International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 04 | Apr 2022 www.irjet.net p-ISSN: 2395-0072

Traffic Sign Recognition Model

Pranay Shetty[1], Shrilatha Shripathi[1], Prof. Amruta Sankhe[2]

[1]*Dept. of Information Technology, Atharva College of Engineering, Maharashtra, India*
[2]*Assistant Professor, Dept. of Information Technology, Atharva College of Engineering, Maharashtra, India*

Abstract - *Traffic Sign Recognition is very important to research in this automotive era. The model we build is to recognize the traffic signs, with an accuracy of 94.98% using the CNN algorithm. The model consists of the German Traffic Sign Recognition Benchmark (GTSRB) dataset which consists of over 43 classes of traffic signs, split into 80% training images and 20% test images. This model recognizes the traffic sign and predict it accordingly. We processed more than 50k images for the traffic signs. Trained the model through the CNN algorithm which gave the highest accuracy compared to other algorithms. This system is portable and can be added in Advanced driver-assistance systems (ADAS) to add a new feature to the vehicle. The results of the final experiment show that the network is valid for the classification of traffic signs with the accuracy of 94.98%.*

***Key Words*: CNN algorithm, ADAS, GTSRB, Accuracy, Traffic signs.**

1. INTRODUCTION

This dataset comprises 43 classes with unbalanced class frequencies. Before proceeding toward the model, the data is cleaned which removes redundancy features. These 43 classes are divided into two sets: training sets and testing sets. 39209 images are in training sets and 12630 images in testing sets where the model will be trained by the training sets and the trained model will be tested with the test set. An activation function is just a simple function that transforms its inputs into outputs that have a certain range. Various types of activation functions perform this task differently. For example, the sigmoid activation function takes input and maps the resulting values between 0 to 1. But we have used the Regression linear activation Unit which is the function simple and it consists of no heavy computation as there is no complicated math. The model can, therefore, take less time to train or run. One more important property that we consider the advantage of using the ReLU activation function is sparsity. The model went through 20 epochs and the last epoch result gave the accuracy as 95%.

2. Literature Review

In [1], Aashrith Vennelakanti, Smriti Shreya, Resmi Rajendran, Debasis Sarkar, Deepak Muddegowda, and Phanish Hanagal use Traffic Sign Detection and Recognition uses image processing for the detection of a sign and an ensemble of convolutional neural network (CNN) for recognition of the signs.

In [2], Akshata V. S and Subarna Panda had published a paper representing the topic of Traffic Sign Recognition and classification using convolutional neural networks that they are going through three stages to recognize the traffic sign which consists of image segmentation, detection of the traffic sign, and a classification phase based on the input image. They will collect the data from the German Traffic Sign Benchmark and it will explore and summarize each of the data sets to visualize all the data uniquely.

In [3], Meenakumari V. Umarani and Raghavendra F. Sheddi used an SVM classifier where the image is processed and LBP features of the image are extracted and given to PCS for further reduction. It is recognized that the traffic sign detection problem using the state-of-the-art multi-object detection systems such as Faster Recurrent Convolution Neural Networks(F-RCNN) and Single-shot Multi-Box Detector (SSD) combined with various feature extractors such as MobileNet v1 and Inception v2, and also Tiny-YOLOv2.

In [4], Deeban Chakravarthi S., Balakumar M., Ahithkumar S., Karthik, and Mr. A. Vellingiri published a highly efficient system to process high-definition (1080p) video, which is captured by a camera to detect the traffic sign using FPGA, it achieves a throughput of 126 frames per second and an energy efficiency of 0.041 J/frame

In [5], MD Tarequl Islam had not only taken the dataset of some particular region but it had considered every data regarding traffic signs which are used all around the world. Here, there are two sets one which classifies the signs and the other the shape. 40000 images have been used to train the first classifier with 28000 positive images and 12000 negative images were used to train the second classifier.

In [6], Jian-He Shi and Huei-Yung Lin used the Taiwan dataset as the videos that are recorded using an onboard dashcam. It is based on image processing, bilateral Chinese transform, and vertex and bisector techniques. Either the RGB image input is used directly, or transformed to the HSI color space and using the hue channel to extract the red color region

In [7], Djebbara Yasmania, Rebai Karima, and Azouaoui Ouahiba kept in mind the era of Advanced Driving Systems (ADAS) and autonomous vehicles used the LeNet-5 network to extract a deep representation of traffic signs to perform the recognition. The model is constituted of a Convolution Neural Network (CNN) Modifies by connecting the output of all convolutional layers to the Multilayer Perception (MLP).

