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Real-Time Recognition and Announcement of Indian Traffic Signs for a Driver Assistance System using Machine Learning on the Indian Dataset

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Abstract: Real-Time Detection, recognition and audio announcement of traffic sign board is vital and might actually be utilised for driver help to decrease mishaps and ultimately an addon in driverless cars. In this paper Convolution Neural Network (CNN) is utilised to build a framework for Real-Time Recognition of Traffic Signs. The proposed framework works progressively to distinguish and identify Traffic Signs. The commitment of this paper is to an Indian Database of 85 Different Classes of diverse traffic sign boards in the Indian environment. These are gathered from irregular street sides. The pictures were taken from various points and included different boundaries and conditions. A sum of 7210 Images was compiled to form a dataset. CNN engineering was utilised with shifting boundaries to accomplish the best accuracy rates. The test results show that the proposed CNN engineering achieved an accuracy of 99.26% in this manner higher than those achieved in past investigations.

Keywords: Traffic Sign Recognition (TSR), Convolution Neural Network (CNN), Machine Learning, Accuracy and Validation, Open CV

I. INTRODUCTION

The Automobile Industry is encountering an exponential Transition from traditional vehicles with human drivers to self-driving, artificial intelligence-powered vehicles. These autonomous vehicles offer a safer and cost-effective transportation option this has the potential to significantly change human mobility.

Automatic detection, recognition and audio output have gained importance with advances in image processing due to the benefits that such a system may provide.

Traffic Sign Recognition (TSR) is a crucial aspect of the intelligent transportation system, as it helps vehicles to understand and respond to the road environment in real time. Machine learning techniques have been widely used for TSR in recent years due to their ability to handle large of data and improve accuracy over time.

One challenge in using machine learning for TSR is the availability of diverse and representative datasets. Indian roads have unique traffic signs and road conditions and using a dataset that is not representative of these conditions may result in poor performance of the TSR system. To address this issue, it is important to use an Indian traffic sign dataset for training and evaluating the TSR system.

There have been several efforts to collect and annotate the Indian traffic sign dataset. This dataset includes a diverse range of traffic signs, including warning signs, and was collected from various locations across India.

II. METHODOLOGY

To build a TSR system using machine learning a common approach is to use a convolution neural network (CNN) as the classifier. CNN is a type of neural network used in deep learning that is characterized by three main features: locally connected neurons, shared weights, and spatial or temporal sub-sampling. Typically, a CNN consists of two main components. The first contains alternating convolution and max-pooling layers. Each layer receives its input from the previous layers' output. This creates a hierarchical feature extractor that transforms the original input images into feature

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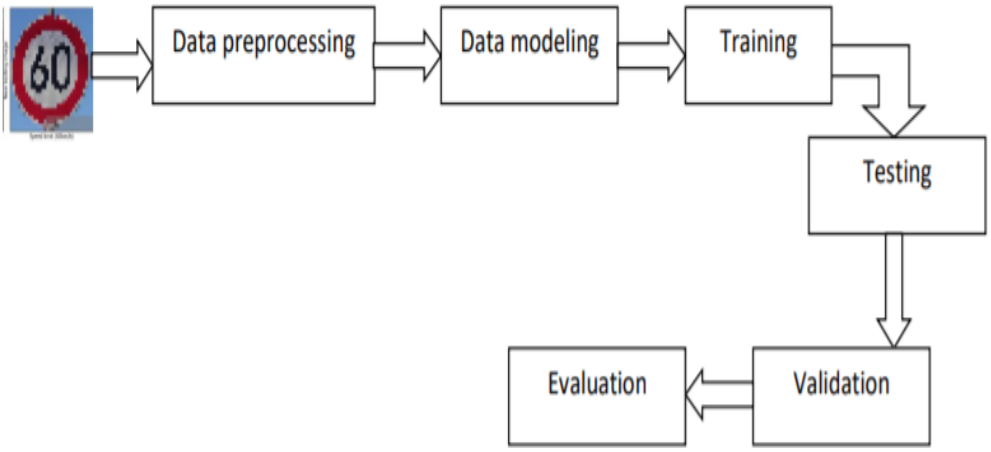
vectors. In the context of TSR, a CNN can learn to recognise the unique visual features of different traffic signs and classify them accordingly.

