Project Report

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Topic: Traffic Signs Classifier (CNN)

Introduction:

Nowadays, there is a lot of attention being given to the ability of the car to drive itself. One of the many important aspects for a self driving car is the ability for it to detect traffic signs in order to provide safety and security for the people not only inside the car but also outside of it.

The traffic environment consists of different aspects whose main purpose is to regulate flow of traffic, make sure each driver is adhering to the rules so as to provide a safe and secure environment to all the parties concerned.

I have focused this project on the traffic signs and a few of the traffic signs which I have in our dataset is as shown in the figure below. I used the German traffic sign dataset that is available on KAGGLE. The dataset consisted of 43 different types of traffic sings.

The problem I am trying to solve has some advantages such as traffic signs being unique thereby resulting in object variations being small and traffic signs are clearly visible to the driver/system.

The proposed approach consists of building a model using convolutional neural networks by traffic signs dataset. I have used convolutional neural networks (CNN) to classify the traffic signs. Also image data generator to process the images.

Background and related work (Literature Review):

Many different techniques have been applied to detect traffic signs. Most of these techniques are based on using HOG and SIFT features.

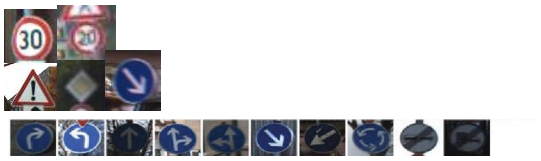
In our approach I use biologically inspired convolutional neural networks to build a model which can predict the type of traffic sign. One such related work based on convolutional neural networks is published in ‘Traffic Sign Recognition with Multi-Scale Convolutional Networks’ by Pierre Sermanet and Yann LeCun[4].

Dataset Used:

The data used to train and test the CNN was obtained from https://www.kaggle.com/gtsrb-german-traffic-sign **dataset.html. It had about 40,000 images and 43 different types of traffic signs.**

The German Traffic Sign Benchmark is a multi-class, single-image classification challenge held at the International Joint Conference on Neural Networks (IJCNN) 2011. We cordially invite researchers from relevant fields to participate: The competition is designed to allow for participation without special domain knowledge. Our benchmark has the following properties:

- Single-image, multi-class classification problem
- More than 40 classes
- More than 50,000 images in total
- Large, lifelike database



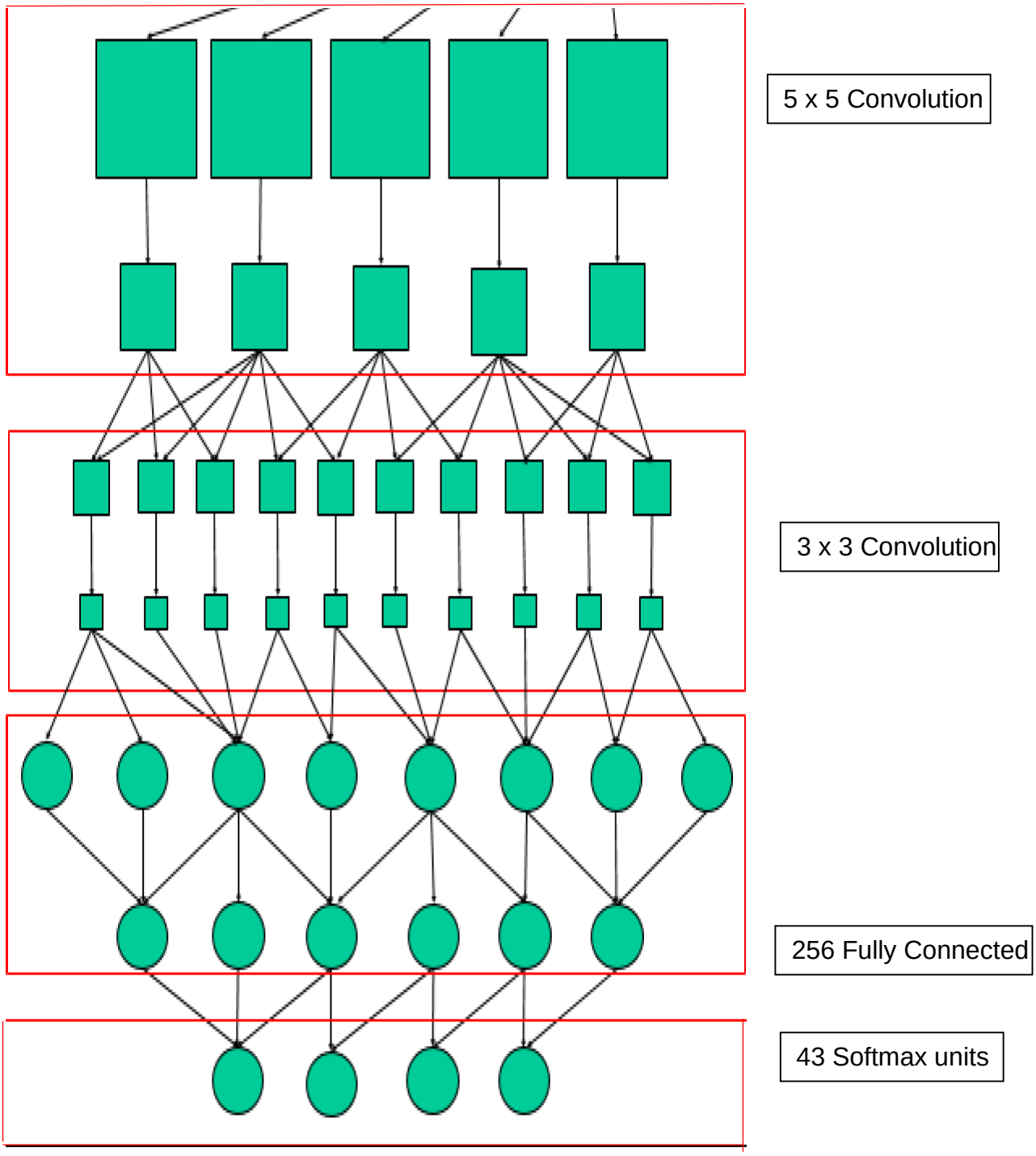
Proposed architecture:

