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# TRAFFIC SIGN DETECTION, RECOGNITION AND NOTIFICATION TO IMPROVE USER'S SAFETY

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**ABSTRACT**

*Accidents are happens due to avoidance of traffic sign. If there is an automatic detection and recognition system, it can promptly report the correct traffic signs to the driver and also reduce the burden of the driver. When the driver ignores a traffic sign, the system can give a timely warning.*

*In this project we proposes a new system to recognize all categories of traffic signs, which include both symbol-based and text-based signs, in video sequences captured by a camera mounted on a car. Traffic sign regions of interest (ROI) from each frame are first extracted using maximally stable extremely regions on gray and normalized RGB channels. Then, they are refined and assigned to their detailed classes via the proposed multi-task convolutional neural network, which is trained with a large amount of data, including synthetic traffic signs and images labeled from street views. The post processing finally combines the results in all frames to make a recognition decision. At last system notify the user by audio.*

**KEYWORDS—** *Faster R-CNN, Traffic signs Detection, Recognition Classification, Conventional neural Network, ROI etc.*

## I. INTRODUCTION

### TRAFFIC SIGN DETECTION:

The traffic sign detection is carried out under the unpredictable complex scene, so there are many difficulties inevitably. (a) Illumination changes, lighting is different according to the time of the day and weather conditions. (b) Scene complexity, many other objects occur in the scene even with some logos and text which are very similar to the traffic signs, sometime the sign may be sheltered. [5]

Color segmentation is the most common method. RGB color model is widely used. RGB color space has a higher sensitivity to light intensity. Therefore, HIS and HSV which are not affected by the lighting changes have been used. Some other authors also used YIQ, YUV, and CIE color spaces for the detection. Some authors developed databases of color pixels, look-up tables and hieratical region growing techniques. Shape-based method is usually used for a final detection after the color segmentation. Many circle, ellipse and triangle detection methods have been used. Hough transform is widely used discussed ellipse detection in complex scene with neighborhood characteristics and symmetric features of the simple coding analyzed the color information and geometrical characteristic of the edges to extract possible triangular or circular signs. [5]

### TRAFFIC SIGN RECOGNITION:

After the detection stage recognition stage comes in system. The detection stage is followed by a recognition stage. In the detection stage, a search for the regions of interest (ROIs), which contain the traffic sign within the image, is performed. These ROIs are then examined by the recognition stage to correctly identify signs. [2] For recognition Color-based segmentation and Convolutional Neural Network is used. [5]

## TRAFFIC SIGN CLASSIFICATION:

Classification of traffic sign image is done by their types and shapes. Many methods have been employed for traffic signs classification such as template matching, LDA, SVM, ANN and other machine learning methods. OCR systems are applied in used the pictogram-based classification by template matching and cross-correlation. In the authors make use of the LDA to distinguish between the road signs. The Multi-Layer Perceptron is widely used in the current approaches. Neural networks are also largely adopted. Support vector machines (SVM) are largely adopted to classify the inner part of road signs. Random forests, an ensemble learning technique, are used by to classify signs, and a comparison is made between this technique and SVM and AdaBoost. [5]

## II. SYSTEM ARCHITECTURE

Fig. 5 shows architecture of our system. We take input video from webcam or any high resolution camera which contain traffic sign. Then using video interpreting and processing convert video in to frames and then display that frame which contain traffic sign. Traffic sign detection is done using Faster R-CNN, Region Praposal Network (RPN), Region of Interest (ROI) pooling layer and last using classifier i.e. Dense layer, Box Regression Layer.

In localization refinement Energy function is used for pixel intensity, Enlarging bounding box are used for object selection, Segmentation is used for dividing image in to number of segments and after colour enhancement technique is used to enhance the colours. Output of localization refinement given to Convolutional Neural Network (CNN) for classification.

Finally we get traffic sign recognition from video which contain traffic. After that system will send notification to driver by audio message. Hence if driver ignore the traffic sign then also by listening audio message he will follow traffic sign.

