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DEEP LEARNING Based Traffic SIGN

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Abstract: Automatic detection and recognition of traffic signs plays a crucial role in management of the traffic-sign inventory. It provides an accurate and timely way to manage traffic-sign inventory with a minimal human effort. In the computer vision community, the recognition and detection of traffic signs are a well-researched problem. A vast majority of existing approaches perform well on traffic signs needed for advanced driver-assistance and autonomous systems. However, this represents a relatively small number of all traffic signs and performance on the remaining set of traffic signs, which are required to eliminate the manual labour in traffic-sign inventorymanagement, remains an open question. In this project, we address the issue of detecting and recognizing a large number of traffic-sign categories suitable for automating traffic-sign inventory management. We adopt aconvolutional neural network (CNN) approach, the mask R-CNN, to address the full pipeline of detection andrecognition with automatic end-to-end learning. We propose several improvements that are evaluated on the detection of traffic signs and result in an improved overall performance. This approach is applied to detection of many traffic-sign categories represented in our novel dataset. The results are reported on highly challenging traffic-sign categories that have not yet been considered in previous works.

Index Terms: Deep Learning, Traffic Sign Detection, Gabor Filter Effect, CNN.

I. INTRODUCTION

Oriented traffic TSR is an significant field to do research that continuously attracts the research's community of the industry .Since Traffic sign helps to interpret the state of the road, regulate the traffic and also helps in warning and guiding pedestrians and drivers. Recently road accidents are occurring frequently across the world. Leading cause of most accidents is the ignorance of the traffic sign. TSR system plays great potential in decline of road accidents by alerting driver in complex scenario and unconscious driver due to many psychological factors. Moreover, road sign provides information about state of the street to the drivers and pedestrians. Designing common TSR system is not conceivable option, because the structure, shape and colors of road signs are country specific. Many researches in this field have been explored for different countries. It is fact that no significant research works has not so far conducted to develop TSR system for Indian road ways. Most of the traffic sign used in Indian are triangular shape classified as warning sign. Non-triangular signs are seen very few. So, we emphasize our works on triangular traffic sign where the border color rim of these signs is red. The TSR system is developed in three modules: detection, shape verification and recognition. Many algorithms had been proposed for traffic signs detection. Most of the methods used color information for segmentation by using RGB, HSV, YIQ, YUV and L*a*b color

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models. Soumen and Kaushik used YcbCr color model to detect road sign. Traffic sign follows some well- defined shape signature such as triangle, circular, rectangle. To verify and classify shape, authors proposed algorithms based on distance to borders vectors, Fourier Descriptor (FD) and classifiers such as SVM, Adaboost. Recognition of traffic signs are implemented by using various feature descriptor(HOG, SURF, LBP, LSS) of the segmented blob and the state of art machine learning procedures such as SVM, extreme learning machine, K-d trees, random forest , artificial neural networks(ANN) and deep learning paradigm . Zumra and Imran used SIFT, SURF and BRISK features descriptor and nearest neighbor classifier (KNN). De La and Moreno proposed ANN as a classifier. SVM was used for recognition module in Huang and Hsieh used Adaboost for the classification of traffic signs. The objective of our research is to design a TSR system by considering distinct color features of signs with automatic features extraction and classification by deep CNN. Organization of this article is structured in a way that describes the system outline, segmentation process is represented for recognition stage and at last conclusion and further research directions are outlined above.

