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Traffic Sign Classifier For Self Driving Cars

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ABSTRACT

The project titled "Traffic sign classifier for self-driving cars", In this project, we are using computer vision-based techniques like machine learning and deep learning that uses convolutional neural network and support vector machine for color detection and image classification that detect the traffic signal. In present generation the autonomous vehicles are raised day by day. Its primary purpose is to detect the traffic signal using the live camera, capture the state, detect the light (yellow, red, green) and send the signal to self-driving cars for safety and efficient driving. This project will help us to reduce the accidents and Challenging conditions such as poor lightening, occlusions and weather distortions.

Keywords *Convolutional neural network (CNN), OpenCV, Image processing, Histogram of Oriented Gradients (HOG), Support Vector Machine (SVM), Colour detection.*

INTRODUCTION

The quick development of autonomous vehicles (AVs) has made traffic signals an essential part of enabling intelligent and safe driving. For self-driving cars to guarantee passenger safety and adherence to traffic regulations, they must be able to reliably read road infrastructure components including traffic lights, signs, and lane markings in real time. Traffic signal categorization is one of the most important of them since it has a direct impact on driving actions like halting, reducing speed, or crossing an intersection.

Since improper classification might result in collisions, moving infractions, or system malfunctions, it is a crucial topic for autonomous driving technology study and development. Historically, human drivers carried out the manual detection and classification of traffic signals. However, vehicles can now recognize signals more reliably, especially in difficult situations like dim lighting, occlusions, or weather distortions, because to the development of computer vision, machine learning (ML), and deep learning (DL) approaches. Current systems continue to encounter difficulties despite developments, including. Regional and national variations in signal design. The need for real-time processing since delays can jeopardize safety. Environmental interferences such as glare, rain, fog, and nighttime situations.

False positives or negatives, which could lead to poor car choices. In order to improve the accuracy and dependability of traffic signal recognition, this project suggests creating a Traffic Signal Classifier for Self-Driving Cars using cutting-edge image processing and machine learning techniques.

LITERATURE SURVEY

Recent years I explored some related papers to traffic sign classifier for self driving cars in that I observe some limitations. In my first paper Road-sign detection and recognition based on support vector machines, I observed that there is problem with the occlusions at the traffic recognition which was proposed S. Maldonado and with my second paper Real-time detection and recognition of road traffic signs I observed that at the time of weather distortions the traffic light cannot be captured by real time detection camera by Greenhalgh and my final paper thatLISA Traffic Light Dataset by UC San Diego Computer Vision Lab in that paper the detection of the light was not clear. These are the limitations solved and proposed by my project.

RELATED WORK

In this project I used CNN, SVM and OpenCv

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for image classification and recognition at the time of traffic sign. A CNN (Convolutional Neural Network) is a type of deep learning model specially designed to process and analyze images and visual data. It's widely used in computer vision tasks like image classification, object detection, and traffic signal recognition. A SVM (Support Vector Machine) a very important machine learning algorithm used before deep learning became popular, especially in image classification, object recognition, and traffic sign detection. An OpenCV is an open-source computer vision and machine learning library designed to help developers build applications that can understand and process visual data (like images and videos).

EXISTING SYSTEM

Road-sign detection and recognition based on support vector machines. The SVM is a supervised machine learning technique used for traffic sign classification. In this paper, they used svm for image classification and object recognition. The
drawbacks of this system is at the time of poor lightening and weather distortions the image recognitions is not possible and at the time of poor lightening the live camera is confused based on the traffic lights that are yellow, red and green. To overcome from this we proposed a new project with the help of convolutional neural network (CNN) and OpenCV for image recognition and colour classification.

PROPOSED SYSTEM

In the exiting method, there are some drawbacks so to overcome from that drawbacks we introduced a new project that is Traffic sign classifier for self-driving cars that used the convolutional neural network (CNN) for automatic feature extraction and classify the traffic signs. The system preprocesses input images through resizing, normalization, and augmentation to improve robustness under varying conditions such as brightness, rotation, and partial occlusion. The classifier is trained using benchmark datasets (e.g., GTSRB) and optimized for real-time performance on GPU/embedded systems. By integrating this system into autonomous vehicles, the car can detect and interpret traffic signs such as speed limits, stop signs, and warnings, thereby enabling safer and more reliable navigation.

