TRAFFIC SIGN DETECTION AND RECOGNITION USING DEEP LEARNING

CH.SHANKAR, K. RAMBABU

1.PG STUDENT of MCA, D.N.R. COLLEGE, P.G. COURSES (AUTONOMOUS), BHIMAVARAM-534202.

EMAIL ID: shankarcherukumilli@gmail.com

1. Assistant Professor in DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS, BHIMAVARAM-534202.

EMAIL ID: kattarambabudnr@gmail.com

ABSTRACT

In today's world, almost everything we do has been simplified by automated tasks. 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. This problem can be avoided if there was an efficient way to notify the driver without having them to shift their focus. Traffic Sign Detection and Recognition (TSDR) plays an important role here by detecting and recognizing a sign, thus notifying the driver of any upcoming signs. This not only ensures road safety, but also allows the driver to be at little more ease while driving on tricky or new roads. Another commonly faced problem is not being able to understand the meaning of the sign. With the help of this Advanced Driver Assistance Systems (ADAS) application, drivers will no longer face the problem of understanding what the sign says. In this paper, we propose a method for Traffic Sign Detection and Recognition using image processing for the detection of a sign and an ensemble of Convolutional Neural Networks (CNN) for the recognition of the sign. CNNs have a high recognition rate, thus making it desirable to use for implementing various computer vision tasks. TensorFlow is used for the implementation of the CNN. We have achieved higher than 99% recognition accuracies for circular signs on the Belgium and German data sets.

1. INTRODUCTION

Proper management of traffic-sign inventory is an important task in ensuring safety and efficiency of the traffic flow. Most often this task is performed manually. Traffic signs are captured using a vehicle-mounted camera and manual localization and recognition is performed off-line by a human operator to check for consistency with the existing database. However, such manual work can be extremely time consuming when applied to thousands of kilometers of roads. Automating this task would significantly reduce the amount of manual work and improve safety through quicker detection of damaged or missing traffic signs. A crucial step towards the automation of this task is replacing manual localization and recognition of traffic signs with an automatic detection. In the computer-vision community the problem of traffic-sign recognition has already received a considerable attention, and excellent detection and recognition algorithms have already been proposed. But these solutions have been designed only for a small number of categories, mostly for traffic signs associated with advanced driver-assistance systems (ADAS) and autonomous vehicles. Detection and recognition of a large number of traffic-sign categories remains an open question. Various previous benchmarks have addressed the traffic- sign recognition and detection task. However, several of them focused only on traffic-sign recognition (TSR) and ignored the much more complex problem of traffic-sign detection (TSD) where finding accurate location of traffic sign is needed. Other benchmarks that do address TSD mostly cover only a subset of traffic-sign categories, most often ones important for ADAS and autonomous vehicles applications. Most categories appearing in such benchmarks have a distinct appearance with low inter-category variance and can be detected using handcrafted detectors and classifiers. Such examples include round mandatory signs or triangular prohibitory signs.

2. LITERATURE SURVEY AND RELATED WORK

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system. The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project Literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations.

[2.1] A novel lightweight CNN architecture for traffic

sign recognition without GPU requirements

For a safe and automated vehicle driving application, it is a prerequisite to have a robust and highly accurate traffic sign detection system. In this paper, we proposed

a novel energy-efficient Thin yet Deep convolutional neural network architecture for traffic sign recognition. Within the proposed architecture, each convolutional layer contains less than 50 features enabling our convolutional neural network to be trained quickly even without the aid of a graphics processing unit. The performance of the proposed architecture is measured using two publicly available traffic sign datasets, namely the German Traffic Sign Recognition Benchmark and the Belgian Traffic Sign Classification dataset. First, we train and test the performance of the proposed architecture using the large German Traffic Sign Recognition Benchmark dataset. Then, we retrain the network models using transfer learning on the more challenging Belgian Traffic Sign Classification dataset to evaluate test performance. The proposed architecture outperforms the performance of the state-of-the-art traffic sign methods with at least five times less parameter in the individual end-to-end network for training.