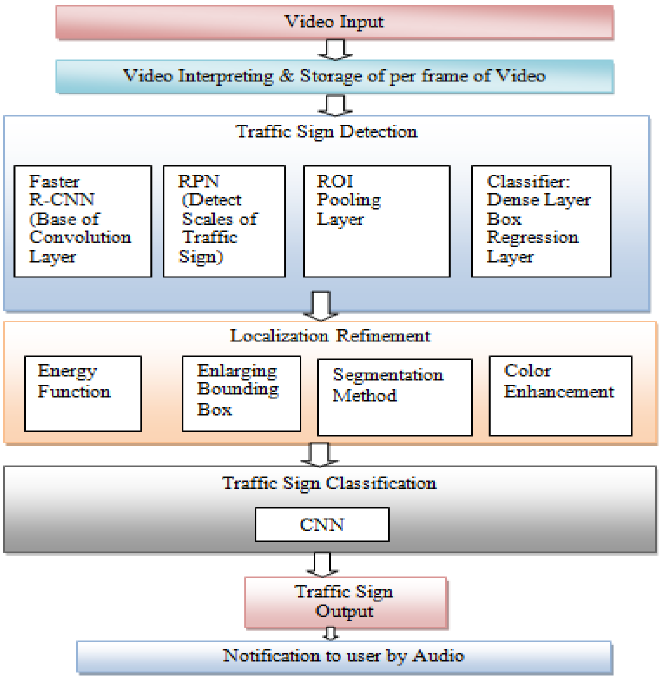


**Fig.1. Block Diagram**

## III.RESEARCH METHODOLOGY

### 3.1 Convolutional Neural Network:

A Convolutional Neural Network is a class of artificial neural network that uses convolutional layers to filter inputs for useful information. The convolution operation involves combining input data (feature map) with a convolution kernel (filter) to form a transformed feature map. The filters in the convolutional layers (conv layers) are modified based on learned parameters to extract the most useful information for a specific task. Convolutional networks adjust automatically to find the best feature based on the task. The CNN would filter information about the shape of an object when confronted with a general object recognition task but would extract the color of the bird when faced with a bird recognition task. This is based on the CNN's understanding that different classes of objects have different shapes but that different types of birds are more likely to differ in color than in shape.

Applications of Convolutional Neural Networks include various image (image recognition, image classification, video labeling, text analysis) and speech (speech recognition, natural language processing, text classification) processing systems, along with state-of-the-art AI systems such as robots, virtual assistants, and self-driving cars.

### Components of a Convolutional Neural Network:

Convolutional networks are composed of an input layer, an output layer, and one or more hidden layers. A convolutional network is different than a regular neural network in that the neurons in its layers are arranged in three dimensions (width, height, and depth dimensions). This allows the CNN to transform an input volume in three dimensions to an output volume. The hidden layers are a combination of convolution layers, pooling layers, normalization layers, and fully connected layers. CNNs use multiple convolutional layers to filter input volumes to greater levels of abstraction.

CNNs improve their detection capability for unusually placed objects by using pooling layers for limited translation and rotation invariance. Pooling also allows for the usage of more convolutional layers by reducing memory consumption. Normalization layers are used to normalize over local input regions by moving all inputs in a layer towards a mean of zero and variance of one. Other regularization techniques such as batch normalization, where we normalize across the activations for the entire batch, or dropout, where we ignore randomly chosen neurons during the training process, can also be used. Fully-connected layers have neurons that are functionally similar to convolutional layers (compute dot products) but are different in that they are connected to all activations in the previous layer.

More recent CNNs use inception modules which use 1×1 convolutional kernels to reduce the memory consumption further while allowing for more efficient computation (and thus training). This makes CNNs suitable for a number of machine learning applications.

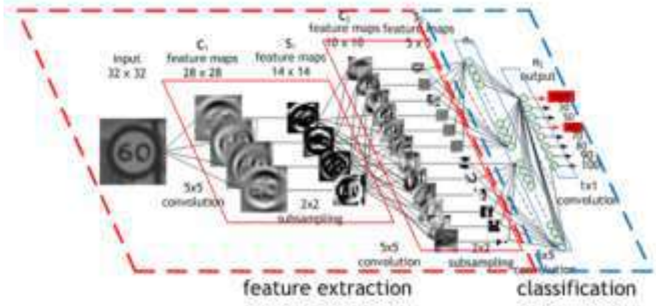


**Fig.2 Components of a Convolutional Neural Network**

### Pooling / Sub Sampling:

Pooling is a procedure that reduces the input over a certain area to a single value (sub sampling). In convolutional neural networks, this concentration of information provides similar information to outgoing connections with reduced memory consumption. Pooling provides basic invariance to rotations and translations and improves the object detection capability of convolutional networks. For example, the face on an image patch that is not in the centre of the image but slightly translated can still be detected by the convolutional filters because the information is funnelled into the right place by the pooling operation. The larger the size of the pooling area, the more information is condensed, which leads to slim networks that fit more easily into GPU memory. However, if the pooling area is too large, too much information is thrown away and predictive performance decreases.

