TRAFFIC SIGNS DETECTION AND RECOGNITION USING DEEP LEARNING WITH 96 PERCENT ACCURACY

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Abstract *A framework is proposed to detect and recognize symbols and text-based traffic guide panels captured in highway environments. This framework could help deliver the text and symbol information from guide panels to human drivers as head-up display information, in this proposal, detection and classification of traffic signs on captured frames are studied. This set is separated into 10 groups: Cluster, Deformed, Mixed, Different Shapes, Illumination, Occlusion, Rotation, Shadows, Sizes, Translation. The implementation should work as fast as the video stream.*

Keywords—Traffic sign, Guide panels, Dataset, Deep learning, Classification

1. INTRODUCTION

Vehicles are the primary means of transportation in our day to day life. Due to increase in the number of vehicles the drivers are experiencing several risks while driving and this may also lead to accidents. A vast amount of accidents are happening every year all over the world. These accidents are mainly because of the driver inability to process all the visual information that is available while driving. According to the 'World Road Statistics' report published by the International Road Federation (IRF), Geneva, India has recorded the second highest number of road accident deaths in the world in the year 2015. For such kind of situation we need the advanced driving assistant system (ADAS). One of the task ADAS is automatic recognition of road traffic signs and to inform it to driver. Such kind of system can alert the driver and can also take necessary action if it is not taken by the driver.

2. RELATED WORK

There are three kinds of traffic signs are there in India namely, mandatory, cautionary and informatory signs. Mandatory signs provide the information about certain laws and regulations to be followed by the driver. Generally these signs will be in circular shape except "STOP" and "GIVE WAY" signs. Cautionary signs warn the drivers about the hazardous road conditions such as humps, narrow bridge, gap in median etc. The Cautionary signs will be in triangular shape with red outer border and the black symbol on the white background. The informatory signs provide the information about the route directions, destination names and distances and help the driver along the routes. As an application of ADAS, traffic sign detection and recognition has become a challenging task since the real-time applications requires a fast and accurate system. Here we are using total 42 class of images for training the model. For each class there are number of images available. The count for these images varies for class to class. The number of images used for training for each class will affect on the accuracy of the result. The convolutional neural network is used for training the model. At the end we test the model with images of the road sign and see the plot of accuracy and loss as well the result of recognition with probability value.[5]

3. NEURAL NETWORK CONVOLUTIONAL

Artificial Intelligence has been witnessing a monumental growth in bridging the gap between the capabilities of humans and machines. Researchers and enthusiasts alike, work on numerous aspects of the field to make amazing things happen. One of many such areas is the domain of Computer Vision.[2]

The agenda for this field is to enable machines to view the world as humans do, perceive it in a similar manner and even use the knowledge for a multitude of tasks such as Image & Video recognition, Image Analysis & Classification, Media Recreation, Recommendation Systems, Natural Language Processing, etc. The advancements in Computer Vision with Deep Learning has been constructed and perfected with time, primarily over one particular algorithm — a Convolutional Neural Network. We will build a deep neural network model that can classify traffic signs present in the image into different categories. With this model, we are able to read and understand traffic signs which are a very important task for all autonomous vehicles.[6]

We are using few convolution layers, few pooling layers and few dropout layers. At the end we use the densed layer which is our output layer and then compile the model. At the end of the scope we store the trained model in pickle object so that we use it later on in real time using over openCV library.

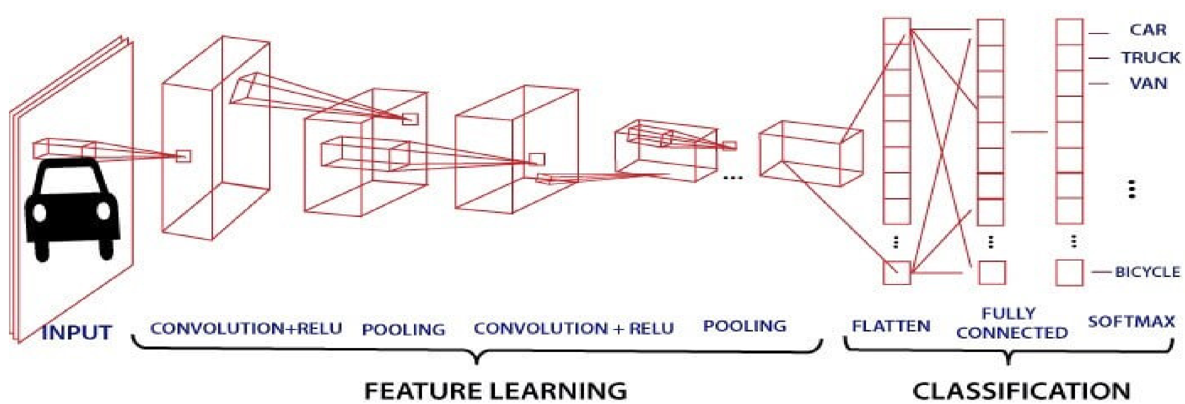

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Figure 1. Convolutional neural network

4. TRAINING DATASET

4.1 Traffic sign images

Followings are the some of the images used for the training the convolutional neural network. For each category of traffic sign certain numbers of different images are taken for training the model. These images contains traffic sign from various angle and views.