[2.2] An efficient convolutional neural network for small traffic sign detection

Deep learning has become a ubiquitous method in object detection among multiple domains recently. However, in the era of edge computing, deploying deep neural networks on mobile edge platforms are challenging due to long latency and huge computational cost. As previous research efforts were usually focused on accuracy, achieving the balance between computational consumption and accuracy is a more significant problem to be tackled in mobile edge computing domain. To this end, we

proposed an efficient convolutional neural network (CNN), which can remarkably minimize the redundancy, reduce the parameters and speed up the networks. The effectiveness of the network is further proved with experiments on a Tsinghua-Tencent 100K traffic sign dataset. Results show that under the same-level model size, our network outperforms the state-of-the-art Fast R-CNN and Faster R-CNN

with 10% improvement in accuracy. Compared to similar work, the computational consumption on running time and memory of our network has been also reduced in the premise of little loss in accuracy.

[2.3] Traffic Sign Detection and Recognition using a CNN Ensemble

In today's world, almost everything we do has been simplified by automated tasks. 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. This problem can be avoided if there was an efficient way to notify the driver without having them to shift their focus. Traffic Sign Detection and Recognition (TSDR) plays an important role here by detecting and recognizing a sign, thus notifying the driver of any upcoming signs. This not only ensures road safety, but also allows the driver to be at little more ease while driving on tricky or new roads. Another commonly faced problem is not being able to understand the meaning of the sign. With the help of this Advanced Driver Assistance Systems (ADAS) application, drivers will no longer face the problem of understanding what the sign says. In this paper, we propose a method for Traffic Sign Detection and Recognition using image processing for the detection of a sign and an ensemble of Convolutional Neural Networks (CNN) for the recognition of the sign. CNNs have a high recognition rate, thus making it desirable to use for implementing various computer vision tasks. TensorFlow is used for the implementation of the CNN. We have achieved higher than 99% recognition accuracies for circular signs on the Belgium and German data sets.

3. EXISTING SYSTEM

Yuan et al. in which though the accuracy rate was high, the processing time was also very high. Another method used fusion network formation to obtain features of the signs and background statistics around the observed image, but the complexity was high.

Disadvantages of existing system :

- Increased algorithms complexity
- Heavy system hardware requirement
- Different pre-processing for training data are necessary

4. PROPOSED SYSTEM

Traffic sign recognition and detection is an important part of any autonomous vehicle. However, the real challenge lies in the

detection and recognition of these traffic sign from the natural image in real time and with accuracy. This paper gives an overview of the traffic road sign detection and recognition system, we developed and implemented using an artificial neural network which is trained using real-life datasets. This paper presents the usage of convolution neural network along with dataset as an implementation of our project to attain real-time result with accuracy. The system developed based on this methodology can be implemented in public transports, personal cars, and other vehicles in order to keep drivers alert and reduce human errors that lead to accidents. The project has a wide implementation of self- driving vehicles.

ADVANTAGES OF PROPOSED SYSTEM :

- Reducing the number of accidents caused by driver distraction and to reduce the seriousness of such accidents.
- Improve the driver's safety on the road.

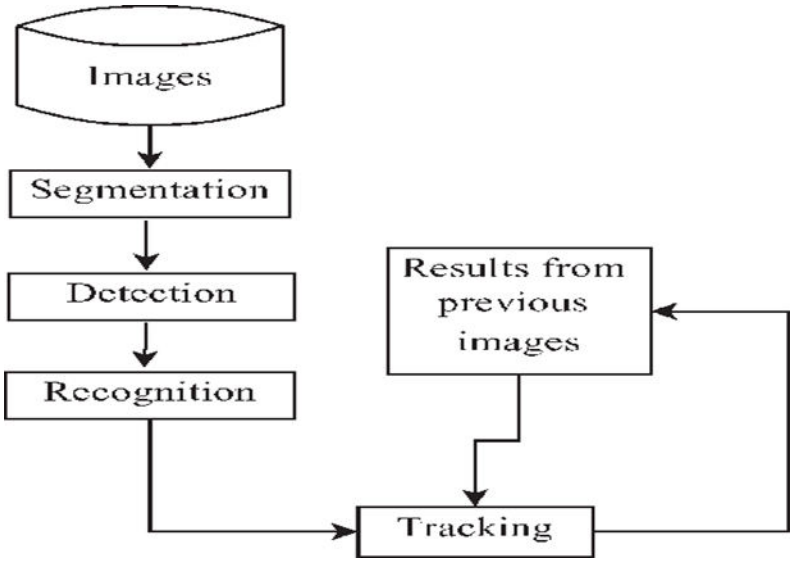


FIG 1- SYSTEM ARCHITECTURE

5. METHODOLOGIES

MODULE

- **Segmentation Module**
- **Data Pre-processing**
- **Traffic Sign-Recognition**
- **Traffic Sign-Detection**

MODULE DESCRIPTION

⚜ Segmentation Module

Segmentation is the method of partitioning a visual image into different subgroups (of pixels) called Image Objects, which reduces the image's complexity and makes image analysis easier. Thresholding is the method of using an optimal threshold to transform a grayscale input image to a bi-level image.

