Traffic Sign Detection Using Convolutional Neural Networks

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Abstract
Traffic Sign Detection and Recognition (TSDR) plays a crucial role here by detecting and recognizing a symbol, thus notifying the driving force of any upcoming signs. this may not only ensure road safety but also allows the driving force to be a little more ease while driving on tricky or new roads. With the assistance of this Traffic Sign Detection System (TSDR), drivers will not face the problem of understanding what the sign says. Because after performing the method of classification of a traffic sign, that output is transferred within the sort of speech. in this system, we propose a way for Traffic Sign Detection and Recognition using image processing for the detection of a symbol and an ensemble of Convolutional Neural Networks (CNN) for the recognition of the sign. Since CNN has a high recognition rate, it's used for implementing various computer vision tasks. For the implementation of CNN, we generally use Tensor Flow.

Keywords
Convolutional Neutral Network, Tensor Flow, Keras.

I. Introduction

Traffic sign detection is often considered a particular case of object-class detection. In object-class detection, the task is to seek out the locations and sizes of all objects in a picture that belongs to a given class. Traffic sign detection algorithms specialize in the detection of traffic signs even from the damaged traffic signboards. Detection determines the locations of signs during a given frame while the classification determines the class of signs that are passed from the detection step.

The problem of sign classification from the detected images is extremely captivating, but also the demanding one. However, many challenges remain for an unsuccessful system because the performance of those systems is greatly suffering from the surrounding conditions that affect the road sign visibility.

II. Literature Survey

Vision oriented traffic sign recognition may be a big field to undertake and do research that continuously attracts the research's community of the industry. Since traffic sign helps us to interpret the state of the road to regulate the traffic and also helps in a warning and guiding pedestrians and drivers. Recently road accidents are occurring frequently across the world. The leading reason behind most accidents is that the ignorance of the traffic sign. Traffic sign detection system plays great potential in the decline of road accidents by alerting the driver in a complex scenario and unconscious driver due to many psychological factors. Moreover, road sign provides information about the state of the road to the drivers and pedestrians. Designing a common TSR system isn't a conceivable option, because the structure, shape, and hues of road signs are country-specific. The main Motive of our research is to form a system by considering distinct color features of signs with automatic features extraction and classification by CNN.

III. Proposed Method

Traffic sign detection techniques are researched for years. Most of the sign detection methods consider detecting traffic signs with good lighting conditions.

A. GTSRB Dataset

The GTSRB dataset used in many systems for literature review and described briefly. For an effective comparison of classification systems, a dataset is employed. Originally utilized in a multi-class single image classification competition, many authors now make use of the dataset for training and testing.

B. Convolutional Neural Networks

Convolutional Neural Networks may be a concrete case of deep learning neural networks. CNN is extremely like neural networks. They're forms by the fundamental units called NEURONS.

C. Layers used to build ConvNets

Convnets are a sequence of layers. The output is given by each layer transform one volume to another through a differentiable function forgiven the output.

1. Input Layer

It holds the images with width 32, height 32 and depth 3.

2. Convolution Layer

It computes the output volume by the dot product between all filters and image that is given as input. As an example, we use a total of 10 filters for this layer then we'll get output volume of dimension 32 x 32 x 10.

3. Activation Function Layer

It'll apply to the element-wise activation function to the output of the convolution layer. They are 7 common activation functions are RELU, Sigmoid, Tanh, Leaky RELU, Parametric RELU, Softmax, Swish. The volume remains unchanged hence output volume will have dimension 32 x 32 x 10.

4. Pool Layer

It periodically inserted within the convnets and its main function is to scale back the dimensions of volume which makes the computation fast reduces memory and also prevents overfitting. Two common kinds of pooling layers are max pooling and average pooling. If we use a max pool with 2 x 2 filters and stride 2, the resultant volume is of dimension 16x16x10.

5. Fully-Connected Layer

This layer takes input from the previous layer and computes the class scores and outputs.

Working of the model:

First the hidden layers which are Convolutional layers of the neural network receive input and transform it into a specific pattern and

send it to the subsequent layer. With more Convolutional layers, whenever a replacement input is shipped to the next convolution layer, they're changed in several ways.

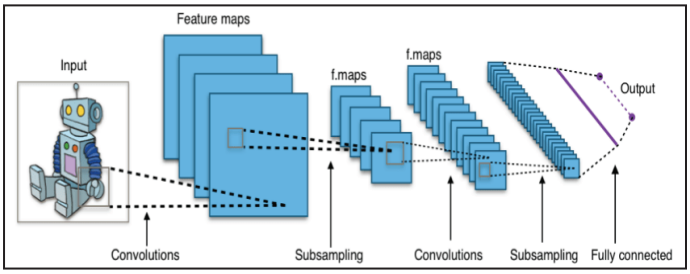

Fig. 1: Working Model of CNN

In the first layer, the filter identifies the shape/color during a region, and the next one could even be able to conclude the thing it is (i.e. stop sign or speed limit 50kmph), and thus the last Convolutional layer may classify the thing. If the input goes through more and more layers, the more sophisticated patterns the long run ones can detect.

IV. Implementation and Results

Import packages like OpenCV, Pandas, Keras, Numpy etc., which would be useful for applying various functionalities. Set a path for training the images of various traffic signs. Convert lists into Numpy arrays and then create the CNN model. CNN consists of hidden layers where functions like Conv2D, pooling is applied. Then epochs are executed. The accuracy of the system is calculated by plotting the graph. Creating GUI is the final step, here an image is uploaded and is classified.

Fig. 2: Interface of Traffic Sign Detection

Fig. 3: After Adding an Image

Fig. 4: Final Output

As shown in the above, the image is added and it is classified and it will be turn out into voice

V. Conclusion

The CNN model works very efficiently by degrading the complex steps into multiple layers. In our process the image which is identified even in adverse situations is solved with ease using CNN Model. The image which is taken as input is reduced in the form of multiple layers which successively reduces the complexity of the system and our effort. The activation functions ReLU and therefore the SoftMax increases the capability and efficiency of the system is a great way.

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