Traffic Sign Recognition System (TSRS): Convolution Neural Network

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Abstract— In modern age, mostly everything around is automated and therefore TSRS plays an essential role in self-driven vehicles, traffic control as well as traffic safety. While driving, one tries to focus on the road and most of the time drivers fail to recognize the signs along the road, which could be harmful as it can cause a serious accident. This problem can be solved if there is an effective way. A Traffic Sign Recognition System (TSRS) plays a crucial role here. The system, recognize and detect a sign, thus giving notification to the driver about the speed of car, school ahead, work in progress, turn left or right etc. It ensures road safety as well as becomes more comfortable while driving on new roads. In this project, we propose to design Traffic Sign Recognition System by using the Convolutional Neural Network (CNN). The only reason of using CNN is because of its high recognition rate.

The main objective of our project is to design computer-based system which can detect the traffic sign automatically thus providing assistance to machine so that it can take the appropriate action. The approach is to build a model using convolutional neural network (CNN) by extracting traffic sign from images used as the dataset. We have used CNN model to classify the traffic sign and Color based segmentation to extract signs from images.

Keywords—Traffic Sign Recognition System, CNN.

I. INTRODUCTION

In the world of Artificial Intelligence and advancement in technologies, many scientist and big companies like Tesla, Uber, Google, Toyota, Audi, etc. are working on autonomous vehicles and self-driving cars. So, for achieving accuracy in this technology, the vehicles should be able to interpret traffic signs and make decisions accordingly. There are several algorithms which gives the ability to detect traffic signs.

- **Traffic Sign Recognition**

Knowledge of Traffic signs play very essential role in today's livelihood. It contains several kind of information which ensures the safety of people. Without the traffic sign, drivers might be clueless that what might be ahead of them. The annual global roach crash statistics say that approx three thousand people die every day in road accident and figure is much bigger in case there is no traffic sign and in other hand, it's very important having ability of driving. There are some rules that have given by government of driving ability.

In our project, we are going to implement a model to detect Different traffic signs using CNN and then drivers can take their directions accordingly. Through this model, people are able to read and understand traffic signs which are a very important task for all autonomous vehicles. This issue has some positivity like visibilities of different traffic signs are being unique which gives small variations in object and Signs are clearly visible to driver while driving. In other hand there are still some problems with low light and bad weather conditions.

The Dataset we will be taking here is the German traffic Sign Recognition Benchmark (GTSRB) dataset. However the traffic signs are pre-cropped for us, implying that the dataset creators have manually labeled the signs within the pictures and extracted the traffic sign Region of Interest (ROI) for us, thereby simplifying the project. There are a several varieties of traffic signs sort of a stop, a right curve, no parking, speed restrictions, side arrow, up-down arrow then finish.

- **Techniques used**
  - **CNN model**

A Convolutional Neural Network (ConvNet/CNN) is one among the Deep Learning algorithmic rule during which image works as a input and allot significance to totally different aspects/objects among the image and be ready to distinguish one from the opposite.

The pre-processing of ConvNet is such a lot lower comparison from alternative algorithms.

When we point out unstructured information like pictures, text, voice, videos, hand designed options square measure time overwhelming, and not climbable in follow. that is why Neural Networks become more and more acknowledge a lot of appreciated to their capability to mechanically notice the representations needed for feature detection or classification from raw data. Manual feature planning is currently replaced by CNN and permits a machine to each learn the options and utilize them to perform a specific assignment.

CNN's were to begin with created and utilized around the 1980s. The foremost that a CNN seem do at that time was recognize manually written digits. It was generally utilized within the postal segments to studied zip codes, stick codes, etc. The vital thing to keep in mind almost any profound learning show is that it requires a huge sum of information to prepare and also requires a part of computing assets. This was a major downside for CNNs at that period and subsequently CNNs were as it were constrained to the postal segments and it failed to enter the world of machine learning.