⚜ Data Pre-Processing Module

To save space or reduce computing complexity, we can find it helpful to remove redundant details from images in some situations. .Converting colorful images to grayscale images, for example. This is because color isn't always used to identify and perceive an image in several objects. Grayscale may be sufficient for identifying such artefacts. Color images can add needless complexity and take up more memory space because they hold more detail than black and white images color images are represented in three channels, which means that converting it to grayscale reduces the number of pixels that need to be processed. For traffic signs gray values are sufficient for recognition.

⚜ Traffic Sign-recognition Module

Deep Learning is a subdomain of Machine Learning that includes Convolutional Neural Networks. Deep Learning algorithms store information in the same manner as the human brain does, but on a much smaller scale .Image classification entails extracting features from an image in order to identify trends in a dataset. We are using CNN for traffic sign recognition as it is very good at feature extraction. In CNN, we use filters. Filters come in a variety of shapes and sizes, depending on their intended use. Filters allow us to take advantage of a specific image's spatial localization by imposing a local communication pattern between neurons. Convolution is the process of multiplying two variables pointwise to create a new feature. Our image pixels matrix is one function and our filter is another. The dot product of the two matrices is obtained by sliding the filter over the image. Matrix called "Activation Map" or "Feature Map". The output layer is made up of several convolutional layers that extract features from the image. CNN can be optimized with the help of hyper parameter optimization. It finds hyper parameters of a given machine learning algorithm that deliver the best performance as measured on a validation set. Hyper parameters must be set before the learning process can begin. The learning rate and the number of units in a dense layer are provided by it. In our system will consider dropout rate, learning rate, kernel size and optimizer hyper parameter.

⚜ Traffic Sign Detection Module

In this Module, we have addressed the problem of detecting and recognizing a large number of traffic-sign categories for the main

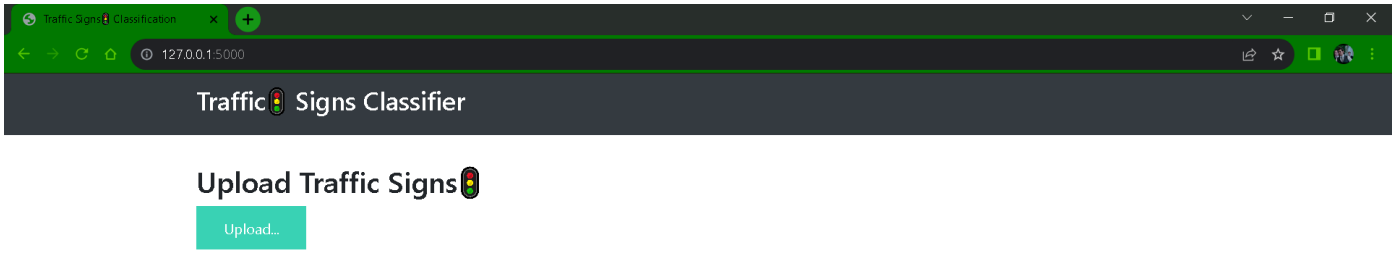
purpose of automating traffic-sign inventory management.

Due to a large number of categories with small interclass but high intra-class variability, we proposed detection and recognition utilizing an approach based on the Mask RCNN detector.

The system provides an efficient deep network for learning a large number of categories with an efficient and fast detection.

6. RESULTS AND DISCUSSION SCREEN SHOTS

HOME SCREEN :



UPLOAD IMAGE :