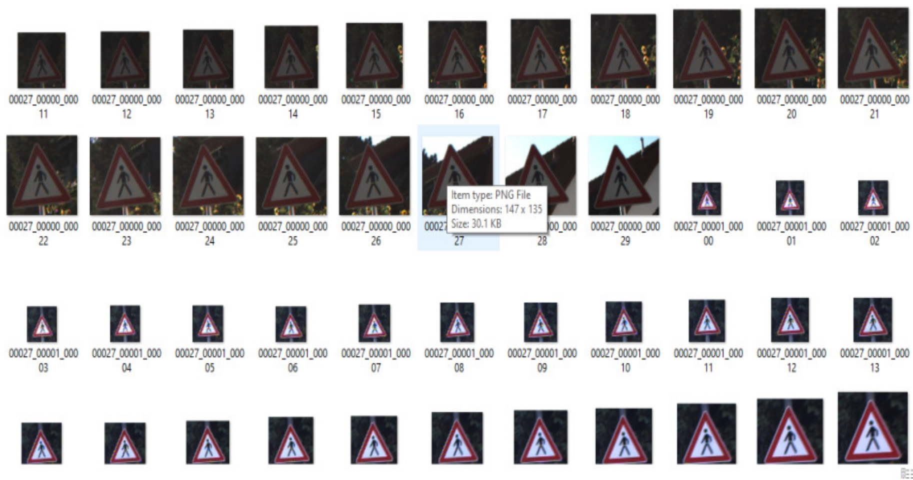


Figure 2. Training dataset

4.2 Distribution of training dataset

The dataset is not evenly distributed. We don't have number of images for each class. From below diagram we can see that we have 200 images for one class and 1300 images for another class. Due to this we might get good classification for one class and bed classification for another class.

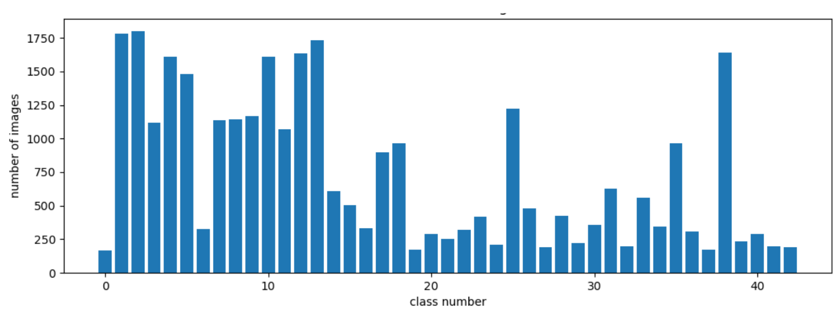


Figure 3. Distribution of dataset

4.3 Preprocesing images

To make the different dataset we process the images in different ways. We are converting images in grey scale and then equalizing them for standardizations. We have to do these to make it more generic. We are rotating the images, we shifting it right, left. We are zooming it so that we can make different dataset and it is more generalized rather than having plain images.

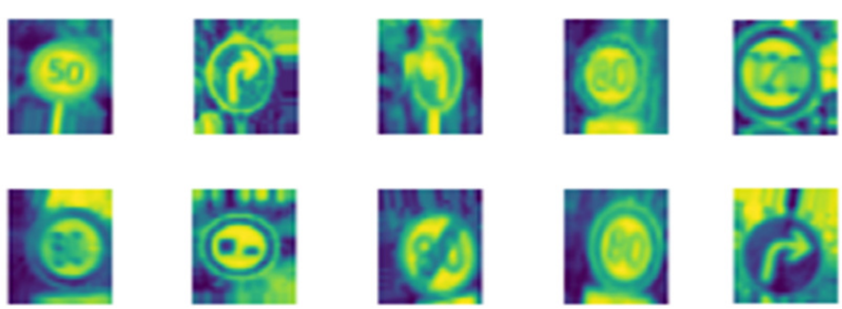
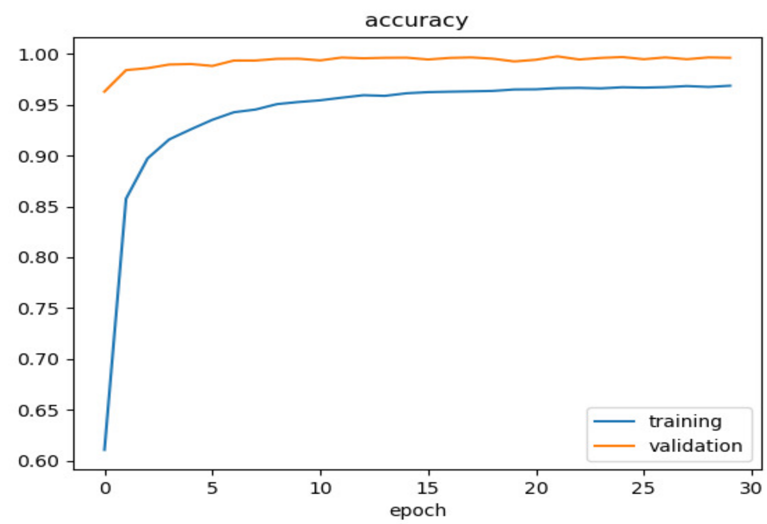


