Traffic Sign Recognition using CNN

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Abstract **- Traffic signs are utilized as a method of warning and guiding drivers, helping to regulate the flow of traffic among vehicles, pedestrians, motorcycles, bicycles and others who travel the streets, highways and other roadways. In an attempt to focus on the road while driving, drivers often miss out on signs on the side of the road, which could be dangerous for them and for the people around them. Many road accidents occur due to lack of traffic signs. Detecting and classifying different group of traffic signs can save our lives as well as resources.**

In this paper a vision-based framework is presented which detects and recognizes traffic signs inside the attentional visual field of drivers. The properties of road and traffic signs and their implications for image processing for the recognition task are understood. The various tasks necessary for this paper is to understand color, color spaces and color space conversion, to develop robust color segmentation algorithms that can be used in a wide range of environmental conditions, to develop a recognizer that is invariant to in-plane transformations such as translation, rotation, and scaling based on invariant shape measures and to evaluate the performance of the aforementioned methods for robustness under different conditions of weather, lighting geometry, and sign.

Index Terms **- Traffic Sign Detection, Vision Based Framework, Indian Sign, Traffic Sign.**

1.INTRODUCTION

Traffic signs are utilized as a method of warning and guiding drivers, helping to regulate the flow of traffic among vehicles, pedestrians, motorcycles, bicycles and others who travel the streets, highways and other roadways. Traffic signs are one of the road equipment, in the form of symbols, letters, numbers, sentences and combinations such as warnings, prohibitions, orders or directions for road users. In an attempt to focus on the road while driving, drivers often miss out on signs on the side of the road, which could be dangerous for them and for the people around them. Many road accidents occur due to lack of traffic signs. Detecting and classifying different groups of traffic signs can save our lives as well as resources. By recognizing the traffic signs expected the vehicle can provide information to the driver. Based on a survey it is found that 70% of people do not recognize traffic signs correctly. This could have an impact on traffic safety. In addition, automotive manufacturers are also currently aggressively developing autonomous cars where detection and recognition of digital image has a very important role for driver assistance systems, and autonomous driving system.

2 OBJECTIVES

The objectives which are considered for this research work are as follows:

The most important objective of this project is to help the driving population residing in the country to be able to recognize the different Indian traffic signs using image processing techniques. This will make their life simpler and better improve their quality and standard of living by reducing their dependency on other individuals and thereby taking care of safety during driving.

The existing system has a lot of drawbacks and it extracts less features from the images. Our proposed system uses convolutional neural network algorithm which provides better accuracy in recognition and has the capability of extracting more features.

In this paper, Indian traffic sign is trained to be detected using very simple image processing technique which makes the processing time very short and with better accuracy.

3. RELATED WORK

This section deals with the literature works:

A) Traffic Sign Detection and Recognition Using Color and Texture Feature Extraction and SVM Classifier

This paper presents traffic sign detection and recognition which is necessary to be developed to support several expert systems such as driver assistance and autonomous driving system. There were some major issues on detecting processes such as damaged signs, faded color, and natural condition. Therefore, this paper is proposed to address some of these issues and will be done in two main processes. The first one is traffic sign detection which is divided into two steps. Start with segmenting images based on RGBN (Normalized RGB), then detects traffic signs by processing blobs that have been extracted by the previous process. The second process is the traffic sign recognition process. In this process there are two steps to take. The first one is feature extraction, in this research we propose the combination of some feature extraction that is HOG, Gabor, LBP and use HSV color space. In the next recognition stage, some classifiers are compared such as SVM, KNN, Random Forest, and Naïve Bayes. The proposed method has been tested on Indonesia local traffic signs.

The main idea behind the HOG method is to express the image as a group of local histograms. This histogram consists of gradient orientation and gradient magnitude. This technique calculates the gradient value in a particular area of an image. Each image has the characteristics indicated by the gradient distribution. This characteristic is obtained by dividing the image into a small area called a cell. Each cell is arranged a histogram of a gradient. The combination of this histogram is used as a descriptor that represents an object. Overall, the HOG algorithm is shown in the below figure.