3. Methodology

3.1. Block diagram

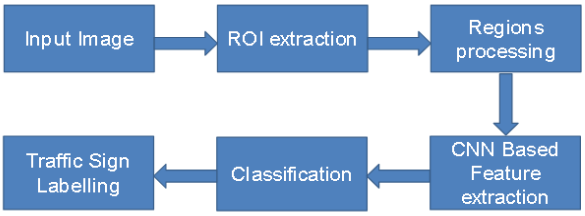

Fig -3.1: Block Diagram

i) Input Image: The dataset of the German Traffic Sign Recognition Benchmark (GTSRB) contains images of traffic signs from this set. We take a sample image for testing in the GUI where the result of the image will be displayed on the GUI according to the input image given.

ii)ROI Extraction: Region of Interest (ROI) Extraction is the interest image extractor where the required information is extracted from the input image and will be processed towards the next step.

iii)Region Processing: The extracted image will be processed and the selected region will be processed in the CNN algorithm.

iv)CNN-based feature extraction: This algorithm will extract the feature present in the images for further classification.

v)Classification: Traffic signs will further classify the process of automatically recognizing the traffic signs along the road, including merge signs, stop signs, turn signs, etc

vi)Traffic Sign Labelling: The dataset is split into training, test, and validation sets.

Storing all this information in the model the GUI gives out the result of the traffic signs as labelling it.

3.2. Architecture

i) Pre-processing the images:

The dataset we have may have null values and redundancy values to eliminate that we clean the data, remove the redundancy features by which we will get the accurate data to train the model.

ii) Splitting the data:

Pre-processed data should be split into two sets i.e., train and test where the train set contains 80% of the data and test data contains 20% of the data which will test the model and give the accuracy.

iii) Building the model:

The model is built using CNN Algorithm where ConV2d is used and ReLU activation is used to get the accurate results.

iv) Test Data:

Trained model is tested on test data to get the result which showed us an accuracy of 95%.

3.3. Flowchart

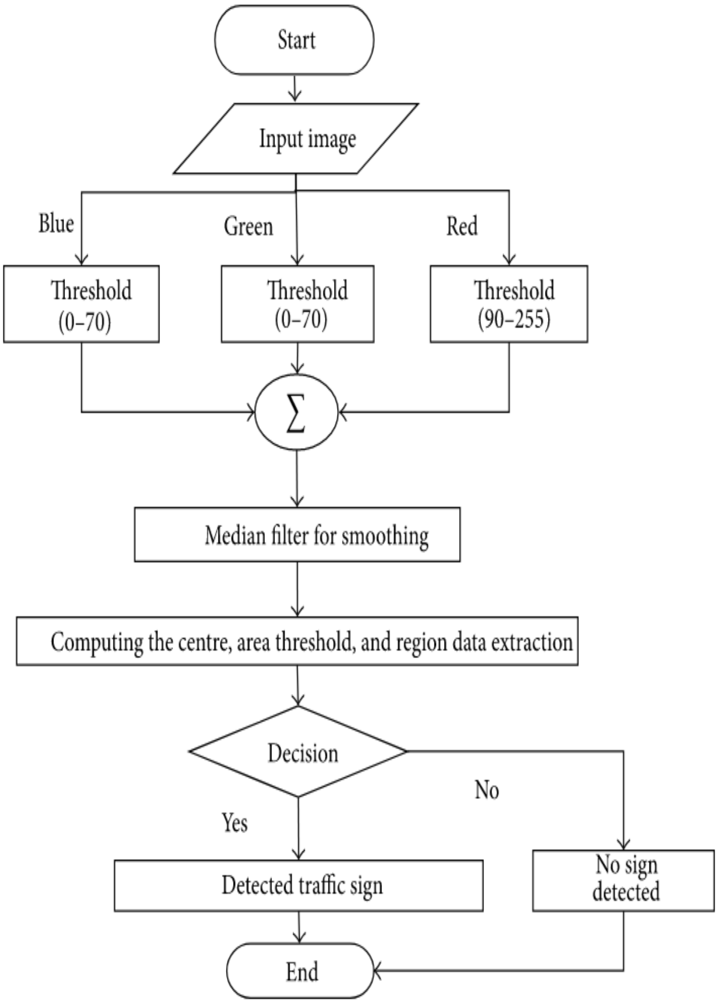

Fig -3.3: Flowchart of Model [8]