Figure 4. Pre-processed images

5. ACCURACY AND LOSS

In the plot we can see the training and validation loss as well as training and validation accuracy. Here we using 30 epoch for the training the model. From the curve shown in below figure we can observe that we have trained the model with 30 epoch and accuracy is 0.97 and training loss is 0.014 which is extremely good. After building the model architecture, we then train the model using model.fit(). I tried with batch size 32 and 64. Our model performed better with 64 batch size. And after 15 epochs the accuracy is stable.



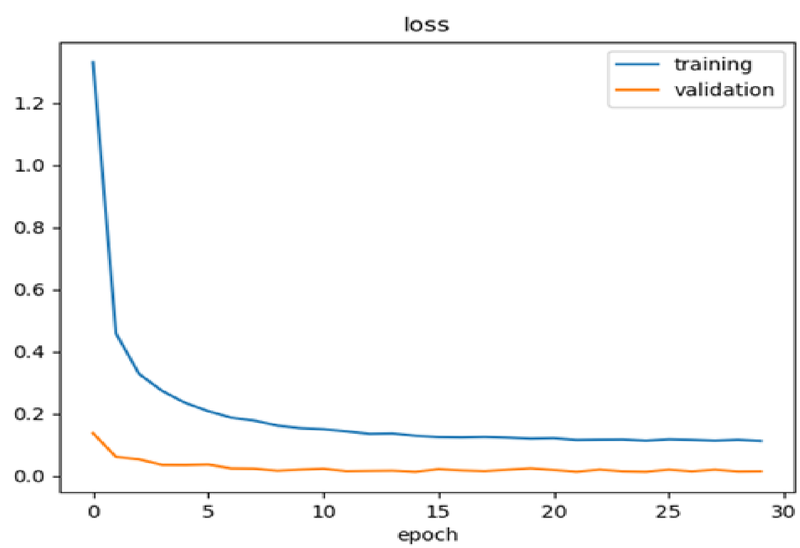


Figure 5. Accuracy and loss curve

6. TEST AND RESULT

In the below figure some of the test and results are shown. In each of the image we get the different value of probability of recognition. This is because of uneven distributions of dataset. The class for which we have more number of images for training they are recognized more accurately and for which we are having less number of images, they are recognized less accurately.

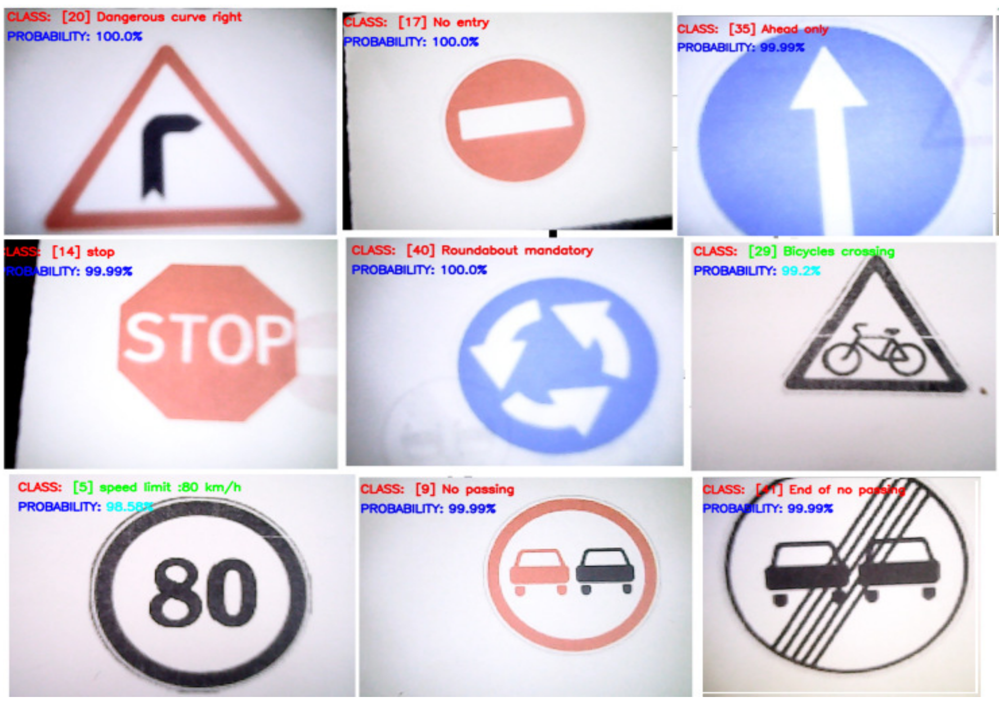


Figure 6. Test results

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