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Road Sign Detection

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Abstract: Road signs are play an important role to ensure smooth road traffic flow without bottle necks or mishaps. Road symbols are the pictorial representations having necessary information required to be understood by driver. Road signs in front of the vehicle are sometimes ignored by the drivers and this can lead to catastrophic accidents. This paper presents an overview of the Road sign board detection and recognition and implements a procedure to extract the road sign from a natural complex image, processes it and alerts the driver using voice alert. It is implemented in such a way that it acts as a aid to drivers to make easy decisions while driving.

Keywords: Deep Learning, CNN, preprocessing, road sign

1. Introduction

Traffic signs provide the necessary information and warn of potential dangers. They are an important part of keeping drivers and pedestrians safe on the road. Road signs play an important role in the smooth flow of traffic and avoid hazardous accidents. Because the primary purpose of traffic signs is to help prevent accidents and protect people on the road, it is critical that they be prominently displayed to command attention and placed in such a way that drivers have enough time to respond to the command given by each sign. From speed limits to directions on where and when to turn, traffic signs provide a wealth of information. Following traffic signs helps to keep everyone on the road safe by reducing the chances of drivers colliding with other vehicles, pedestrians, or cyclists. Accidents can occur, for example, because drivers do not notice a sign in time or by lack of attention at a critical moment. In bad weather conditions such as heavy rain showers, fog, or snow fall, drivers pay less attention to traffic signs and concentrate on driving. In night driving, visibility is affected by the headlights of traffic oncoming and drivers could easily be blinded.

Hence, we propose a system for detection of traffic sign and convey the driver the sign using audio output.

2. Literature Review

This paper aims to present a new approach to detect Road signs without colour attributes in real time with account for illumination and distance changes. Road sign recognition, including sign detection and classification is essential for advanced driver assistance systems and autonomous vehicles. Automatic Road sign detection and recognition is a field of computer vision which is very important aspect for advanced driver support system. This framework will detect and classify different types of Road signs from images. The technique consists of two main modules: road sign detection, and classification and recognition. In the first step, colour space conversion, colour-based segmentation is applied to find out if a Road sign is present. If present, the sign will be highlighted, normalized in size and then classified. Neural network is used for classification purposes.

The classification method we are using is CNN (convolutional neural network) the reason we are using CNN is because the processing method required in a CNN is much lesser as compared to other classification algorithms present in today's

generation. While in primary methods filters are manually handled, with enough training module, CNN have the ability to learn these filters/characteristics with proper specialization.

The experimental results show the detection rate is above 90% and the accuracy of recognition is more than 88%. Road sign recognition, including sign detection and classification is essential for advanced driver assistance systems and autonomous vehicles and thus, we are proposing this effective and simplified approach.

Road Sign Detection

Road signs play a vital role in the smooth flow of traffic and avoid hazardous accidents. Accidents may occur, when drivers do not notice a sign in time or by lack of attention at a critical moment. Sometimes in bad weather conditions such as heavy rain showers, fog, or snow fall, drivers pay less attention to traffic signs and concentrate on driving. When one drives at night, visibility is affected by the headlights of traffic oncoming and drivers could easily be blinded.

In this paper we propose a road sign detection using Deep Learning and CNN algorithm. The machine is trained to detect the road sign. Preprocessing of the input image will be done which will convert the image from RGB to binary. We used machine learning classifier i.e., CNN (Convolutional Neural Network) algorithm. As the road sign will be detected a voice alert will be given the driver thus avoiding any mishaps.

Dataset

Dataset in simple words is collection of data. The process of creating a dataset involves mainly three important steps namely, Data acquisition, data cleaning, data labelling.

For data acquisition we have created a dataset using collection of hundreds of different images of different traffic signs. After collecting these images, the process of sorting them into different classes was carried out. Images were sorted into different folders depending upon the traffic sign. Each folder contains a specific type of sign. The folders were named after a particular class which will be used to train the CNN (Convolutional Neural Networks) algorithm effectively and accurately. Total 57 classes were created for each sign. For example, if the dataset consists of traffic symbol of Speed limit 20kmph then it will be in folder 0.

Image Pre-processing

Pre-processing is used for the improvisation of image quality so that it becomes easy to analyse the image in a better way.