Convolutional neural network (CNN) works

Firstly, image is taken as a input by the CNN model and then using the forward propagation it is sent to the network to obtain the desired output. The weight and offset of the network is updated by predicting the error of the obtained output and label. The principle followed is as: To start, it takes N inputs randomly from the dataset and assign each

input weight and offset to initialize the learning rate in order to obtain actual output vector of the network. To calculate the output error, it takes picture an input and then performs comparison of the output vector with the target vector. Adjustment amount of each weight and offset is calculated to adjust the weight and threshold. At last it is observed that whether the indicator meets the accuracy requirement, if yes then goes to the next step otherwise continue the iteration. On the completion of training, the weight and offset is saved in the file which indicates that the stabilization of weight and formation of classifier.

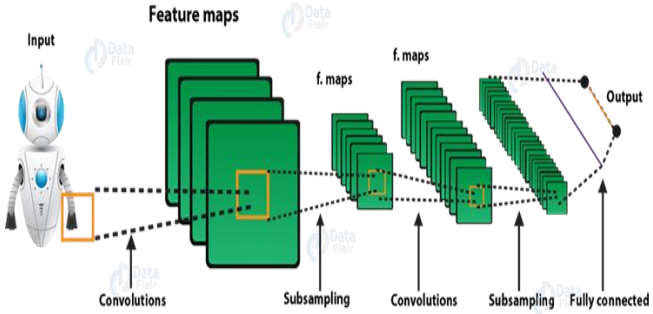

Fig:1 Working of CNN

➢ Traffic Sign Classifier graphical user interface(GUI)

Here we have a tendency to ar planning to build a graphical program for our classifiers of Traffic signs with Tkinter. Tkinter could be a graphical user interface toolkit within the commonplace python library. Produce a replacement goes in the project folder and duplicate the code. Reserve it as graphical user interface.py and you'll run the code by typewriting python graphical user interface.py within the statement.

In this file, we've got 1st loaded the trained model exploitation Keras. So, for uploading the image; we have a tendency to produce the graphical user interface and a button is employed to classify that calls the classify () operate. The classify () operate is changing the image into the scale. This is often as a result of to predict the traffic sign we've got to produce a similar dimension we've got used once building the model. Then we have a tendency to predict the category, provide output range |variety} between (which is one in all our number of images) that represents the category it belongs to. We have a tendency to use the lexicon to induce the knowledge regarding the category.

Tools used: python, scikit-learn, keras, numpy.

II. MOTIVATION

The first and foremost reason of choosing this particular work is to reduce the number of accidents which take place every day due to poor infrastructure of the pavement. By developing such system, one would underneath the bar of number of deaths, thus saving life of millions. Even the self-driven vehicles can extract huge benefits from the TSR system which could help the them to recognize and understand the traffic signs. Apart from this, already conducted researches on the same topic are also one of the reason of choosing Traffic sign detection System as the Project. Numerous good ranked Research Papers have been published which motivated us to develop such a system that can overcome all the traffic related difficulties and even can guide the driver on the safer route. Most of the authors have built such a system by using different Machine Learning concepts and of all those, the one which fascinated us the most ,is the use of CNN model to develop the Traffic Sign Detection System. This is because of its ability to detect the essential features without any human intervention and it can work efficiently with the image classification problem which is counted as a positive aspect when working with the set of images as the dataset. Overall, the motivation behind developing such a system is crystal clear due to benefits it offers by saving lives of the population around as well as saving cost.

III. PREVIOUS WORKS

Nowadays, Traffic Sign Recognition System had gained popularity because of its image processing ability and many others benefits that it provides as the system. An ample amount of research has been already done on Traffic Sign Recognition System (TSRS) using different ML techniques.

In [1], Nazmul Hasan proposed an approach in a paper which was published in 2020 to recognize the traffic sign using two Machine Learning algorithms that is SVM and CNN.A real dataset was prepared from random videos in which essential traffic sign images were cropped. In total 1200 images were captured, that were further classified into training and validation set. In order to obtain good result, 80% data was considered for training purpose while remaining 20% for testing. After inputting these datasets in SVM and CNN, the 98.33% accuracy was achieved in case of SVM while 99.56% training accuracy and 96.40% accuracy was obtained from CNN.

