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# TRAFFIC SIGN DETECTION AND RECOGNITION USING CNN

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**ABSTRACT:**
Traffic sign detection and recognition plays an important role in expert systems, such as traffic assistance driving systems and automatic driving systems. It instantly assists drivers or automatic driving systems in detecting and recognizing traffic signs effectively. In this paper, a novel approach for real-time traffic sign detection and recognition in a real traffic situation was proposed. First, the images of the road scene were converted to grayscale images, and then we filtered the grayscale images with simplified Gabor wavelets (SGW), where the parameters were optimized. The edges of the traffic signs were strengthened, which was helpful for the next stage of the process. Second, we extracted the region of interest using the maximally stable extremal regions algorithm and classified the superclass of traffic signs using the support vector machine (SVM). Finally, we used convolution neural networks with input by simplified Gabor feature maps, where the parameters were the same as the detection stage, to classify the traffic signs into their subclasses. The experimental results based on Chinese and German traffic sign databases showed that the proposed method obtained a comparable performance with the state-of-the-art method, and furthermore, the processing efficiency of the whole process of detection and classification was improved and met the real-time processing demands.

***Key words: SVM, Traffic Sign, CNN.***

## I INTRODUCTION

Traffic signs are road facilities that convey, guide, restrict, warn, or instruct information using words or symbols. With the development of automotive intelligent technology, famous car companies, such as Mercedes-Benz, BMW, etc., have actively invested in ADAS (Advanced Driver Assistance System) research. Commercialized ADAS systems not only include Lane Keep Assist Systems, but also include TSR (Traffic Sign Recognition) systems to remind drivers to pay attention to the speed. If drivers and pedestrians do not notice this information, it can lead to the occurrence of traffic accidents. With the increasing demand for the intelligence of vehicles, it is extremely necessary to detect and recognize traffic signs automatically through computer technology. Research in this area began in the 1980s, to solve this problem.

To make them easy for drivers to read and recognize, traffic signs are often designed to be of a particular shape and color with symbols inside, so that there is a significant difference between the traffic signs and the background. For example, the speed limit 60 traffic sign is a circular shape with a strong number “60”. These features are also important information for traffic sign recognition systems. However, traffic sign recognition is not an easy task, because there are many adverse factors, such as bad weather, viewpoint variation, physical damage, etc. The difficulties in this area that we faced, were as follows:

Although the same kind of traffic signs have some consistency in color, in outdoor environments the color of the traffic signs is greatly influenced by illumination and light direction. Therefore, the color information is not fully reliable.

As vehicle mounted cameras are not always perpendicular to the traffic signs, and the shape of traffic signs are often distorted in road scenes, the shape information of traffic signs is no longer fully reliable.

Traffic signs in some road scenes are often obscured by buildings, trees, and other vehicles; therefore, we needed to recognize the traffic signs with incomplete information.

Traffic sign discoloration, traffic sign damage, rain, snow, fog, and other problems, are also given as challenges in the process of traffic sign detection and classification.

## II LITERATURE SURVEY

In general, traffic sign recognition mainly includes two stages: the first stage is traffic sign detection, which concerns the location and size of the traffic signs in the traffic scene images, and the second stage of the process is traffic sign recognition, which pays close attention to the classification of what exact class the traffic signs belong to. Traffic sign detection is usually based on the shape and color attributes of traffic signs, and traffic sign recognition is often used with classifiers, such as convolutional neural networks (CNNs) and SVM with discriminative features.

Traffic signs have a strict color scheme, which includes red, blue, and white that allow us to distinguish traffic signs from the background scene. It is not difficult for human beings to distinguish traffic signs from a background, so for a computer detection system, color information is also an important feature. In the present research, color-based traffic sign detection method is shown to be the most straightforward and simplest method [1,2,3,4]. As red, green, blue image (RGB) is too sensitive to illumination, color space conversion algorithms have often been applied to traffic sign detection. For example, Shadeed et al. [5] segmented the image by the U and V chromaticity channels in YUV space, where U is positive and V is the color red. This information was combined with the hue channel of the hue, saturation, value (HSV) color space to segment the red road signs from the image. In Reference [6], thresholds were used in the color channel of the HSV color space, to segment the red road signs. Unfortunately, due to strong light, poor light, and other bad weather conditions, color-based detection methods often fail to achieve better results.

Except for countries like Japan and a few others, traffic signs have pairs of different signs when converted to grayscale which appear the same, and traffic signs from most countries have a strict shape and symbol distinction. This design allows color blind and color weak drivers and pedestrians to recognize traffic signs without or with less color information. Based on such features, some algorithms completely ignore color information and adopt shape-based image segmentation [7,8,9]. In addition to the above-mentioned factors, some algorithms use image features other than the raw color space and shape information. The authors in Reference [10] used the color probability model, and traffic sign proposals were then extracted by finding the most stable extremal regions on these maps. Reference [11] used rotation invariant binary pattern-based features. In any case, finding good feature expression is an important part of traffic sign detection, and is also an important research topic in this field.

