ARTIFICIAL INTELLIGENCE FINAL PROJECT PROPOSAL

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1 Introduction

Traffic sign recognition is a critical component of modern transportation systems, enhancing road safety and facilitating traffic management. It is also a crucial part of the autonomous driving system. This proposal outlines a project aimed at developing a robust Traffic Sign Visual Recognition System using machine learning algorithms. By addressing this problem, we aim to significantly contribute to road safety and the efficiency of traffic control systems.

The primary objective of this project is to create an automated system capable of accurately detecting and classifying traffic signs from visual data obtained through various sources such as cameras, images, or videos. This problem is fundamentally about image classification and object recognition within a specialized context, where the objects are traffic signs.

2 Background

With the increasing prevalence of private vehicles ownership throughout the United States and the world, the public transportation system is currently facing unprecedented challenges. As data provided by Virginia DMV indicated, there were over 3,500 major car crashes happening annually in District 25 in Virginia(Charlottesville City and Albemarle County) from 2018 to 2021, and over 1,200 cases were reported with injuries. Meanwhile, as a report from the UK revealed, misreading the confusing traffic signs leads to more than 25% of drivers crashing their cars. Recognizing that traffic sign confusion is a serious issue, we decided to utilize AI tools to develop a visual classification system in order to help both machines and humans understand the traffic signs' indications immediately.

The general novelty of this project is basically using machine learning algorithms to understand the project, including the KNN algorithm and CNN model. With this classification system incorporated, it can largely improve the current situation in the following three ways. Firstly, it will facilitate a better understanding of the traffic signs for new drivers. With the new classification model, humans will be much more able to recognize and memorize each sign's functionality and diminish the chances for them to make major mistakes in driving. Secondly, the system can be incorporated into navigation applications such as Google Maps or Apple Maps. With the accuracy of the visual classification of signs, the navigation applications will be able to cover a wider range of traffic signs including those which are less commonly seen. Consequently, the navigation system is enabled with a more comprehensive advanced notification system, which can also reduce driver's major mistakes. Thirdly, as we know, many cars now have intelligent systems that can recognize the situation happening in front of cars. If equipped with this classification system, it will be much easier for the cars to recognize different signs and make corresponding responses in order to eliminate human errors. Last but not least,

when foreign tourists visit the United States, this model saves the hassle of unfamiliarity with local signs when they rent cars. This ensures both tourists' and locals' safety and wellness. Therefore, we think this classification system has a wide range of applications and will be beneficial to current traffic management.

3 Project Tasks

To train a model to recognize traffic signs, our team will start by sourcing our data from the specified Kaggle dataset. The first step will be to preprocess and clean the data. Once our data is ready, we will split it into training, validation, and test sets. We'll then select an appropriate neural network architecture, likely a Convolutional Neural Network (CNN), given its success in image classification tasks. Post-training, we will evaluate the model's performance on a test dataset of our own and refine it as necessary.

4 Feasibility

The dataset we plan to use contains 58 classes of traffic signs, and each class on average has 120 training images. Overall, the project will be manageable in time to finish, three out of four team members are familiar with machine learning algorithms and there are also public data set resources available online. We decided to meet at least once a week to discuss current progress in order to ensure the project can be completed on time. We plan that by the end of November, we should be able to demonstrate the training model for some different signs.

Team Roles
Project Lead: Zhangchi Chen
Presentation Lead: Jieshuai (Christian) Zhu
Research Lead: Tianze Ren
Coding Lead: Wenhao Xu

References

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