II. LITERATURE REVIEW

TSR has always been a hot research topic in recent years. For this purpose, TSR is investigated to detect traffic sign region and non-traffic sign area in complex scene of images, TSR is to extract the specific features represented through traffic sign patterns. The existing TSR methods are basically grouped into two categories: One is based on traditional methods, the other is related to deep learning methods.The main steps of TSR methods based on color and shape of a given image are to extract the visual information contained in the candidate area, capture and segment the traffic signs in the image, and correctly label the signs through patter classification. Although TSR requires color and shape information which is employed to improve the recognition accuracy. The problems of illumination changes or color fading of traffic signs, as well as the deformation and the occlusion of traffic signs, are still unresolved problem. Conventional machine learning methods usually selected specified visual features and take use of the features to classify the classes of traffic signs. The specific features include Haar-like features, HOG features, SIFT features, and so on. Conventional TSR methods are based on template matching, which needs to extract and utilize the invariant and similar visual features of traffic signs, the matching algorithms are run for pattern classification. The feature representation of these methods needs to be specified well, which is a tough problem to describe the visual features precisely because of the variations of traffic signs. The neural networks, Bayesian classifier, random forest, and Support Vector Machine (SVM) are employed as classifiers. However, the performance of conventional machine learning methods depends on the specified features, they are prone to missing the key features. Furthermore, for different classifiers, corresponding feature description information is required. Hence, traditional machine learning methods have limitations, their real-time performance is not comparative relatively. Deep learning utilizes a multilayer neural network to automatically extract and learn the features of visual objects, which has merits for image processing . CNN models are one of the most popular deep learning approaches for TSR. TSR algorithms are based on region proposals, also known as two-stage detection algorithm, the core idea is selective search, its advantages are the great performance of detection and positioning, but the cost is a large amount of computations and high-performance hardware for computing. The CNN models encapsulate R- CNN, Fast R-CNN, and Faster R-CNN. Faster R-CNN combines the regression of bounding boxes and object classification, takes use of end-to-end methods to detect visual objects, which not only improve the accuracy of object detection, but also uplift the speed of object recognition. The road signs usually were detected from the driver's point of view, in this paper, we view the signs from the viewpoint of satellite images. In guided image filtering was employed for the input image to remove image artefacts such as foggy and haze. The processed image is imported into the proposed networks for model training. Meanwhile, TSR algorithms based on regression, also known as single-stage detection algorithm. This kind of TSR algorithms eliminate the idea of Region Proposal Network (RPN), and directly perform regression and classification in a network. You Only Look Once (YOLO) and Single Shot MultiBox Detector (SSD) belong to the single-stage category. Visual object detection consists of two tasks, which are classification and positioning. Before the emerging of YOLOs, these two tasks are different in visual object detection. In the YOLO models, the object detection is simply converted into a regression problem. Furthermore, YOLOs follow an end-to-end structure of neural networks for visual object detection that obtains the coordinates of the predicted bounding boxes, the confidence of the target, and the probability of the class that the target belongs to simultaneously through one image input. In 2020, three YOLO versions had been released, i.e., YOLOv4, YOLOv5, and PP-YOLO. When the YOLOv4 was released, it was considered as the faster and more accurate real-time object detection model, which inherits the Darknet and has obtained a distinct average precision (AP) based on Microsoft COCO dataset while achieved a fast detection speed based on Tesla V100. Compared with YOLOv3, the AP and FPS (i.e., frames per second or video frame rate) have been effectively improved. YOLOv5 was published in 2020. There is little research outcome on the performance of YOLOv5 for TSR. Nevertheless, an experiment of detecting apples was conducted by using YOLOv5 to compare with the performance of YOLOv3. The experimental results indicate that YOLOv5

Output formed the previous model. YOLOv5 obtained 4.30% increment of the detection accuracy. Moreover, a similar experiment was conducted for the apple picking-up. The comparable outcomes with an improved YOLOv5s model, which were 14.95% and 4.74%, are satisfactory by comparing YOLOv3 and YOLOv4, respectively.SSD is well known since it has been proposed. Meanwhile, the SSD model is already being improved and employed to detect visual object in various fields. Recently, the experiments are implemented based on CTSD dataset with the improved SSD model, the results reach 94.40% for the precision and 92.60% of the recall. Besides, a comparison of traffic sign recognition between SSD and YOLOv2 was carried out. The GTSRB dataset was taken into consideration. In general, SSD was 21.00% less than YOLOv2 in accuracy, the latter was 16.00% faster than the SSD model.

III. EXISTING SYSTEM

Previously, Traffic sign detection, as one category of object detection, is attracting the attention of many researchers. Compared with general object detection, traffic signs are designed with a strict color and shape, so that they can be distinguished more easily from the background through these characteristics, either by a human being or an intelligent machine. Therefore, the detection method for traffic signs is generally based on color, shape, or both. However, the color images captured by mounted cameras on a vehicle often fail to highlight the shape information, and cannot express the color information stably, which causes the loss of such information. In existing technology, color information enhancement or shape information enhancement methods are usually used as the preprocess stage of traffic sign detection. The shape is determined by the edges of the objects in the images, so strengthening the information of the edges of the object and weakening the non-edge area can enhance the shape information. In our method, we enhanced the shape information of traffic signs by edge enhancing technology through simplified Gabor filters.