The next phase after dataset collection is Pre-Processing Phase. This phase or stage is very crucial in in terms of enhancements or improvement in accuracy. The reason this part is important because the pre-processing part handles the change in color of traffic-signs images by converting them into black and white images which helps in the simplification or easier feature selection.

There are Three steps in Pre-Processing:

1.Contrast enhancement

2.RGB to Grayscale conversion

Contrast enhancement: It is done so that the contrast of the darker and lighter parts of image is clearly visible.

RGB to Grayscale conversion**:** It converts the colorful RGB image into grey image or black and white so that the color difference issue is resolved.

CNN (Convolutional Neural Networks)

A Convolutional Neural Network (CNN) is a Deep Learning algorithm that takes input as an image, assigns importance measurable weights and biases to different objects in the images, and differentiate the objects from each other. The processing method required in a CNN is much lesser as compared to other classification algorithms present in today's generation. While in primary methods filters are manually handled, with enough training module, CNN has the ability to learn these filters/characteristics with proper specialization.

After all the preprocessing part, segmentation and feature extraction then comes CNN (convolutional neural network). CNN algorithm then trains on the dataset provided and extract the features using filters from the training images and then on that basis it classifies the input image to which traffic sign class it belongs to.

Segmentation

Image segmentation is a frequently used technique in digital image processing and analysis to partition an image into multiple regions, oft based on the characteristics of the pixels in the image. Image segmentation involves separating foreground from background, or clustering regions of pixels based on similarities in color or shape.

Several algorithms and techniques for image segmentation are developed over the years using domain-specific knowledge to effectively solve segmentation problems in that specific application area.

Image segmentation involves converting an image into a group of regions of pixels that are portrayed by a mask or a labeled image. By dividing an image into segments, you can process only the necessary segments of the image rather than processing the entire image. A frequently used technique is to look for abrupt discontinuities in pixel values, which typically indicate edges that define a region.

Image segmentation is the process of partitioning a digital image into multiple image segments, also known as image regions or image objects. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region are similar with respect to some characteristic or computed property. In our project we have divided the whole image into segments which have certain characteristics especially geometrical which we will see in Feature Extraction.

Feature Extraction

Feature extraction is a fragment of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduced to more manageable groups which makes it easier to process. The most crucial characteristic of these large data sets is that they have a large number of variables. A lot of computing resources are required for these variables to process. Feature extraction assists to get the best feature from those big data sets by selecting and combining variables into features, thus, effectively lessen the amount of data. Even though features are easy to process, they are still able to describe the actual data set with accuracy and originality.

Feature extraction is performed using many layers in deep learning. Output of the previous layer is used as an input by each layer. CNN are one of the deep learning architectures that include artificial neural networks and layers of feature extraction. It is also a type of Multi-Layer Perceptron (MLP). CNN is the most well-known algorithm of deep learning and it is able to classify a model directly from images, text, videos or sound.

After Segmentation the next phase is feature extraction that is basically retrieving the features or characteristics from the images Feature extraction refers to the portion of the training process by which a CNN learns to map input space to a latent space that can subsequently be used for classification via the final layer. In other words, the hidden layers learn discriminatory features in the form of weight-adjusted (usually by backpropagating the error) convolutional filters. These characteristics could be anything can be shape, size, color but specifically in our project we need to be very precise about our image features and hence we choose or extract the features on the basis of geometrical shapes like triangle, circle, square.

3. Proposed System

We are proposing a system that will use machine learning algorithm i.e., CNN Convolutional Neural Network. Our planned model will be trained with around 100-500 images of and with increasing epoch in order to increase accuracy. The reason we are using CNN is it has multiple layers hence it will help into training model with easy manner. Open Computer Vision Technology is used simultaneously to interact with camera, to take live input from camera. We will set and define different signs with images and that image will be trained with algorithm. Person will have to perform sign in front of camera. After taking live input from camera the sign will be recognized. Recognized sign will give text output and it will be translated to audio sound. So, system will work as Sign to Speech.