In [2], This Paper was printed in 2020; it contains implementation on Traffic sign Detection and recognition mistreatment Image process. Image analysis consists of 3 steps: Detection, Segmentation and classification. This paper centered on correct and high economical results of detection and recognition. Deep Convolutional neural network square measure used for training then classifying traffic sign .Here some methodology square measure accustomed phase traffic sign by applying different techniques like filtering, edge detection, DWT Feature segmentation (color segmentation). The YCBCR conversion method square measure used for comparison. Proposed feature selection extraction, wherever the 2 datasets of GTSRB and GTSDB square measure used for implementation. These dataset contains several advanced traffic signs. Final result is showed in screen by notification crop up.

In [3], Autonomous Traffic Sign Detection (ATSR) system was made using Deep CNN model. This paper was published in 2019 in 16th International Learning & Technology Conference and it carried out two main tasks; one was to create a database on its own and second one was to develop and design CNN architecture. The dataset consisted of 2728 RGB images which required preprocessing before inputting it to CNN network. The process of preprocessing converted it to gray scale images and then the CNN was designed which achieved the accuracy of 100 % and was successful in detecting traffic symbols.

In [4], Traffic Sign Detection and Classification has been done using Deep Learning. The paper was published in May

2019 in IRJET and author of paper is Shalinia. The author proposed the system which used the feature extraction method in order to obtain the efficient results. The German Traffic sign detection benchmark dataset has been used in the project which contains 39209 images in total. For the preprocessing, Adam was used which basically includes all the aspects of CNN. In this System, RGB images were preprocessed using Local Histogram Equalization and Normalization and the data in hand was trained and tested using TensorFlow with LeNet architecture. To improve the quality of RGB images, Contrast Limited Adaptive Histogram Equalization (CLAHE) is applied on images given as input. The accuracy of 98.3% was achieved with RGB which concluded that RGB were more accurate in comparison with Gray images.

In [5] Oct 2018, Citlalli Gámez Serna and Yassine Ruichek had planned the implementation on classification of real-world traffic signs on European dataset. This dataset combined with six European countries traffic sign. This implementation had taken quite 80,000 pictures divided in 164 categories. Models square measure trained in GPU mode employing a NVIDIA GeForce GTX1080Ti with 11GB of memory. For this implementation they were getting to perform dataset comparison between classification performances of 5 CNN design. Comparison had taken on GTSDB and European Dataset. After performing training and validation on each dataset, analyzed accuracy of model. Some techniques like Preprocessing and data-augmentation square measure accustomed improve accuracy. All these implementation work on TensorFlow Framework. Here CNN asymmetric and CNN-8 layers model were enforced on GTSRB and European information set with original and augmented data. Accuracy goes to 99.37% on GTSRB dataset and 98.99% on European dataset.

In [6], April 2017 ,Traffic sign recognition task had done by Alexander Shustanova and Pavel Yakimova.This paper contains implementation of classification formula for the real- time traffic sign recognition task with preprocessing and localization steps. In which they used Deep learning library TensorFlow. After some implementation they normalize all the layers. Due to sizable amount of layers, training taken batch of 50 pictures, result not provide excellent accuracy then they scale back convolutional layer. After reducing range of iterations they found that result was worse than before, it results that one convolutional layer isn't enough to urge excellent accuracy. To judge the classification, execution time is 20ms. Once many implementation they found that it's most effective methodology for TSR mistreatment GTSDB and GTSRB is mistreatment convolutional neural network for each localizing and classifying traffic signs and accuracy goes to 99.89% once police detecting a symbol and 99.55% once classifying it. It acknowledges traffic sign distance up to 50m.This methodology was enforced on device with Nvidia Tegra K1 processor.

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