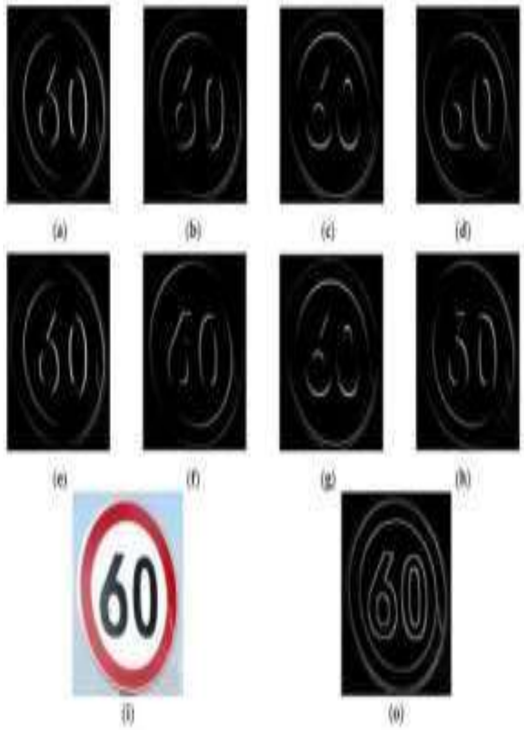

Fig1: Gabor filter effect sign-60

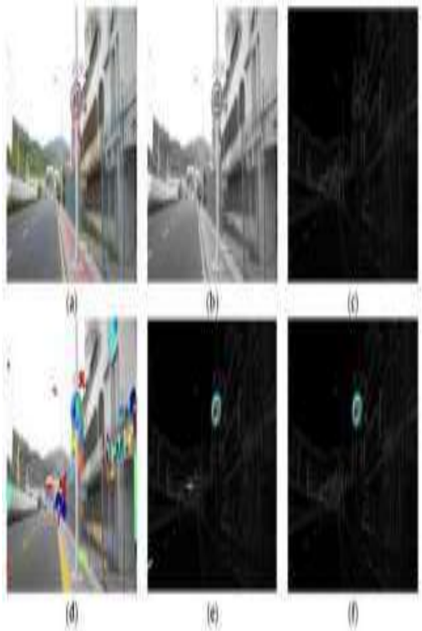

Fig2: Gabor filter effect on sign speed-40.

IV. PROPOSED SYSTEM

The convolutional neural network (CNN) is a type of multi-layer neural network, which extracts features by combining convolution, pooling, and activation layers. The CNN is widely used in the field of pattern recognition. Many researchers have applied the CNN to traffic sign recognition and detection and have achieved good results. The CNN achieved perfect performances in the 2011 International Joint Conference on Neural Networks (IJCNN). Recently, the CNN has been adopted in object recognition with high accuracy. Most of these models use raw images rather than hand-coded features, and most of them regard feature extraction and classification as a whole; this is known as end to end classification. Although raw image-based CNN image classification methods have achieved better performance, many scholars have also further researched the performance of CNN classification after feature transformation. The rotation invariant binary pattern-based feature, was used as the input for an artificial neural network in Reference. Grey relational analysis was used before traffic sign recognition in Reference, and distance to border feature express was used as the input of the CNN in Reference. Research into the expression of image features has attracted significant attention in the field of image classification.The Gabor filter attempts to imitate the characteristics of certain visual cells of mammals and has been successfully used as a preprocessor and feature extractor for a large variety of image processing applications, such as pattern recognition and analysis motion. In image classification fields, the Gabor feature has been widely used as the input of classifiers. In References, the Gabor feature was used for face recognition, mostly obtaining the performance of state-of-the-art methods. Many researchers have used the Gabor feature as an input of CNN and achieved better results. In the fingerprint image recognition area, Reference used the Gabor filter to preprocess the raw image and made it the input of the CNN. In Reference, the speech signal was filtered by the Gabor filter, and then recognized by the CNN. In Reference, the Gabor filter was used as the first layer of the neural network and experiments regarding the open database in the area of face detection, digit recognition, and objection recognition, where it obtained a comparable performance with energy efficiency and fast learning during the training of the CNN. Therefore, the use of the special parameters of Gabor-based preprocessed images as the input of the CNN for image classification is very valuable research. In the detection stage of our method, we classified the traffic signs into super classes. We obtained information about the locations and sizes of the traffic signs in the traffic scene, and whether the traffic signs were circular or triangular signs. However, it is not known which subclass these traffic signs belonged to. In traffic sign design in China and Germany, there are no two traffic signs with the same shape and symbol but different colors; therefore, the traffic signs can be classified just by shape and the inside symbol. Moreover, it is also mentioned in Reference [41] that color information has little effect on the classification of traffic signs. As mentioned above, simplified Gabor filters can enhance the edge information of the image. This ability of the SGW can be used to strengthen the edges and internal symbols of traffic signs, which is conducive to shape-based classification. In our method, to classify the traffic signs, we used the simplified Gabor feature map as input, followed by the CNN.