There are several approaches to training a CNN for TSR using the Indian dataset. One approach is to use a pre-trained CNN model, such as VGC or ResNet, and fine-tune it on the dataset using transfer learning. This allows the model to benefit from pre-trained weights and architecture while adapting to the specific characteristic of the Indian traffic signs.

An alternative method is to create and train a CNN from scratch using a dataset. This requires a larger dataset and more computational resources, but it allows the model to learn from scratch and potentially achieve better performance.

Once the CNN has been trained and evaluated on the dataset, it can be deployed in a TSR system for real-time traffic sign recognition. The system can be integrated into a variety of applications, such as autonomous vehicles, and advanced driver assistance systems (ADAS).



Current popular algorithms mainly use convolution neural networks to execute both feature extraction and classification. Such methods could achieve impressive results but often because of an extremely huge complex network with massive data. For the purpose of making full use of the advantage of CNN, we propose a novel traffic sign recognition architecture. Before being sent to CNN for feature extraction, the average image of the traffic signs is subtracted to ensure illumination invariance to some extent.

The building blocks of a neural network are called neurons, which are individual units. Neurons are organised into groups called layers. The Neurons in each layer are linked to the neurons in the next layer. The input layer sends data to the output layer through these pathways. Individual neurons perform simple mathematical calculations on their own. The node performs simple mathematical calculations.

Then it transmits its data to all the nodes it is connected to CNN is a special architecture of the artificial neural network. CNNs frequently find application in image classification due to their utilization of features from the visual cortex.

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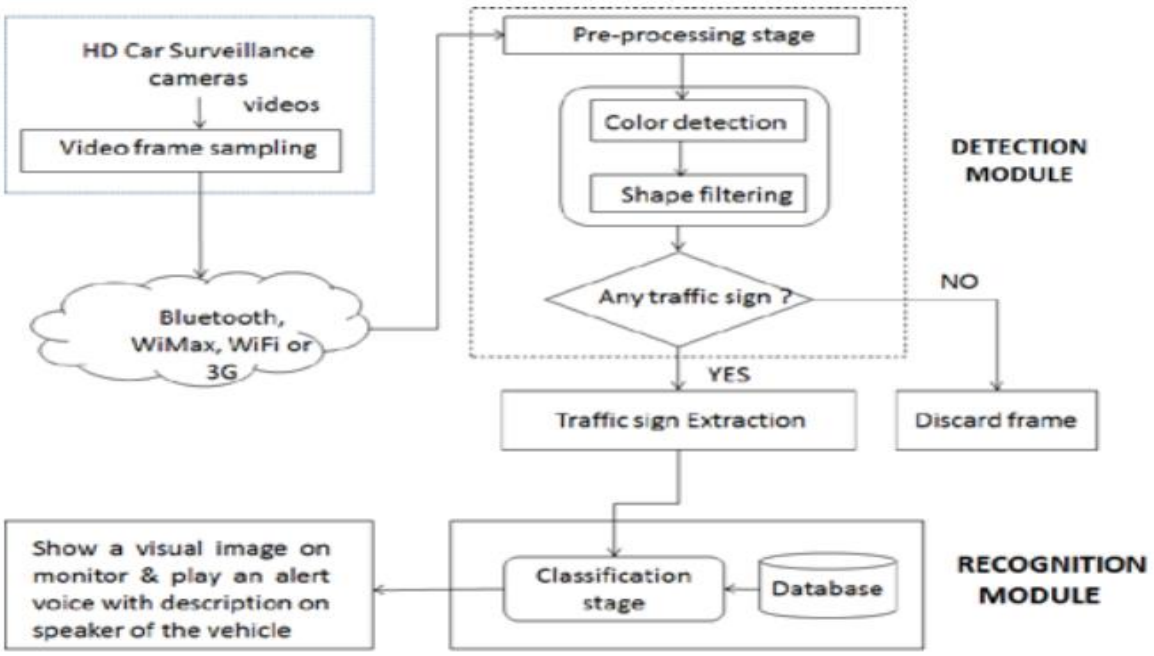

Fig. 1 Block Diagram

III. RESULT

In this section, we will examine the analysis of results we obtained by training our model on Google Collab Research. We trained our model with up to 99.26% training accuracy. The training accuracy, approval accuracy and Loss are given in Graph.