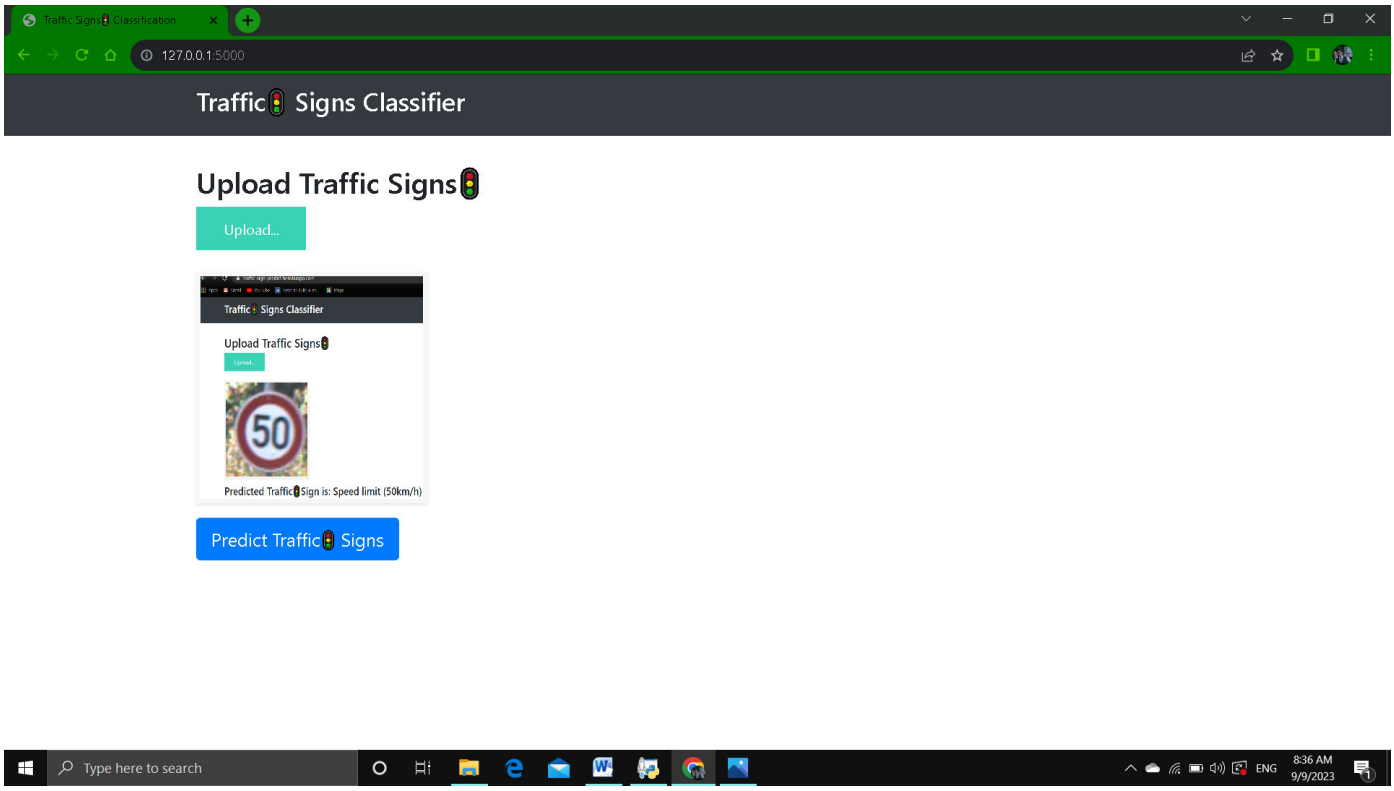


IMAGE LOADED :

