQL database where future CAT vehicle researchers can conduct search queries with different parameters to easily locate desired content. These parameters include various signals from the CAN bus, vehicle information, objects detected in dash cam videos, and GPS messages. Objects in the dash cam videos were detected using a YOLOv5 model that was pre-trained on the COCO dataset. The results of this project include a modifiable database with searchable indexes.

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Partners: Sara Roman and Isaac Wasserman

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