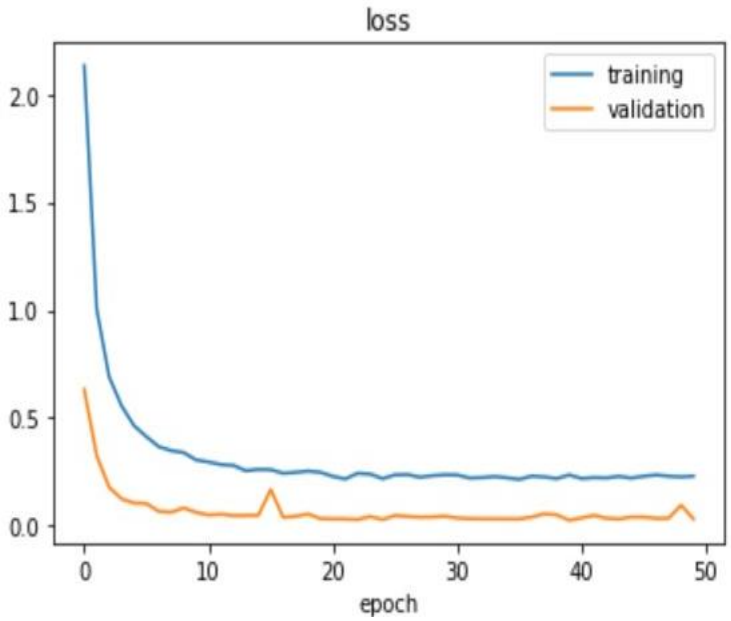

Fig. 2 Loss Epoch Graph

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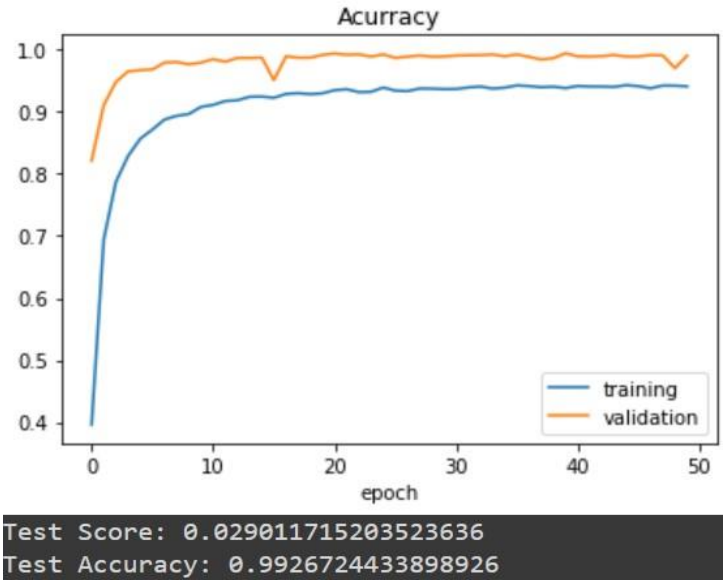