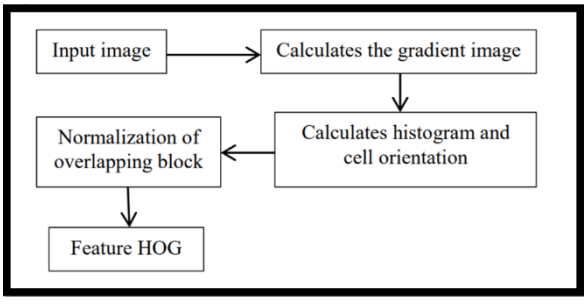

Figure 1: Histogram of Oriented Gradient Algorithm

B) Novel Deep Learning Model for Traffic Sign Detection Using Capsule Network

This paper proposes a novel method for Traffic sign detection using deep learning architecture called capsule networks that achieves outstanding performance on the German traffic sign dataset. Capsule network consists of capsules which are a group of neurons representing the instantiating parameters of an object like the pose and orientation by using the dynamic routing and route by agreement algorithms. Unlike the previous approaches of manual feature extraction, multiple deep neural networks with many parameters, our method eliminates the manual effort and provides resistance to the spatial variances.

Capsule networks consist of capsules rather than neurons. Capsule is a group of artificial neural networks that perform complicated internal computations on their inputs and encapsulate the results in a small vector. Each capsule captures the relative position of the object and if the object pose is changed then the output vector orientation is changed accordingly making them equi-variant.

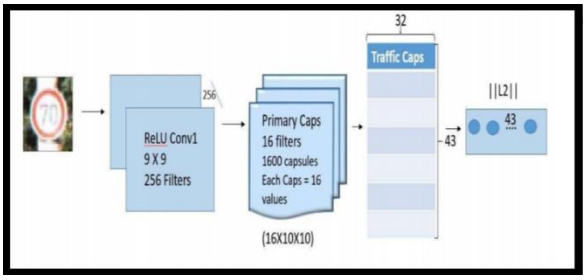

Figure 2: Capsule Sign Architecture

C) Simultaneous Traffic Sign Detection and Boundary Estimation Using Convolutional Neural Network:

A novel traffic sign detection system that simultaneously estimates the location and precise boundary of traffic signs using convolutional neural networks (CNN). Estimating the precise boundary of traffic signs is important in navigation systems for intelligent vehicles where traffic signs can be used as 3-D landmarks for the road environment.

In this work, the boundary estimation of traffic signs is formulated as a 2D pose and shape class prediction problem, and this is effectively solved by a single CNN. With the predicted 2D pose and the shape class of a target traffic sign in an input image, the actual boundary of the target sign is estimated by projecting the boundary of a corresponding template sign image into the input image plane. By formulating the boundary estimation problem as a CNN-based pose and shape prediction task, this method is end-to-end trainable, and more robust to occlusion and small targets than other boundary estimation methods that rely on contour estimation or image segmentation.

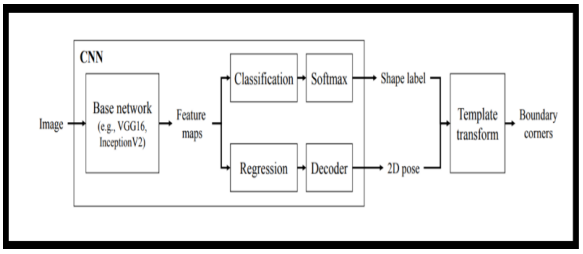

Figure 3: Architecture of proposed method

D) Optimized segmentation and multi-scale emphasized feature extraction for traffic sign detection and recognition:

The paper includes a completely data driven segmentation technique that adaptively selects an optimized color space based on available training data. A completely data driven segmentation technique that adaptively selects an optimized color space based on available training data. To recognize the contents of potential traffic signs, they present a hybrid spatio-frequency radial feature extraction technique with an emphasis on the regions containing useful information. To get rid of irrelevant and redundant attributes in long hybrid feature vectors, we use an effective feature selection strategy based on feature interaction. In addition to a benchmark dataset, the proposed traffic sign detection and recognition algorithm is tested on a self-collected dataset obtained from the longest national highway in Pakistan (N5 highway) represented with deteriorations typical to the developing world. They explore the energy compaction property of steerable discrete cosine transform for feature extraction and augment it with a well-known circular histogram of oriented gradients in a pyramid.

