Report

On

Traffic sign Prediction

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Abstract:

Deep learning has been an area of research and used widely in different applications.. This process of prediction is one of the applications NLP and DL deals with. We have made huge progress here and we can use Convolutional neural networks for such a process. In Traffic sign prediction the sign are predicted which could help to avoid uncertain accidents and to follow rules.

Problem Description:

Traffic sign prediction is the process of automatically recognizing traffic signs along the road, including speed limit signs, yield signs, merge signs, etc. Being able to automatically recognize traffic signs enables us to build "smarter cars" .Self-driving cars need traffic sign prediction in order to properly parse and understand the roadway. Similarly, "driver alert" systems inside cars need to understand the roadway around them to help aid and protect drivers-Traffic sign prediction is just one of the problems that computer vision and deep learning can solve.

Objectives:

The main objective of our project is to design and construct a computer based system which can automatically detect the road signs so as to provide assistance to the user or the machine so that they can take appropriate actions. The proposed approach consists of building a model using convolutional neural networks by extracting traffic signs from an image using color information. We have used convolutional neural networks (CNN) to classify the traffic signs and we used color based segmentation to extract/crop signs from images

Notebook used:

Google Colab - Colaboratory, or "Colab" for short, is a product from Google Research. Colab allows anybody to write and execute arbitrary python code through the browser, and is especially well suited to machine learning, data analysis and education.

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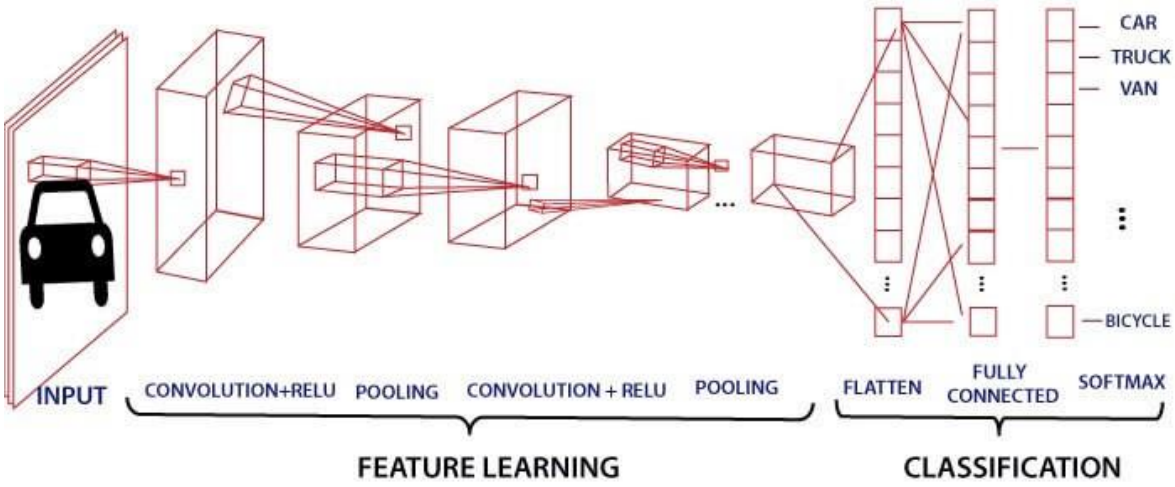
Technical requirements:

Sr no.	Name	Description
1	CNN	CNN help in running neural networks directly on images and are more efficient and accurate than many of the deep neural networks. ConvNet models are easy and faster to train on images comparatively to the other models.
2	Augmentation	Data augmentation in data analysis are techniques used to increase the amount of data by adding slightly modified copies of already existing data or newly created synthetic data from existing data. It acts as a regularizer and helps reduce overfitting when training a machine learning model. It is closely related to oversampling in data analysis.
3	TensorFlow	TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.
4	Keras	Keras is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library.

Architecture of CNN:

CNN help in running neural networks directly on images and are more efficient and accurate than many of the deep neural networks. ConvNet models are easy and faster to train on images comparatively to the other models.