Recently, as deep learning methods have demonstrated prominent representation capacity and achieved outstanding performance in traffic sign recognition, more scholars have applied technologies to this area [12,13,14,15]. Jin [12] used a convolution neural network based on deep learning with a hinge loss stochastic gradient descent method, which achieved a high recognition rate. Dan [13] provided a multi-column deep neural network for traffic classification running on a graphic processing unit (GPU), and obtained a better-than-human recognition rate. Qian [14] used CNN as the classifier to learn the discriminative feature of max pooling positions to classify traffic signs and obtained a comparable performance with the-state-of-the-art method. Ali [15] used a procedure based on color segmentation, histogram of oriented gradients, and CNN, for the detection and recognition of traffic signs, which achieved better classification accuracy and computational speed. However, in the field of traffic sign recognition by deep learning methods, to meet the demands of real time application, it is necessary to further study the choice of discriminative features and to research the network structure to improve classification accuracy and processing time.

For a long time, there were no public and challenging datasets available in this area, but this situation changed in 2011. Larsson and Felsberg [16] and Stallkamp et al. [17] introduced challenging databases, including annotations for traffic sign detection classification. These databases included the Belgium Traffic Sign Classification (BTSC), the German traffic sign detection benchmark (GTSDB), and the German Traffic Sign Recognition Benchmark (GTSRB) databases. In particular, the GTSDB and GTRSB have attracted more scholars to find new methods to verify through this database, and some of them have achieved good results. The existence of open databases has made the research methods comparable. The above traffic signs databases belong to European traffic laws and regulations. Some Chinese scholars have paid more attention to the problem of traffic sign detection and recognition in the Chinese traffic environment [18,19,20,21]. The construction of a traffic sign database for Chinese traffic environment is very necessary. Fortunately, the Chinese Traffic Sign Dataset (CTSD) was constructed by Yang [10], which has

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attracted the attention of more Chinese researchers.

## III EXISTING SYSTEM

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 [22] or shape information enhancement [3] methods are usually used as the preprocess stage of traffic sign.

## IV PROPOSED SYSTEM

We propose simplified Gabor filters to preprocess the grayscale images of traffic scenes, to enhance the edges and strengthen the shape information. In addition, this could make the non-edge areas of painted artificial objects, such as traffic signs, more stable and reduce the noise in such areas.

We use the maximally stable extremal regions (MSERs) algorithm to process the simplified Gabor filtered map to find the regions of interest more effectively, and we used our defined rules to filter out significant negative samples.

We first used an eight-channel simplified Gabor feature as the input of the CNNs, which were defined as a pre-convolution layer of the convolutional neural networks (CNNs) for traffic sign classification.

Our method performs only one feature extraction through the detection and classification stage, which causes feature sharing throughout the two stages. Compared with algorithms used in the different feature extraction methods, in the detection and classification stage, this saves a lot of processing time and makes it feasible for use in real time applications.

## V METHODOLOGY:

### TRAFFIC SIGN DETECTION

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 [22] or shape information enhancement [3] 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

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can enhance the shape information. In our method, we enhanced the shape information of traffic signs by edge enhancing technology through simplified Gabor filters.

## TRAFFIC SIGN PROPOSAL EXTRACTION

To detect the traffic signs in the traffic scene, in the following stage, we aimed to find the traffic sign proposal regions proposed by the MSERs region detector. The MSERs algorithm has often been used as a method for blob detection in images. This technique was proposed by  to solve problems regarding the robust wide-baseline stereo, and was first used for traffic sign detection. MSERs are regions that maintain their shape, whilst thresholding the image at several levels. The advantage of this approach is its robustness to variations in contrast and lighting conditions in outdoor traffic scenes. This method has been widely used in natural scene text location and traffic sign detection.

## ALGORITHM:

## TRAFFIC SIGN CLASSIFICATION:

## CNN:

The Convolutional Neural Network gained popularity through its use with image data, and is currently the state of the art for detecting what an image is, or what is contained in the image. CNNs even play an integral role in tasks like automatically generating captions for images.

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.

In the detection stage, the traffic signs were classified into two super classes: Circular and triangular traffic signs. In the classification stage, we trained three CNNs for two classification methods. One method trained two CNNs for circular and triangular traffic signs independently. The other method trained one CNN for the overall traffic sign classification. Each of the three CNNs had two convolutional layers, and each of the convolutional layers were followed by a subsampling layer. They all used a fully connected layer to produce the final classification result. The eight Gabor features of each traffic sign were used as inputs of the three CNNs, with a fixed size of 32 × 32. The first convolutional layer extracted six features for each input with 8 × 6 kernels (size 5 × 5). Additionally, the second convolutional layer extracted 12 features for each input; hence, the second convolutional layer consisted of 6 × 12 kernels with a size of 5 × 5. The 12 feature maps from the second layer were used as feature vector inputs to the fully connected layer, to produce the final classification result.

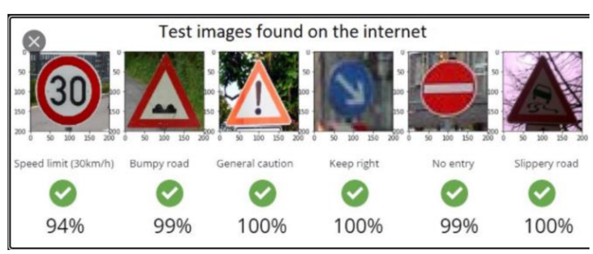


**Fig.3.1. OUTPUT RESULTS.**

## VI CONCLUSION

This paper proposed a system that is able to detect and classify a set of 28 traffic signs in different environments. The results are moderate and it can be improved by testing different neural network structures. As a neural network is often called a black box, there is no guarantee that it will perform best with the defined set of parameters stated above. New methods of data augmentation can also be applied to make the classifier more robust. Real-time detection and recognition can also be implemented in the future.

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