f (x, y) = [f1(x, y) f2(x, y) f3(x, y)] T is a tuple taken from an RGB image at coordinates (x, y) whereas f1(x, y), f2(x, y) and f3(x, y) are scalar values of red, green and blue channels respectively. g (x, y) is the corresponding tuple of channel values in the transformed color space at coordinates (x, y) obtained by executing a linear transformation g (x, y) = T [f (x, y)] = A × f (x, y). The transformation matrix A is of size 3 × 3 whose 9 elements (a11...a33) are computed based on the available data. In the detection phase, maximum discrimination among classes of different colors is achieved by obtaining parameters of the linear transformation from the solution of an optimization problem. A famous technique, linear discriminant analysis (LDA), reduces within class variance and increases between class variance but the data is mapped to a hyperplane.

The recognition phase includes identifying super classes of the blob taken from the output of the segmentation process followed by recognizing its contents.

Extreme Learning Machine (ELM) classifier was trained on low resolution versions of broad shapes of the targeted traffic signs. Input neurons were set equal to the number of pixels in the image being presented and the number of output neurons equal to the classes. A blob is considered as a background item if the score of all classes is below a certain threshold. To read contents of traffic signs, support vector machine (SVM) classifier was trained on the training data and was tested on images reserved for the purpose.

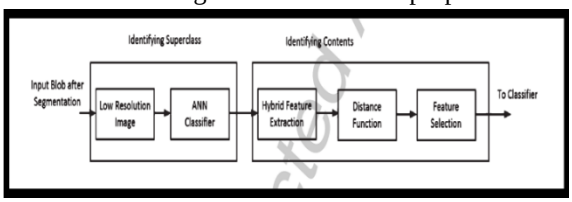

Figure 4: Block diagram of recognition method

E) Research and Application of Traffic Sign Detection and Recognition Based on Drop Learning:

Based on the application of road traffic sign detection and recognition, this article focuses on the correctness and high efficiency of detection and recognition. Through focus on the correctness and high efficiency of detection and recognition. Through Caffe which is the open-source framework, a deep convolution neural network algorithm is proposed to train traffic sign training sets to get a model that can classify traffic signs and to learn and identify the most critical of these traffic signs Features, so as to achieve the purpose of identifying traffic signs in the real scene.

This paper uses VGG-16 as a front-end network structure of the SSD algorithm to detect and identify traffic signs. The VGG-16 consists mainly of five stacked convolutional layers, three fully connected layers and a SoftMax. Each stacked convolutional layer consists of several common convolutional layers, forming a local convolutional network structure followed by a pooling layer. After the completion of the convolutional kernel pooling operation and the three fully connected layers, the output of the last fully connected layer is used as input of the SoftMax layer,

and finally the traffic sign recognition result is obtained.

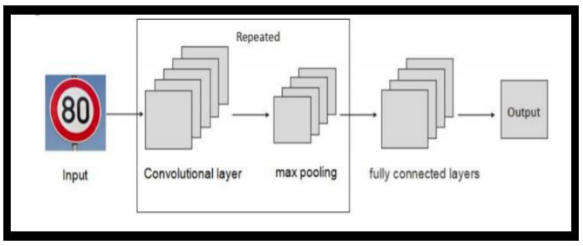

Figure 5 : Network Structure

4 METHODOLOGY

In this part we will understand how the methodology we have adopted to improve the detecting of Indian currency here is a block diagram to illustrate the proposed system