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METHODS:

1. Extracting a potential traffic sign from an image.

Traffic signs are designed such that they appear unique and easily identifiable to the human eye.
Work Since the color of a traffic sign is unique in a background we can use the color information to narrow down our areas of interest (parts potentially containing the traffic sign).
Since RGB colored images are susceptible to variations in lighting, we use HSV (Hue, Saturation, and Variation) images.
Once we have the HSV image our next goal is to define our areas of interest (i.e. range of Yellow, Red and White) so that we can segment our HSV image based on these 3 colors.
The color ranges used are as follows

Color	Lower Range (HSV)	Upper Range (HSV)
Yellow	([10,50,50])	([30,255,255])
Red	([170,50,50])	([185,255,255])
White	([0,0,50])	([120,15,255])

2) Predicting the type of Extracted traffic sign
From the extracted areas of interests in the previous step we want to determine if it is a sign or not and if it is a sign we wish to know what the type of sign it actually is.
For this purpose, we can train a convolutional neural network. For each frame, the coordinate positions for the traffic sign in the image is given. From these positions the traffic signs were cropped out to use for training the CNN.
A CNN is basically inspired by the connections between the neurons in the visual cortex of animals. [7]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 Laplacian operation on the traffic sign. We can apply the Laplacian operation by convolving the following kernel on the input image:

0	-1	0
-1	4	-1
0	-1	0

Consider the following traffic sign and its Laplacian:

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

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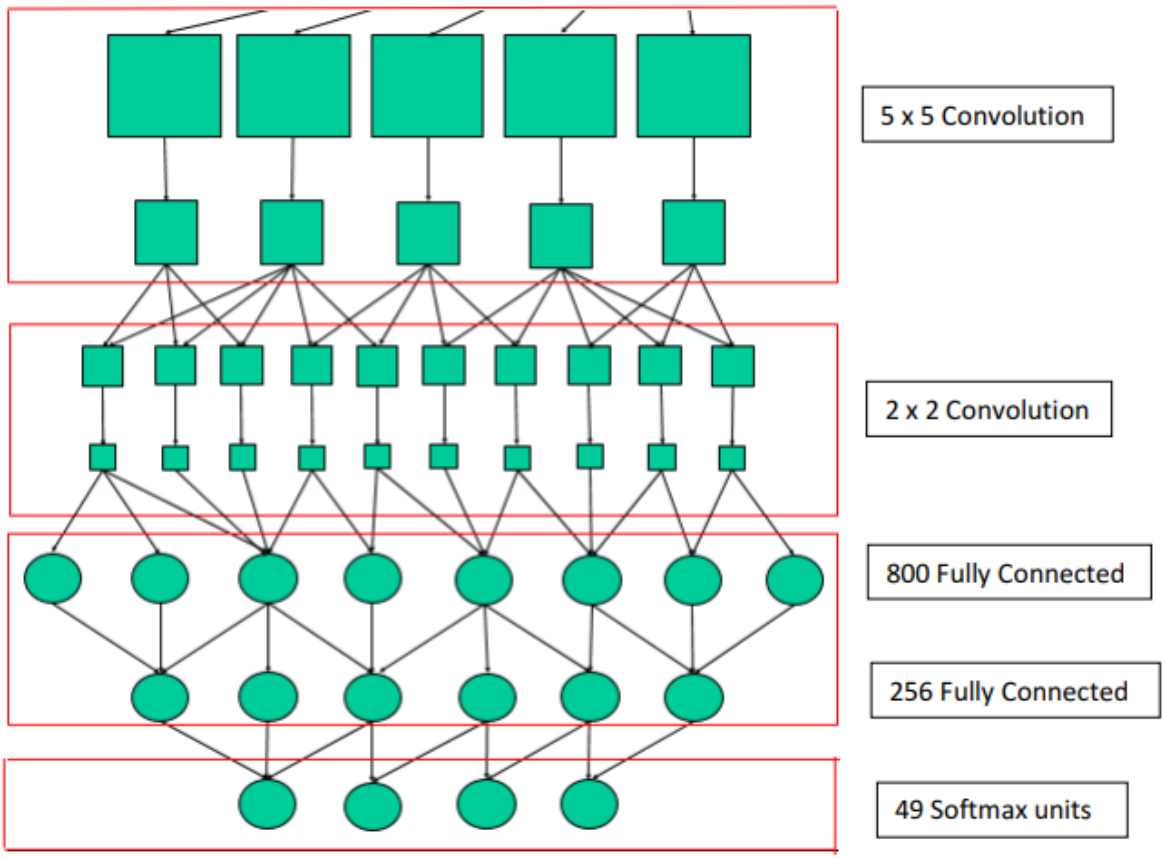

CONCLUSION:

From the following results we can see that the CNN is doing a good job in classifying different types of traffic signs when the extracted signs are cropped perfectly from the image.

Our approach fails to give good results when the extracted signs from test images are cropped incorrectly.

Another drawback of our 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.

Future improvements can be made for extracting signs from test images by using advanced segmentation methods

Dataset location:

https://www.kaggle.com/indhusree/traffic-signal-predection-cnn/data

GitHub Code link:

https://github.com/khushi0patel/traffic_sign_prediction.git

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