Plan Overview

A Data Management Plan created using DMPTool

Title: Risk-Aware Warning and Control for Interactive Traffic Safety

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Affiliation: Carnegie Mellon University (CMU)

Funder: United States Department of Transportation (DOT) (transportation.gov)

Template: Digital Curation Centre

Project abstract:

This project aims to pioneer a risk-aware control methodology tailored for ego vehicles operating in freeway driving scenarios, such as ramp merging and lane changing. These dynamic situations, characterized by intricate interactions, require special care due to uncertainties stemming from various sources like human factors and sensor-based stochasticity. These uncertainties pose a substantial challenge to the safety of autonomous vehicles navigating such intricate dynamics. Our core objective is to develop a comprehensive risk assessment tool capable of quantifying the diverse risk factors impacting ego vehicles within multi-vehicle interactions. This tool has the potential to significantly enhance overall safety, whether the human driver is utilizing active ADAS or opting for full automation by the controller. Seamlessly integrating with existing ADAS, this tool can alert drivers to potential dangers when risk assessment surpasses a certain threshold and can enact necessary preventative actions to avert collisions. To validate our approach, we will undertake a rigorous testing phase on a 1/10th scale autonomous race car. Relevance to safety is twofold: use of such an approach 1) in driver assistance systems to convey to drivers the potential comprehensive risk of a desired action within the current interactive environment; 2) in autonomous vehicles to provide interpretable risk-aware behavior with provably correct safety guarantees.

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End date: 06-30-2024

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Risk-Aware Warning and Control for Interactive Traffic Safety

Data Collection

What data will you collect or create?

There are potentially three types of data that will be collected. All data will be associated with traffic and will be either state data (vehicle position and velocity) or metadata such as laser point clouds from which
state data can be extracted. The data types are:

1. Simulation data. In this case, the state data for both the egovehicle and surrounding traffic data are
   simulated according to driving models.
2. Real-world data from F1Tenth RC car testing. In this case, the data are collected from sensors mounted on the F1Tenth RC car.
3. Naturalistic driving data. In this case, all data are from real driving scenarios. It remains to be determined whether PennDOT will be able to provide this kind of data.

The purpose of the research is to improve autonomous driving safety on highways. The data for types 1 and 2 above will be exclusively numerical, whereas the data for type 3 could be image data, though its exact form is TBD. There will also be source code for the simulation and the developed algorithms. The value of the data lies in their ability to improve driving safety in highway scenarios. The PI will be responsible for managing the data.

How will the data be collected or created?

Simulation data will be generated by sensor simulators. Real-world data will be collected from LIDAR, IMU, cameras, and wheel encoders on the car. In both cases, the data will be written to logs and stored on our lab's servers. Naturalistic driving data will be collected using PennDOT vehicles.

Documentation and Metadata

What documentation and metadata will accompany the data?

Documentation will be in the form of standard-format files (e.g. pdf) and will include clear descriptions of each data field. Data will be readable using the relevant software (e.g. ROS, Matlab, etc.). The data will also be available in broadly portable forms, such as ASCII.

Ethics and Legal Compliance

How will you manage any ethical issues?

Type 1 and 2 data should not have any deidentification issues associated with them. Type 3 data would, if camera-based, and in that case we will ensure no public access to the primary dataset and take the appropriate measures to anonymize the imagery data and extract only de-identified state data.

How will you manage copyright and Intellectual Property Rights (IP/IPR) issues?

IP issues will be handled according to the CMU policies.

Storage and Backup

How will the data be stored and backed up during the research?

We will save data on our lab server using open data formats, such as ROS bagfiles or Matlab datafiles. The details are TBD. For the code, we will use a common version control platform such as github.

How will you manage access and security?

Lab members will have password access with dual authentication to the servers containing the data.

Selection and Preservation

Which data are of long-term value and should be retained, shared, and/or preserved?

This is unknown as of yet and will have to be determined during the course of the project.

What is the long-term preservation plan for the dataset?

We will initially use a lab-based archive which has automatic backups. If the project continues to be funded and results in large amounts of valuable data, we will make a transition to an institutional or extra-institutional repository, but the benefit is not deemed worth the expense at first.

Data Sharing

How will you share the data?

Data will be shared with authorized individuals via online access to a shared repository.

Are any restrictions on data sharing required?

No.

Responsibilities and Resources

Who will be responsible for data management?

The PI will be responsible for data management.

What resources will you require to deliver your plan?

Current lab resources (servers, hard drive backups) will suffice for the time being.
