CSE343: Machine Learning Project Proposal

Intelligent Object Detection & Adaptive Navigation for Autonomous Vehicles using Machine Learning

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1. Motivation

In today's rapidly advancing world, self-driving vehicles have gained immense significance. They hold the potential to revolutionize transportation by enhancing safety, efficiency, and convenience. At the same time, the growing need for efficient object detection and intelligent decision-making within these vehicles is crucial to ensure their practicality and widespread adoption. With the onset of expansion of self-driving vehicles in society, it is more important than ever to deploy safe and sound measures for road navigation.

This project aims to address this need by developing an advanced system that not only detects objects, animals, and pedestrians but also makes informed decisions to navigate safely and effectively, be it a distant vehicle coming towards the vehicle with a specific speed or a flying football coming towards the vehicle. We aim to train the model for Indian traffic and infrastructural problems.

2. Related Work

- *Pedestrian Detection using HOGs in Python - simplest way - easy project - 2023 - Machine Learning Projects*
- *Application of Machine Learning In Posture Detection and Correction | by Robert Griffith*
- *Pedestrian Detection: An Evaluation of the State of the Art | IEEE Journals & Magazine | IEEE Xplore*

Comprehensive evaluation of various pedestrian detection methods, including traditional machine learning techniques. The articles use techniques like HOG combined with SVM, YOLO & SSD.
2nd article studies the postures of the moving objects along with their speed & direction to decide the best course of action to be taken.

3. Final Outcome

The project aims to deliver a system that combines object detection using machine learning with advanced adaptive navigation strategies for autonomous vehicles. The final model should be capable of accurately detecting and identifying various objects and pedestrians, while the navigation system should dynamically respond to the detected objects to ensure safe and efficient navigation. We also wish to test for the best possible path/course of action to take in case of almost certain accidents.

This comprehensive solution has the potential to greatly enhance the safety and reliability of autonomous vehicles, contributing to the broader adoption of self-driving technology while maintaining a high standard of safety on the roads.

4. Timeline

Week 1	Initial Analysing and selection of Dataset and discussing about the future use and making amendments to data to match real world scenarios
Week 2	Preprocessing the data and visualising the available data using various kinds of graphing techniques
Week 3-4	Extracting and selecting useful and relevant features and finding correlation present in the available data
Week 5-7	Applying various possible appropriate ML models and techniques to the data through code like Logistic Regression, SVM, Random Forest, Naive.
Week 8-9	Analysing the performance of each model for accuracy through various parameters
Week 10	Further Optimization of the model with best results according to various parameters and finally deploying the model for the project.
Week 11	Documentation of the work along with creating PPTs and making final amendments

5. Individual Tasks

Shivam	Lead research and paper review, dataset collection and preprocessing
Nitesh	Model selection, architecture design, and implementation
Pratham	Fine-tuning, optimization, and hyperparameter tuning, Dataset Trimming, Feature Extraction & analysis
DivyaRaj	Model training, evaluation metrics implementation, and performance analysis