4. System Architecture

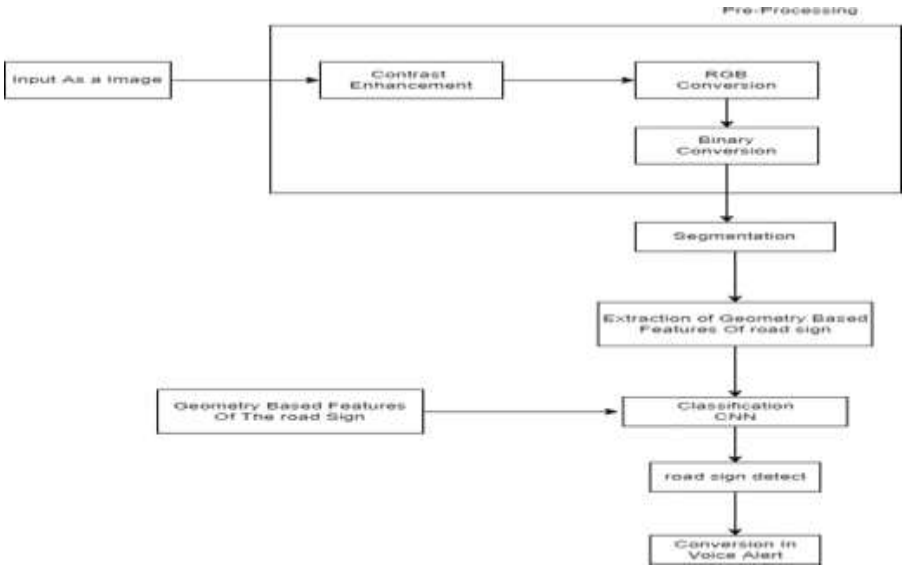


Fig. System Architecture for Sign Detection

5. Result

To execute the system, hardware and software requirement is as follows. The hardware requirement is as follows:

Processor: Intel i5 processor

Hard Disk: 40GB

RAM: 8GB

Processor Speed: 1.1 GHz

Webcam

Software requirement is as follows:

OS: Windows 10

Python Version 3.8

IDE: Anaconda Spyder

On accessing the system, the user has three choices, train the model, detection of sign and exit the system.

On clicking Train model button, the system will start training the model with dataset.

On clicking Sign Detection button, the system will detect the sign. Camera starts and live video is recorded, it is taken as an input by the system. The system detects the sign and output is given in the form of text and audio.

Fig.2. Traffic Sign Detection System Page

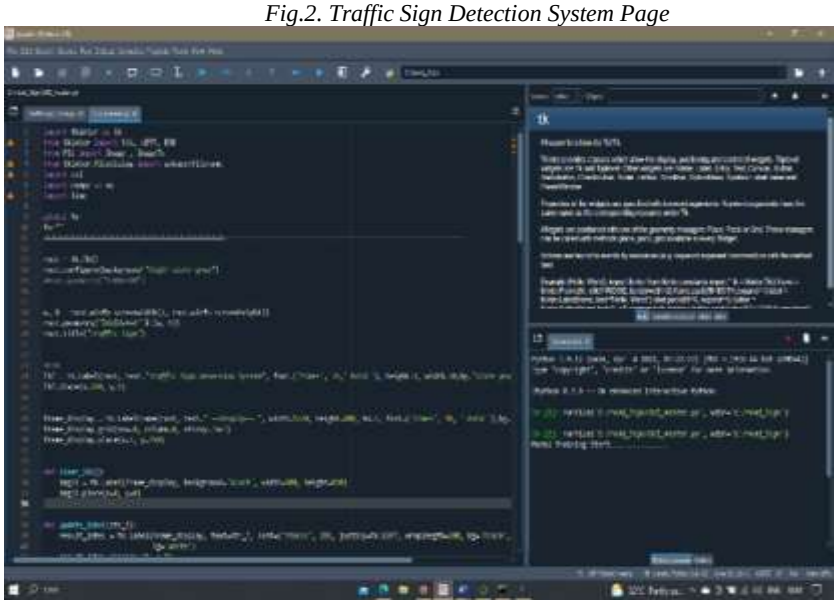
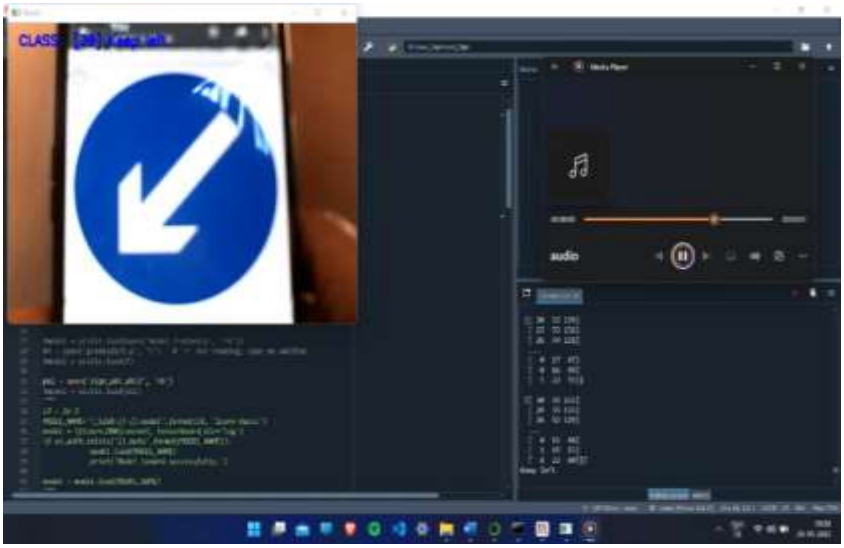