Predicting the type of traffic sign.

For this purpose, I can train a convolutional neural network. The data used to train and test the CNN was obtained from **https://www.kaggle.com/gtsrb-german-traffic-sign dataset.html**. It had about 40,000 images and 43 different types of traffic signs. For each image, the label for the traffic sign in the image was given. The traffic signs are cropped or processed out to use for training the CNN.

A CNN is basically inspired by the connections between the neurons in the visual cortex of animals. Since traffic signs have unique shapes inside them like arrows, words, circles and so on. It is useful to convert the traffic sign into a more useful form by using a equalize operation on the traffic sign image.

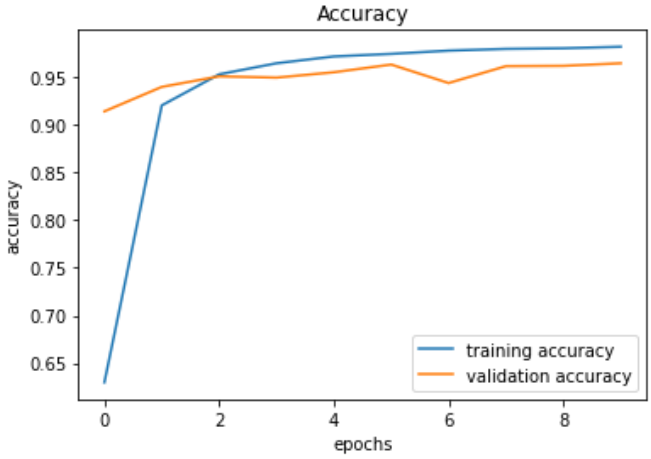
The processed image is now fed into the CNN whose architecture in shown below:

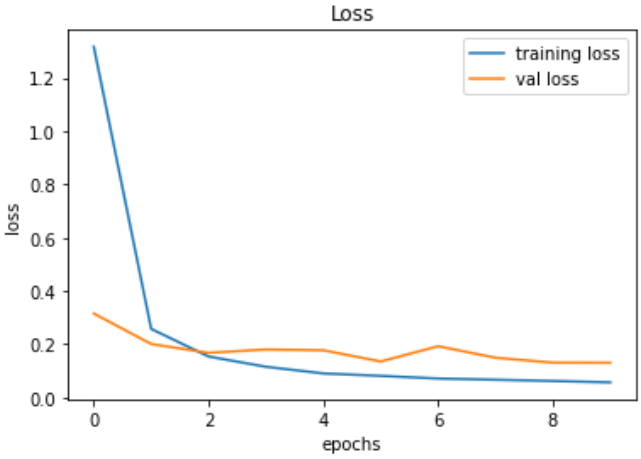


The learning rate used to train the CNN was 0.001 .The CNN was trained for 10 iteration.

Once the CNN has been trained, it is used to predict the signs.

Following is the image which shows the accuracy of the model for classifying signs.





I can also use the trained CNN to get the Accuracy, Precision, Recall and F1 score metrics on the test set. These results are discussed in the next section.

Results:

The following table gives the Accuracy and loss metrics on the test set. The test set was already split in train, test and validate.

The followings results take into consideration the traffic sign that is perfectly cropped from the image. This may not be true when I are extracting traffic signs from the image without the prior knowledge of their position.

Metric	Score
Accurac y	96.45%
loss	0.1304

Conclusion:

From the following results I can see that the CNN is doing a good job in classifying different types of traffic signs.

Drawback of this approach is that when the color of the traffic signs vary which may be due to bad weather conditions and poor camera quality, the image masks obtained are not perfect and hence the signs are not detected properly.

It can be used in self driving cars to benefit the safety of not only the people in the car but also who are on the road.

References:

[1] https://bartlab.org/Dr.%20Jackrit's%20Papers/ney/3.KRS036_Final_Submission.pdf
[2] http://cvrr.ucsd.edu/LISA/lisa-traffic-sign-dataset.html
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