SYSTEM ARCHITECTURE

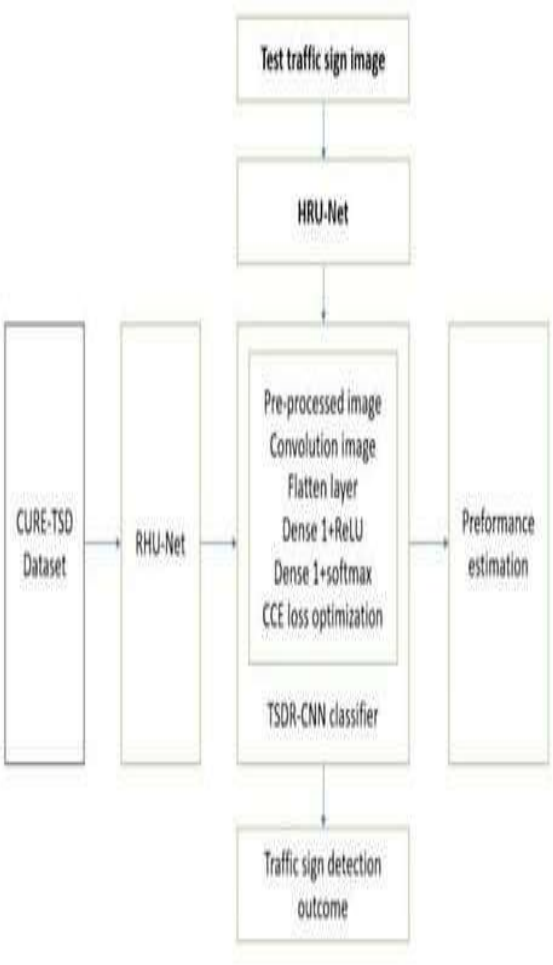

Fig:1 Architecture of Traffic ign classifier for self-driving car

METHODOLOGY DESCRIPTION

The system begins by capturing the image of traffic sign provided by the live camera of a car. The methodology of the Traffic Sign Classifier involves data collection, preprocessing, feature extraction, model training, and integration. Traffic sign images are collected from public datasets like GTSRB and LISA, covering various lighting and weather conditions. The collected images are preprocessed through resizing, normalization, and augmentation to improve quality and reduce noise. Important visual features such as color, shape, and edges are automatically extracted using Convolutional Neural

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Networks (CNNs). The extracted features are then used to train the CNN model using optimization techniques like Adam and regularization methods such as dropout. After training, the model accurately classifies traffic signs into categories like stop, speed limit, or warning. The trained model is integrated into the self-driving car system for real-time detection and decision- making. Finally, the system is tested under different conditions to ensure reliability, accuracy, and adaptability in real-world scenarios.

RESULTS AND DISCUSSION

This is the home page of our project that capture the image when we click the start detection button.

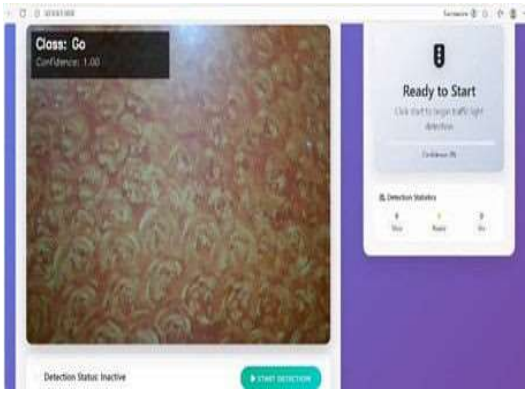

Fig :2 Login page

When the red sign is captured by the live camera, the signal is sent to the car control system, which first preprocesses the image and verifies the color condition.

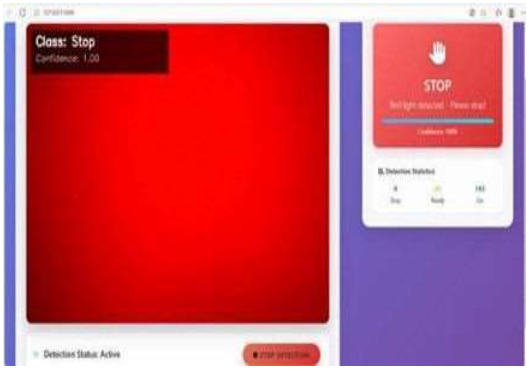

Fig :3 Camera detects red sign

The live camera indicates that we must be prepared to move the car when it detects a yellow sign.

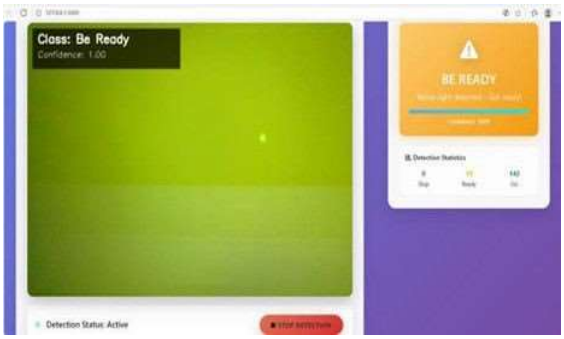

Fig 4: Camera detects yellow sign

After the live camera takes a picture, it preprocesses it and indicates that it's a green light, allowing you to proceed.

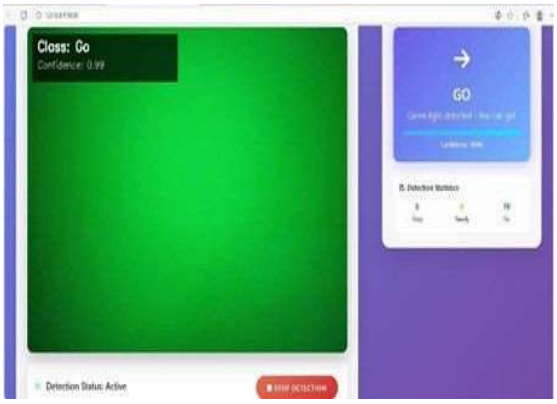

Figure 5: Camera detects green sign

CONCLUSION

Traffic sign classification plays a vital role in enhancing the safety and reliability of autonomous driving systems. By leveraging machine learning and deep learning algorithms, self-driving vehicles can accurately detect and interpret traffic signs, enabling them to make informed driving decisions similar to human drivers. This technology forms the foundation for safer and more intelligent transportation systems, significantly reducing human error and road accidents.

FUTURE SCOPE

Future advancements in traffic sign classification can focus on integrating real- time object detection frameworks such as YOLO and Faster R-CNN to improve detection speed and precision. Additionally, combining data from multiple sensors, including cameras and LiDAR, can enable multi-modal learning for more robust and accurate recognition under varying

environmental conditions. These enhancements will further advance the development of fully autonomous vehicles capable of safe and efficient navigation in complex traffic scenarios.

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