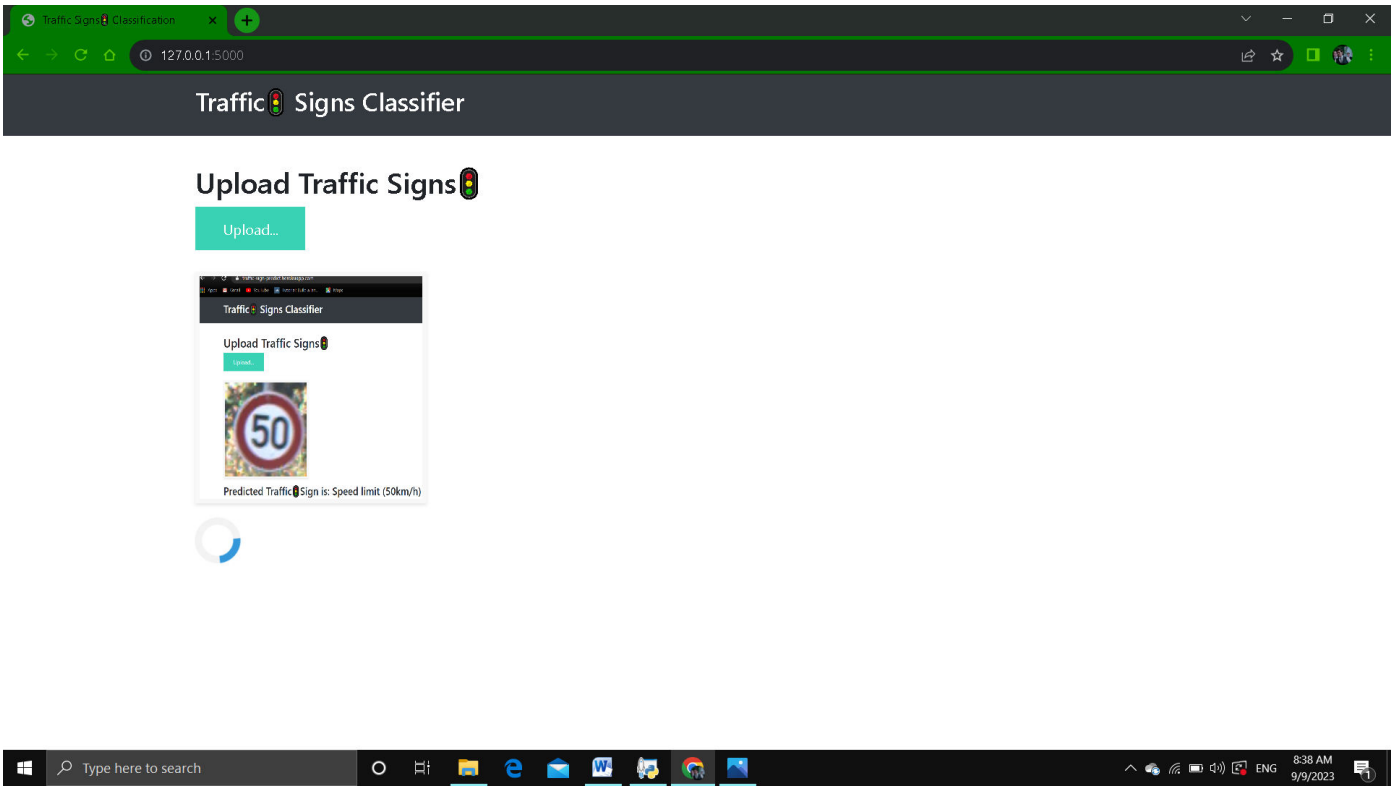
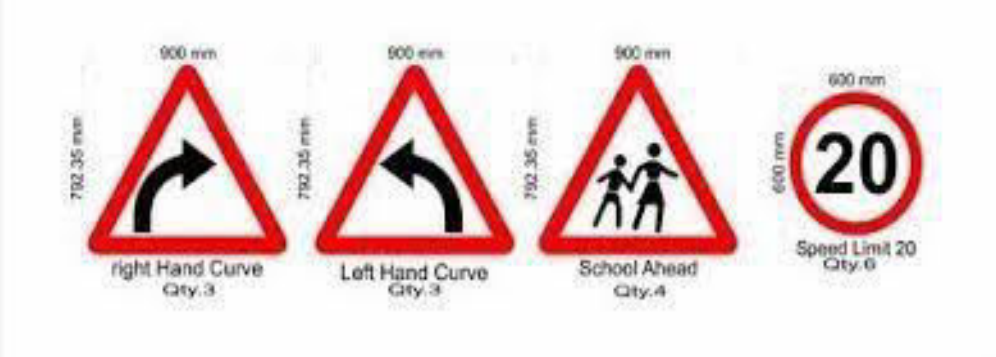


IMAGE COMPRESSION :

SIZE COMPRESSION IN DIRECTORY :



SIZE COMPARISION AFTER COMPRESSION :

