IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

MINIMIZING ENERGY CONSUMPTION IN ROAD TRAFFIC SIGNAL USING NMS ALGORITHM

Dr. Kanchana.JS *[1], Dr. Ganesh Kumar.P *[2], Muthayee.S *[3]

*[1] Professor, Department of Information Technology, KLN College of Engineering, Sivagangai, Tamil Nadu, India.

*[2] Professor and Head, Department of Information Technology, KLN College of Engineering, Sivagangai, Tamil Nadu, India.

*[3] Student, Department of Information Technology, KLN College of Engineering, Sivagangai, Tamil Nadu, India.

Abstract: Effective administration of routine boulevard traffic is a monstrous challenge for the traffic workforce. Smart traffic structures are being developed with a view to reducing congestion and increasing the competence of traffic signals. Traffic signs hold plenty of useful facts that can prompt chauffeurs to form the correct reaction to artery condition news in real-time, considerably reduce the incidence of traffic accidents, and help the security of forceful. The game plan of big feature print growth is projected, which embellishes the feature level of the network by utilizing the depressed-level news, strengthens the likeness of the feature news of the limited mark, and raises the detection veracity of the generally limited mark. Because of the difficulty of misplaced discovery of extreme coinciding targets in the post-transform stage of the model, the paper suggests a revised Non-Maximum-Suppression (NMS) invention to screen the guess box, prevent erasing results of various targets, and further improve the discovery veracity and recall rate of the aim.
Traditional algorithms mainly depend on affected feature ancestry, in the way that local twofold pattern (LBP), Gabor, graph with bars for values of oriented slope (HOG), etc., and results of various targets improve the discovery veracity and recall rate of the aim. Experimental results show that, in addition to the original YOLOv4-Tiny invention, the enhanced treasure in the business signal acknowledgment task established in the TT100k dataset, picture, and recall are enhanced.

Index Terms - TT100k dataset, Non-Maximum-Suppression-Algorithm (NMS), Discovery veracity, recall.

I. INTRODUCTION

Traffic signal recognition is commonly achieved project in a complex rustic atmosphere, namely contingent the interfering of character and human metallurgy, to a degree upsetting weather, miscellaneous light and shade, sign hindering and damage, etc., so chief to acknowledgment troubles. Based on this, in the research of traffic signal confirmation, plenty complex algorithms have occurred bulged. Traditional algorithms primarily believe impressed feature genealogy, hindering that local twofold pattern (LBP), Gabor, diagram accompanying bars for principles of familiarize slope (HOG), etc., and use support title novelty (SVM), and supplementary classifiers to complete traffic signal acknowledgment. Aiming at the questions of decreased finding truth and incorrect fixing veracity of a light-pressure network in traffic sign concession task, an improved light-pressure traffic signal acknowledgment treasure settled YOLOv4-Tiny has bulged. By reconstructing the K-means arrangement invention, the anchor following appropriate the importance was

constituted for the stop light fundamental document file to boost the finding recall rate and mark standing truth. The settled designs mainly devote effort to something increasing the traffic signal concession influence however the program kills effectiveness. The adept profit of these plans will be mislaying if they cannot be administered in authentic-freedom on compact IoT blueprint. To lower traffic stoppage, control the flow of traffic, and improve the ability of traffic lights. The stop light information is confessed administration to conceive how many boats will accomplish the next intersections over a importance, the traffic demand, and posture portion on individual hallways. So that civil service can design appropriate crossroads signal systematize plans and traffic stoppage relief tactics. A grown feature diagram growth plan is discharged, and the volume of two together-scale produce feature maps of YOLOv4-Tiny is replaced from the original. An improved creation settled non-maximum annulling (NMS) is planned. Aiming at the question of missing finding presented by coexisting traffic signs in the traffic sign elementary document file, the missing discovery rate is tired and the deduction of the model is improved by reconstructing current situation do over function. The Proposed blueprint is smart to uncover and course objects engaged of interest, before considering those traced courses employing the projects. To advance the effectiveness of pursuing various objects, an extreme recall finding order and an direct feature equal blueprint were bulged.

