

# D2CAV: Creating a Maneuver-based Driving Dataset and Model based on Recurrent Neural Networks (RNNs) for Autonomous Vehicles



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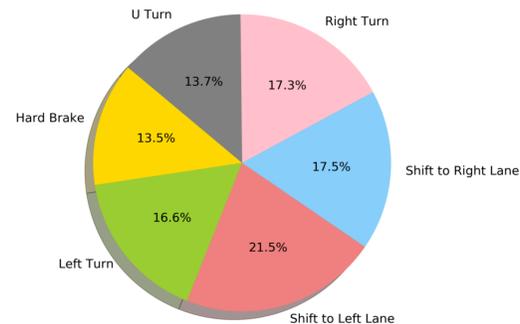


## 1. Introduction

- ❑ The rise of Artificial Intelligence and Machine Learning algorithms has sped up the research in Autonomous Vehicles.
- ❑ Commercial level-4 autonomous vehicles are expected to emerge by 2020, leading to hybrid AI-Human scenario on roads.
- ❑ These interactions require autonomous vehicles to be aware of human driving patterns.
- ❑ Our work is directed towards making these interactions possible by creating human driver behavioral model for AI to adapt to..
- ❑ We train the model by the dataset collected by us containing information about vehicle's state in order to classify different maneuvers
- ❑ Other aim for this project is to train models to label other larger datasets, eliminating the need of manually labelling them and then could be used to train self driving vehicles.

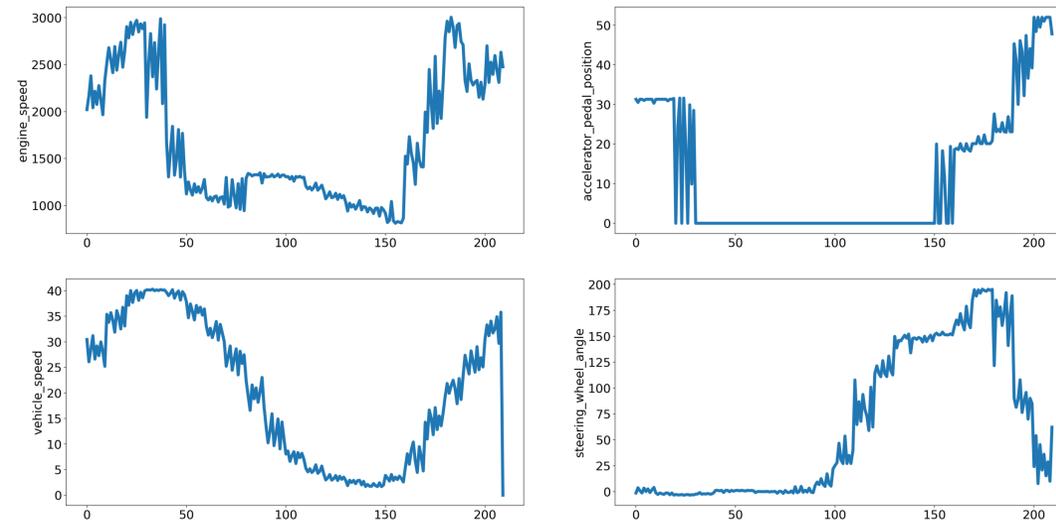
## 2. Dataset Description

- ❑ We collected a Ford vehicle's CAN Bus data using Ford OpenXC OBD connector.
- ❑ Various data fields such as torque, transmission, accelerator position etc. are reported but, only few are used as features.
- ❑ The dataset contains many instances of maneuvers in the Orlando metro area, FL. We limited our dataset on narrow set of maneuvers.
- ❑ We collected and processed 452 instances of different maneuvers with around 1000 minutes of urban driving.

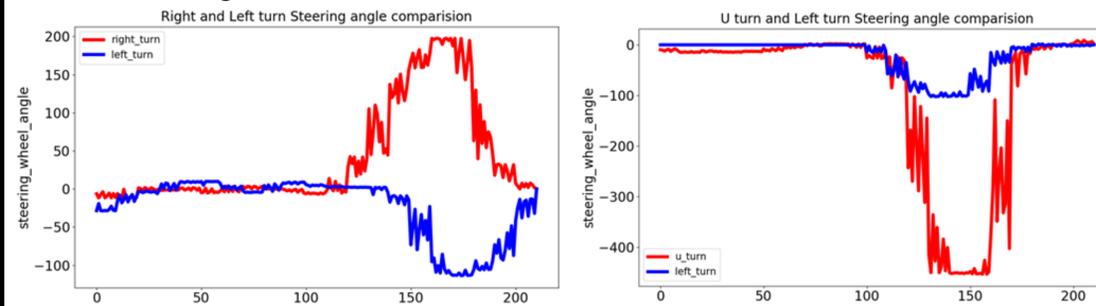


## 3. Dataset Visualization and Insight

- ❑ Visualizing data can help identify unique features of maneuvers.