Fig. 3 Accuracy Epoch Graph

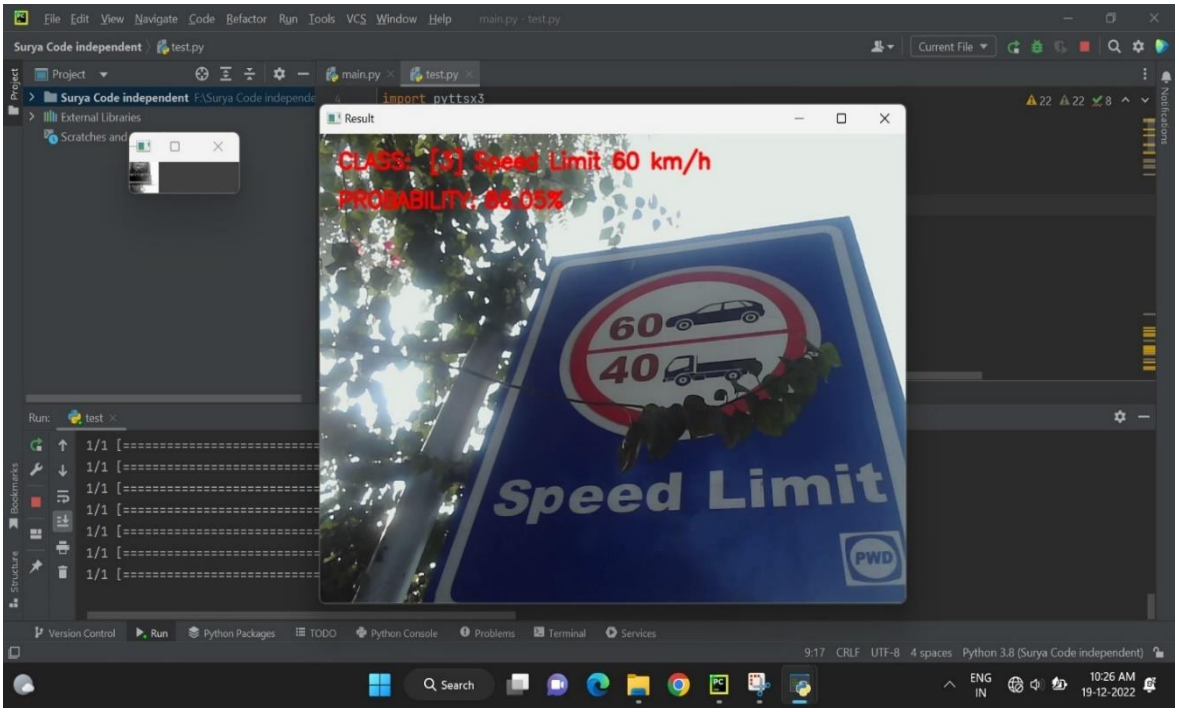

Fig. 4 Recognition and Announcement of Traffic Sign "Speed Limit 60km/h"

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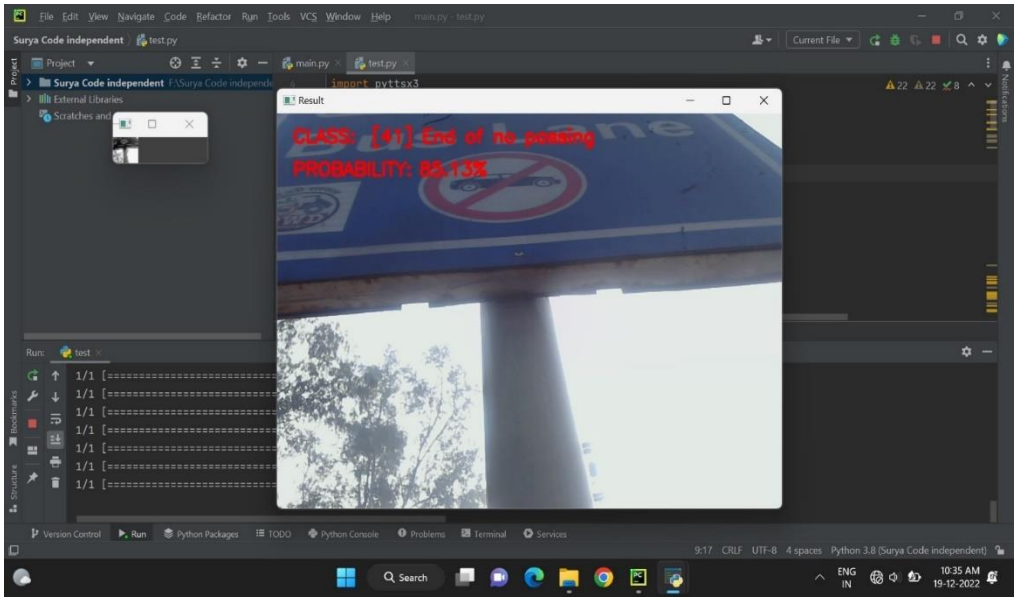

Fig. 5 Recognition and Announcement of Traffic Sign "No Passing"

IV. CONCLUSION

This paper aimed to offer an effective and successful traffic sign recognition and announcement architecture in India. Also using an Indian Dataset. In this process of traffic sign recognition, our first step is feature extraction followed by image classification by utilizing a variety of traffic signs using a CNN classifier. Thus, this project uncovers the fundamental idea of the CNN algorithm required to accomplish image classification from traffic sign recognition. The performance of our model has been exceptional, evidenced by its high level of accuracy. We have found that the model reaches saturation after about 15 epochs when run on Google Collab. However, this model is only effective for identifying traffic signs that are centred in the middle of the image and do not currently have the ability to detect signs that are located in the corners of the image. In summary, the application of machine learning in traffic sign recognition holds promise for enhancing road safety and efficiency in India. Using an Indian traffic sign dataset, and a machine learning model such as CNN, it is possible to build a TSR system that is effective and adaptive to the unique characteristics of Indian roads.

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