Here, we start by taking the image as an input where the image consists of Traffic Signs from the dataset of the GTSRB. The image taken consists of RGB values, these values are then divided into 0-70 thresholds each. Threshold values are then submerged into a median formula for smoothening. After filtering and analysing the features of the detected object, the candidates of the traffic sign are selected. The flow chart of the system is shown in fig 3.3

4. Datasets and Resources

Object recognition based on neural networks requires extensive data sets to train the system and evaluate its results. To classify traffic signs, we used the GTSRB. It contains 43 classes divided into 3 categories as shown in the table.

Table -4.1: Distribution of Dataset

Data	Task	No. of image
Training data	Used to train the network	34799
Validation data	Allows to supervise the network performance while training	4410
Testing data	Used to evaluate the final network	12630

5. Result

The results obtained are very accurate. The main motivation was to achieve maximum accuracy so that users can get accurate information about the traffic signs. The results of the traffic images recognized by this CNN algorithm were perfect. Future implementations of this model will be in advanced autonomous transportation systems as the graphical interface used to display the results is customized for simulation purposes.

Fig -5.1: Traffic Sign Recognition Model

EPOCH:

An epoch is the one where the dataset passes by it forward and backward through the neural network only once. Passing the epoch through the same neural network is necessary because we are using a limited dataset.

One epoch can lead to underfitting if we increase the number of epochs the curve moves to optimal and if we increase more, it will move the curve towards overfitting. Getting the optimal curve for the epochs only depends upon the diversity of the dataset.

Table -5.1: Accuracy and Loss Table for 20 Epochs

Epochs	Loss	Accuracy	Validation Loss	Validation Accuracy
1	0.8245	0.4777	45.29%	88.23%
2	0.6693	0.8041	21.56%	94.75%
3	0.4435	0.8719	18.40%	95.31%
4	0.3345	0.9028	14.29%	95.69%
5	0.3016	0.9114	11.64%	96.77%
6	0.2908	0.9186	9.95%	97.26%
7	0.2583	0.9264	7.96%	97.77%
8	0.2440	0.9306	7.04%	98.16%
9	0.2337	0.9342	5.25%	98.74%
10	0.2256	0.9370	7.19%	97.77%
11	0.2194	0.9396	6.39%	98.21%
12	0.2239	0.9399	8.47%	97.70%
13	0.2272	0.9386	7.15%	97.91%
14	0.2229	0.9426	8.27%	97.67%
15	0.2456	0.9375	4.99%	98.65%
16	0.2043	0.9459	6.14%	98.64%
17	0.2187	0.9443	6.54%	98.24%
18	0.2276	0.9443	5.35%	98.71%
19	0.2236	0.9449	6.33%	97.79%
20	0.2194	0.9498	5.35%	98.23%