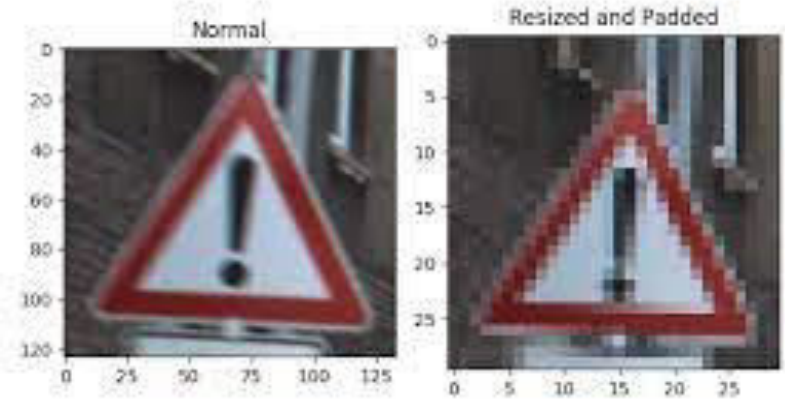
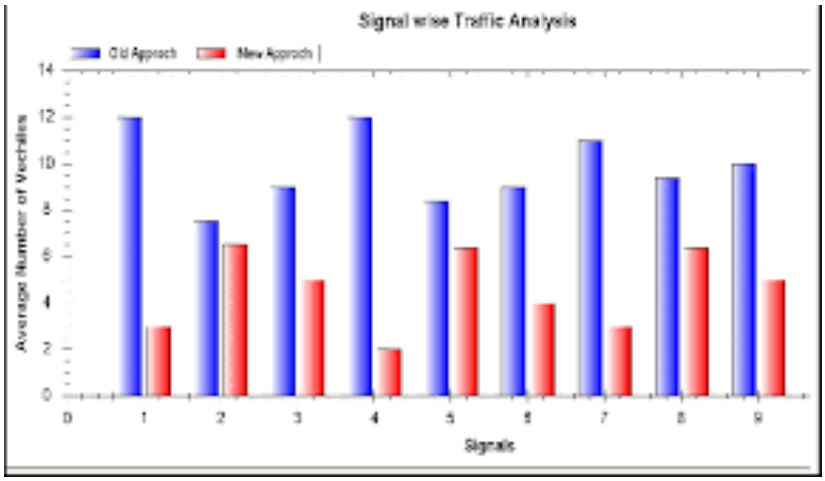


IMAGE COMPARISION GRAPH :



7. CONCLUSION AND FUTURE SCOPE

In this paper, we have discussed that how our proposed system detects the traffic signal and recognizes using machine learning algorithms. The proposed system is also scalable for detecting and recognizing the traffic sign by image processing. The system is not having complex process to detect and recognize that the data like the existing system. Proposed system gives genuine and fast result than existing system. Here in this system we use cnn algorithm to detect and recognize the traffic sign.

8. REFERENCES

[1] Aziz S, Mohamed E, Youssef F (2018) Traffic sign recognition based on multi- feature fusion and ELM classifier. Proc Comput Sci 127:146–153.

[2] Jang, C., Kim, H., Park, E., Kim, H. (2016). Data debiased traffic sign recognition using MSERs and CNN. In 2016 International Conference on Electronics, Information, and Communications (ICEIC), Da Nang, Vietnam, pp. 1- 4. https://doi.org/10.1109/ELINFOCOM.2016.7562938.

[3] Lai, Y., Wang, N., Yang, Y., & Lin, L. (2018). Traffic signs recognition and classification based on deep feature learning. In 7th International Conference on Pattern Recognition Applications and Methods (ICPRAM), Madeira, Portugal (pp. 622-629).

[4] Rosario G, Sonderman T, Zhu X. (2018) Deep Transfer Learning for Traffic Sign Recognition[C]//2018IEEE International Conference on Information Reuse and Integration (IRI). IEEE: 178–185. MLA.

[5] Hatolkar, Y., Agarwal, P., & Patil, S. (2018). A Survey on Road Traffic Sign Recognition System using Convolution Neural Network.

[6] Huang, Z., Yu, Y., Gu, J., & Liu, H. (2017). An efficient method for traffic sign recognition based on extreme learning machine. IEEE transactions on cybernetics, 47(4), 920-933.

[7] Li, C., Hu, Y., Xiao, L., Tian, L. (2012). Salient traffic sign recognition based on sparse representation of visual perception. In 2012 International Conference on Computer Vision in Remote Sensing, Xiamen, China, pp. 273-278. https://doi.org/10.1109/CVRS.2012.6421274.

[8] Shi W, Xin L, Yu Z et al (2017) An FPGA-based hardware accelerator for traffic sign detection. IEEE Transactions on Very Large Scale Integration Systems 4:1362– 1372.

[9] Rosario G, Sonderman T, Zhu X. (2018) Deep Transfer Learning for Traffic signal Recognition[C] 2018 IEEE International Conference on Information Reuse and Integration.

[10] Li, H., Gong, M. (2017). Self-paced Convolutional Neural Networks. In IJCAI, pp. 2110-2116.