Fig.3. Model Training



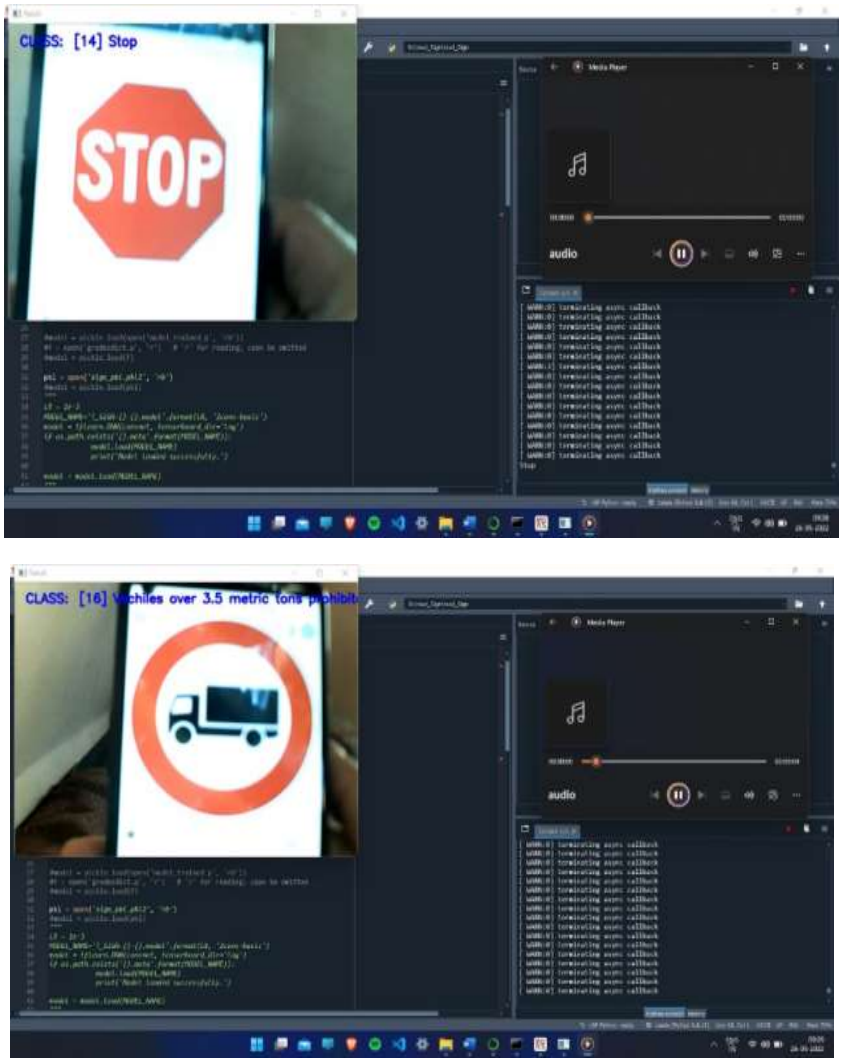


Fig.4. Sign Detection

6. Conclusion and Future Scope

We propose a smart driver alert system which detects and recognizes Road signboard from video stream input and gives voice message to the driver. By using this technology, we can reduce the road accidents as well as regulate Road safely.

In future the system can also be developed in a way that the traffic signs focus on reduction of the traffic load on existing road network through various travel demand management.

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