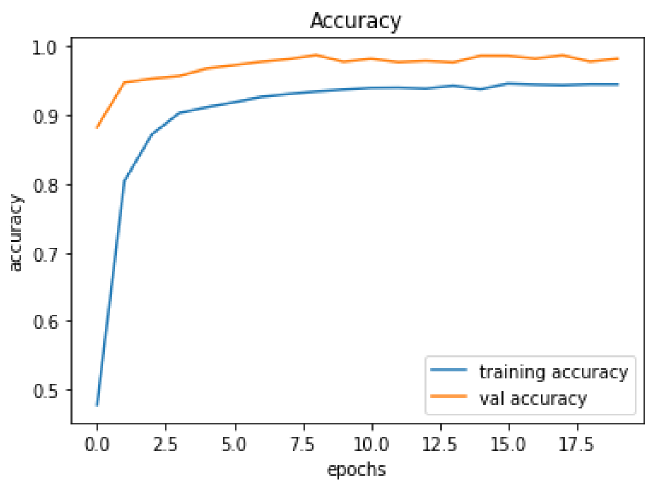

Fig -5.2: Accuracy Graph of Model

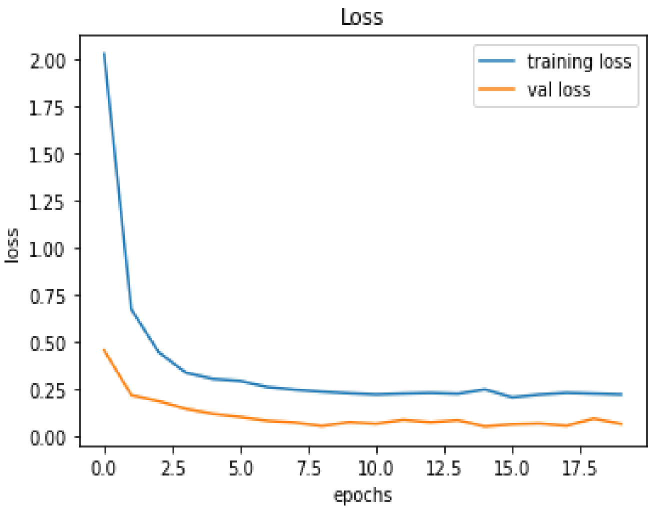

Fig -5.3: Data Loss Graph of Model

6. Conclusions

This paper proposes a deep learning-based framework for fast and efficient traffic sign recognition. To improve the accuracy speed of the model, a convolutional neural network (CNN) is used as the base line network. The convolution module is used to create an enhanced feature map with greater representation. In the test, a widely used dataset is adopted to improve the performance of the model and the entire framework including the German Traffic Sign Recognition Benchmark (GTSRB) dataset. Test results on these datasets show that the proposed framework improves traffic sign detection performance in difficult driving conditions and meets the real-time requirements of advanced driver assistance systems. This system can only recognize forty-three classes of traffic signs, so the traffic sign recognition range is limited. To increase the range, a dataset containing different types of traffic signs can be used.

REFERENCES

[1] A. Vennelakanti, S. Shreya, R. Rajendran, D. Sarkar, D. Muddegowda and P. Hanagal, "Traffic Sign Detection and Recognition using a CNN Ensemble," 2019 IEEE International Conference on Consumer Electronics (ICCE), 2019, pp. 1-4, doi: 10.1109/ICCE.2019.8662019.

[2] Akshata V. and Subarna Panda, "TRAFFIC SIGN RECOGNITION AND CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORKS", International Journal of Emerging Technologies and Innovative Research (www.jetir.org | UGC and issn Approved), ISSN:2349-5162, Vol.6, Issue 2, page no. pp186-204, February-2019, Available at: http://www.jetir.org/papers/JETIRAB06034.pdf

[3] Meenakumari.V.Umarani, Raghavendra. F. Sheddi, "Road Sign Detection and Recognition System Using LBP and SVM", International Journal of Engineering Development and Research (IJEDR), ISSN:2321-9939, Volume.7, Issue 4, pp.139-144, October 2019, Available at http://www.ijedr.org/papers/IJEDR1904025.pdf

[4] Deeban Chakravarthi S, Balakumar M, Ajithkumar S, Karthik V and A. Vellingiri, "FPGA Based Traffic Sign Detection with High Resolution Camera," February 2018 | IJIRT | Volume 4 Issue 9 | ISSN: 2349-6002 IJIRT 145372

[5] M. T. Islam, "Traffic sign detection and recognition based on convolutional neural networks," 2019 International Conference on Advances in Computing, Communication and Control (ICAC3), 2019, pp. 1-6, doi: 10.1109/ICAC347590.2019.9036784.

[6] J. Shi and H. Lin, "A vision system for traffic sign detection and recognition," 2017 IEEE 26th International Symposium on Industrial Electronics (ISIE), 2017, pp. 1596-1601, doi: 10.1109/ISIE.2017.8001485.

[7] D. Yasmina, R. Karima and A. Ouahiba, "Traffic signs recognition with deep learning," 2018 International Conference on Applied Smart Systems (ICASS), 2018, pp. 1-5, doi: 10.1109/ICASS.2018.8652024.

[8] Safat B. Wali, Mahammad A. Hannan, Aini Hussain, Salina A. Samad, "An Automatic Traffic Sign Detection and Recognition System Based on Colour Segmentation, Shape Matching, and SVM", Mathematical Problems in Engineering, vol. 2015, Article ID 250461, 11 pages, 2015.