### CNN Training and Inference:

Like multi-layer perceptrons and recurrent neural networks, convolutional neural networks can also be trained using gradient-based optimization techniques. Stochastic, batch, or mini-batch gradient descent algorithms can be used to optimize the parameters of the neural network. Once the CNN has been trained, it can be then used for inference to accurately predict outputs for a given input.

### 3.2 Faster R-CNN:

R-CNN has fast processing power than CNN and Fast CNN. If CNN require 20sec then Fast CNN requires 2 sec for processing and Faster R-CNN requires 2 ms for processing. Using Faster R-CNN we can detect the objects within minimum time and accuracy is more when we use CNN.

Colour Segmentation:

Colour processing is nothing but using different technique and methods operations performed on traffic sign. Colour Segmentation method is used for colour Processing. [4]

Color-based segmentation includes two steps: color quantization, ROI locking. In first step, we extract the target color pixels. In the last step, we get the ROI from the pixels based on constraints on bounding box of the connected-components of the pixels. The main color of them include: red, blue, yellow, white and black. Among them white and black always appear with other black. Among them white and black always appear with other three colors. So in our detection method, we focus on the three colors: red, blue and yellow. The RGB color model is highly related to the light intensity. [4]

Object Feature Analysing using Edge detection :

In traffic sign image where intensity change abruptly is called edge. In edge detection technique the longest connected component are determine by various operator. Sobel operator for detection of edges in traffic sign image. [4]

**Fig.3 Edge Detection**

### Object Feature Analysing using Shape Matching:

Shape matching is nothing but the matching the shape of extracted object from traffic sign image. Shape matching used for traffic sign detection where different sign have different shapes and after shape matching we can recognise that which traffic sign is present in Image. [4]

### Extract our desired road sign:

The traffic sign contains traffic sign but in that image unwanted object also present so we required only traffic sign. In this process only selected area is extracted using different methods. After verify the detected sign by applying sobel edge detection operator we extract the road sign from background. After the extraction of sign next process start that is matching the shape of object to the shape of sign which is stored in database. The figure of traffic sign extraction from scene is shown below. [4]

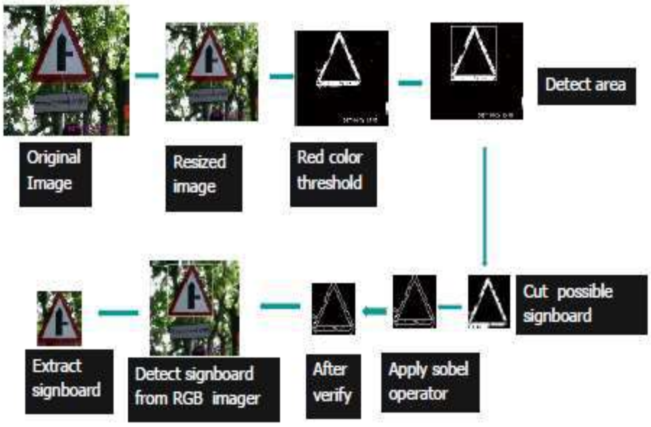


**Fig.4 Extract our desired road sign**

### 3.3 The Region Proposal Network (RPN):

The region proposal network takes as input a 3 × 3 spatial window of the input feature map. An anchor is cantered at each sliding window location, which is illustrated in Figure 3. Three scales and three aspect ratios of anchors are used. The anchor scales should be tuned according to the scales of traffic signs to detect because traffic signs usually occupy only a small fraction of the whole image and the sizes vary a large range.The features in each sliding window are fed into a 3 × 3 convolutional layer and is mapped into a lower-dimensional feature (256-d). The number of sliding window locations is 50 × 85 according to Table I and 50 × 85 features which are 256-d are outputted by this layer. Then, the 256-d features are fed into a two-layer fully convolutional neural network to yield 9 anchors. The two convolutional layers with sigmoid activation functions and processing speed. [6]