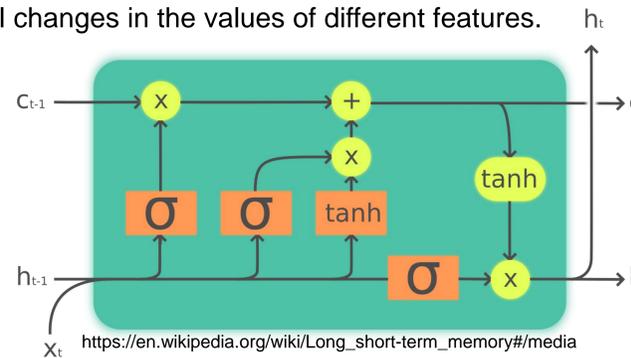


- ❑ Inherent difference of various maneuvers gets visible by visualizing the dataset. Such as A U-turn is differentiated from left turn by magnitude of the steering wheel angle



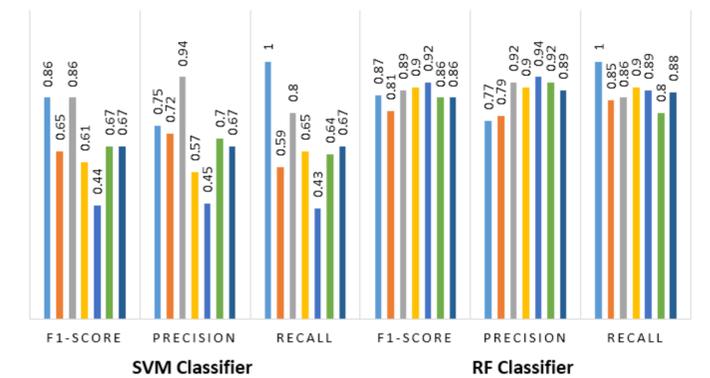
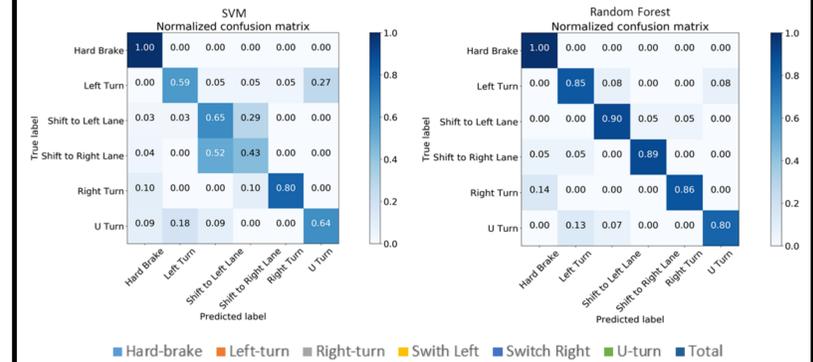
## 4. Statistical Analysis

- ❑ The dataset collected is preprocessed and a file system is developed for all the features of different maneuvers.
- ❑ We trained a SVM and a Random Forest classifier to classify all different maneuvers for the initial phase of this research to validate the practicality for our dataset.
- ❑ SVM and Random Forest gave us 70% and 89% accuracy respectively.
- ❑ RNNs such as LSTMs can be trained with more robustness. LSTMs can relate to temporal changes in the values of different features.



## 5. Results

- ❑ The confusion matrices of SVM and Random Forest give us the insight of what is being misclassified.
- ❑ Major drawback of SVM is that it fails to differentiate a left turn from a U-turn and right and left lane change as it is evident from the confusion matrices.



## 6. Conclusion and Future Directions

- ❑ In order to prepare the coming AI for human driving interactions it needs to learn the behavior of human drivers. This research demonstrates and takes another step in that direction. Raw data is collected and then the processed version of dataset is used to train statistical models to classify different maneuvers.
- ❑ The next step of this research is to train a LSTM model to also include the temporal relation of values of different features. This will help create robust models and automatically label various datasets which are available with no annotations.

## 7. Acknowledgment

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