We designed two CNNs to classify the subclasses for the two super classes of traffic signs independently. One CNN was used to classify the subclass of circular traffic signs, and the other was used for the triangular traffic signs. The CNN for circular traffic signs classified the super class into 20 subclasses, and the CNN for triangular traffic signs classified the super class into 15 subclasses. We believe that further partitioning the subset of the database and classifying it independently, reduces the interference between different classes and improves classification accuracy. To verify the effectiveness of this approach, we designed the third CNN that classified all the traffic signs.We used four orientations and two scales for the SGW filtered image, as the eight-channel input of the three CNNs. The parameters of SGW were the same as that of the detection phase. When our algorithm was used in online applications, the features used in the classification phase were the features extracted from the detection phase, and features extracted twice during detection and classification were avoided. In this way, time was greatly saved, and the method better met the demands of real-time. As the inputs of the CNN must all be the same size, we resized all the images to a size of 32×32 before being filtered by the SGW. The three CNNs had the same structure.

The proposed system works on the Deep learning. In this, the image which should be detected has all the possible image angles of sign in drive. Now the image is detected using deep learning from the data posibilities. Finally the output is Classified and Identified. Select the Image Address to be identified from the drive. Paste the image address in the path line below in the algorithm. Identified Image type is displayed and classified.

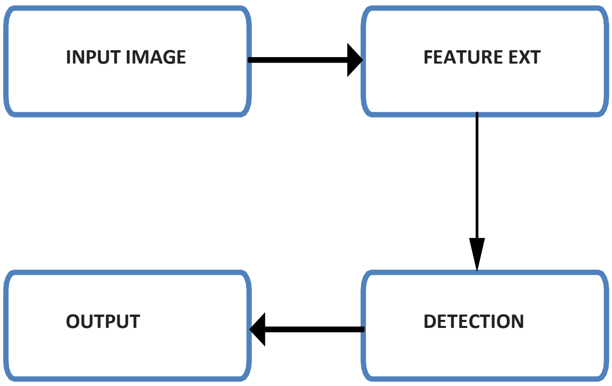

Fig3: Block Diagram

V.SIMULATION RESULT

Fig4: Final Output

Fig5: Training and Validation Accuracy-1

Fig6: Training and Validation Accuracy-2.

VI.CONCLUSION

This paper represents a new efficient traffic sign detection and recognition algorithm towards the design of TSR system in the domain of India. Segmentation is done using color information and CNN is used as a classifier. As a classification tool it is a well-accepted technique as it shows invariance to affine transformation of the image. It uses convolution layer which perform most key role in features selection. CNN allow networks to have fewer weights and they have a very effective tool named as convolutions for image processing. The proposed system is for red rim triangular Indian traffic sign. The system is tested for four types of sign. Due to absence of a good GPU they are quite slow to train. In future, we will try to improve this problem. We will try to detect sign from more complex scenarios and to increase the number of classes. We will try to include other sign containing different colors and shapes into account. We are also planning to develop this system in real time.

FUTURE SCOPE: In future, this project can be enhanced to detect sign from more complex scenarios and to increase the no. of classes. As it is a Deep learning based project, which comes under Artificial Intelligence. So, it has a good scope in future.

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