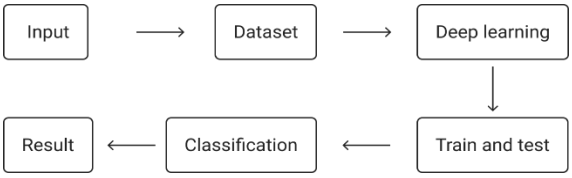

Figure 1: Block diagram of our proposed system

4.1 Block Diagram Description
This project mainly contains 4 parts:
4.1.1 Input
The input is given in the form of image where the user takes an image and upload in the system with help of cable or cloud transferring it is sent to the system

4.1.2 Data
The dataset is a collection of different types of notes in the form of image taken at different to improve the training sets and obtain better training results

4.1.3 Deep Learning
It Helps to develop the knowledge of what human naturally learns which helps in processing and the predicting an output which helps to find greater result
4.1.4 Train and Test
We have trained the dataset which help to get better accuracy with better sets of data and with the help of testing we how accurate our system we achieve and understand we failed to train our data

4.1.5 Classification
We used to classify the kinds of traffic signs we have in the dataset like STOP,80, U-TURN, SCHOOL AREA. Which helps to classify the current signs we detected

6. EXPERIMENTAL RESULTS

The result of proposed system has been significant the aim of this project was to achieve better accuracy of the detection and with the result was quite impressive and below are the accuracy details in the table and graph of the output detected from training model

Training Data	Accuracy
65	94.66
70	96.23
75	96.47
80	97.10

Figure 6: Training Size and Accuracy

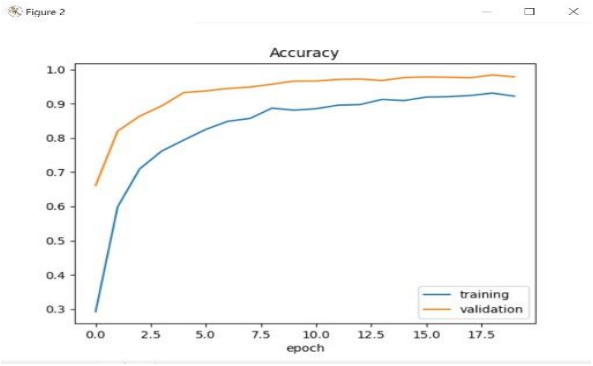

Figure 7: Accuracy Graph

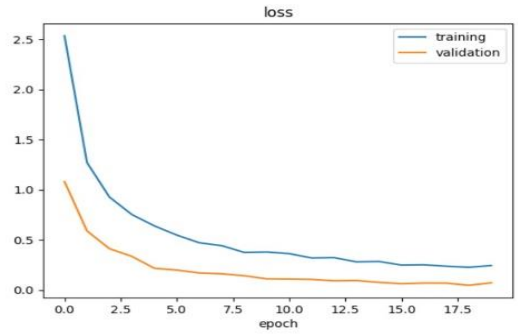

Figure 8: Model Loss

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Accuracy: 0.980856
Precision: 0.980856
Recall: 0.980856
F1 score: 0.980856
Confusion Matrix:
[[ 35   0   0 ...   0   0   0]
 [  3 292   1 ...   0   0   0]
 [  0   2 293 ...   0   0   0]
 ...
 [  0   0   0 ...  49   0   0]
 [  0   0   0 ...   0  41   0]
 [  0   0   0 ...   0   0  37]]
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Figure 9: Confusion Matrix

7. CONCLUSION

The purpose of this technology is to help improve the driver's safety on the road, especially when he or she is tired or has failed to notice signs and signals. With the use of video cameras inside the vehicles, signs such as those prohibiting certain manoeuvres, speed limit signs and passing indicators are captured by these video cameras and shown on the car's dashboard.

Good signs on streets and highways are vital for safety, since in addition to regulating traffic, it informs the driver of the condition of the roads. The current challenge is to combine this sign detection system with other driver assistance systems, in order to offer greater comfort and safety to drivers, all with the same final objective: to achieve fully automated driving and zero accidents on our streets and roads.

Our Proposed System was successfully achieved the desired output and fulfil all the vision of why the project was created. This project has completed the main objective i.e., to improve the accuracy of the existing system with the help of deep learning

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