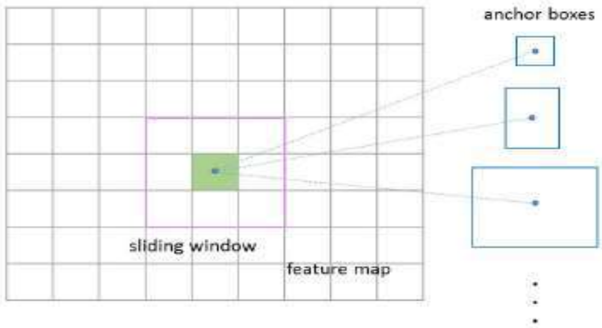


**Fig.5 Anchors**

The region proposal network proposes several anchor boxes at each sliding position on the feature map. In this work, the number of anchor boxes is set to 9 at each sliding position for the trade-off between recall and processing speed. [6]

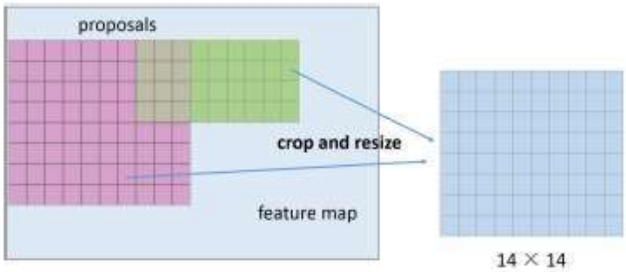


**Fig.6 The operation of ROI pooling**

The feature map is outputted by the base convolutional layers. The fixed spatial extent is set to 14 × 14 according to the detection performances. linear activation functions respectively serve as an anchor box score layer and an anchor box regression layer . As a result, 9 possible proposals are yielded at each sliding position. [6]

### 3.4 Classifier: Dense Layer and Regression Layer:

The classifier after the RPN is defined. All convolutional layers are followed by a batch normalization layer and a ReLU layer. The number of ROI's to be selected and used, which are proposed by the RPN. The classifier has two fully connected layers (dense layer), i.e., a box classification layer and a box regression layer. The first dense layer has two outputs, which are fed into the softmax layer to compute the confidence probabilities of being traffic signs and negative samples. The second dense layer with linear activation functions regress the bounding boxes of candidate traffic signs.

### 3.5 The ROI Pooling Layer:

The ROI pooling layer uses max pooling to convert the features inside any valid region of interest proposed by the RPN into a feature map with a fixed spatial extent. But the max pooling operation brings about the problem of misalignment obviously. A differentiable ROI warping layer is added before the standard max pooling to perform the ROI pooling, compensating for this problem to some extent. However, for simplicity in our implementation, we perform the ROI pooling by cropping a feature region proposed by the RPN and resize the region to the fixed spatial extent of 14 × 14 via bilinear interpolation, which is illustrated in Figure. Subsequently, the fixed size feature map is fed into the classifier after the RPN. The classifier which will be introduced next is a small classification network to discriminate between traffic signs and negative samples.

## IV. APPLICATIONS

1. **Prevent Accidents:** Using Traffic Sign Detection and Recognition system we can prevent accidents, because sometime we can't see the traffic sign for example stop, school and hence accidents may be happens, so using Traffic Sign Detection and Recognition system we can easily detect traffic sign and avoid accidents.
2. **Public Safety:**Traffic Sign Detection and Recognition system we can prevent accidents, because sometime we can't see the traffic sign for example speed limit, stop, school and hence accidents may be happens, so using Traffic Sign Detection and Recognition system we can easily detect traffic sign and for public safety it plays important role.
3. **Navigation:** In rural area GPS is not

available and hence for navigation Traffic Sign Detection and Recognition system is used. Traffic Sign Detection and Recognition guides us for taking left turn, right turn, speed limit etc.

4. **Better Driving Experience:** For better driving experience Traffic Sign Detection and Recognition system is used. We cannot miss any traffic sign hence our driving experience is good as compared to without Traffic Sign Detection and Recognition system.

## V. CONCLUSION

We propose a new system to recognize all categories of traffic signs in low quality short videos captured by a car mounted camera. Then system notifies the user with meaning of sign in the form of audio information for better driving performance.

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