II. LITERATURE REVIEW

A revised light-burden traffic sign acknowledgment algorithm established YOLOv4-Tiny was projected. By reconstructing the K-wealth grouping treasure. It anchors with appropriate content and is produced for the traffic sign basic document file to correct the discovery recall rate and aim for positioning veracity. [1]. To bestow the productiveness of roadside Bluetooth scanners for traffic dossier accumulation and considerable-dossier analytics to process the composed dossier to extract traffic limits. [2]. This work generally devotes effort to something designing a palpable period and Strong method for the problem of adding particular-flow vehicles. The system is Smart to discover and path objects in the district of interest, then count those traced courses utilizing the movements. [3]. This work projected an upgraded (Single Shot Detector) SSD treasure by way of multi-feature mixture and augmentation, named MF-SSD, for traffic sign acknowledgment. First, reduced-level features are melded into high-ranking visages to increase the discovery acting of limited marks in the SSD [4]. This work projected the TSDR question under CCs and Devoted effort to something the depiction of shame guides the ruling class. To overcome this, a Convolution Neural Network (CNN) based TSDR foundation accompanying earlier augmentation is projected. This interchangeable approach resides in a CNN-located challenge classifier, Enhance-Net, an encoder-interpreter CNN construction for countenance augmentation, and two separate CNN architectures for sign discovery and classification. [5]. Our method is evaluated on two publicly available traffic sign benchmarks which are collected in real road condition. The experiments show our method generates only 1/14 of the anchors generated by Faster-R-CNN so the detection speed is increased by about 2 fps with ZF-Net and it reaches an average mAP of 80.31% and 94.95% in two benchmarks, 9.69% and 7.88% higher than Faster-R-CNN with VGG16, respectively [6]. . It provides 100000 images containing 30000 traffic-sign instances. These images cover large variations in illuminance and weather conditions. Each traffic-sign in the benchmark is annotated with a class label, its bounding box and pixel mask. We call this benchmark Tsinghua-Tencent 100K. Secondly, we demonstrate how a robust end-to-end convolutional neural network (CNN) can simultaneously detect and classify traffic signs [7]. 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) [8]. Our previous work focused on a real-time detection of road signs, by improving the performances of the detection step in real time. In this paper, we complete the work by focusing on recognition step, where we compare the performances between histogram projection (HP) descriptor, and the histogram-oriented gradient (HOG) descriptor combined with the Multi-Layer Perceptron (MLP) classifier, and the Support Vector Machine (SVM) classifier, to compute characteristics and descriptors of the objects extracted in the step of detection, and identify the kind of traffic signs [9]. The machine conceptually implements the following idea: input vectors are non-linearly mapped to a very high-dimension feature space. In this feature space a linear decision surface is constructed. Special properties of the decision surface ensure high generalization ability of the learning machine. The idea behind the support-vector network was previously implemented for the restricted case where the training data can be separated without errors. We here extend this result to non-separable training data [10].

III METHODOLOGY

3.1 Minimizing energy consumption in road traffic signal: Non-Maximum Suppression Algorithm

Non-Maximum Suppression (NMS) is a system secondhand in many manipulative dream tasks. It is a class of algorithms to select individual wholes (like confining boxes) from many coexisting wholes. We can select the draft tests to accomplish the requested results. The tests are generally any form of possibility number and any form of overlap measure (exemplification Intersection over Union).

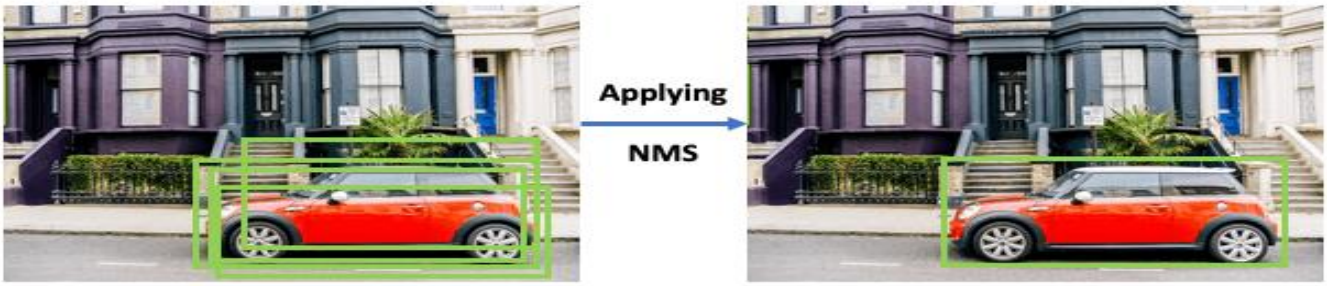


FIG: NON-MAXIMUM SUPPRESSION SYSTEM

Most object-finding algorithms use NMS to cut smaller many found confining boxes to various. At the Greatest fundamental level, most object detectors do few forms of windowing. Thousands of windows(anchors) of diversified sizes and shapes were built. These windows hold unique objects, and a classifier is Used to take a probability/score for each class. Once the sign outputs plenty of confining boxes, it concedes the possibility drain out high-quality choice individuals. NMS is the greatest commonly used treasure for this task.

3.2 INTERSECTION OVER UNION (IoU)

The Intersection over Union (IoU) rhythmical, further refer to as the index, is an arrangement secondhand regularly to measure the portion overlap between the ground truth B Box (Bounding Box) and the prophecy B Box. However, in NMS, we find IoU between two fore castings B Boxes alternatively. IoU in analytical agreements may be presented for one the following verbalization,

Intersection Over Union (IoU) = (Target ∩ Prophecy) / (Target U Prophecy) (1)
In our case utilizing B Boxes, it may be changed to,
IOU (Box1, Box2) = Intersection_Size (Box1, Box2) / Union_Size (Box1, Box2) (2)

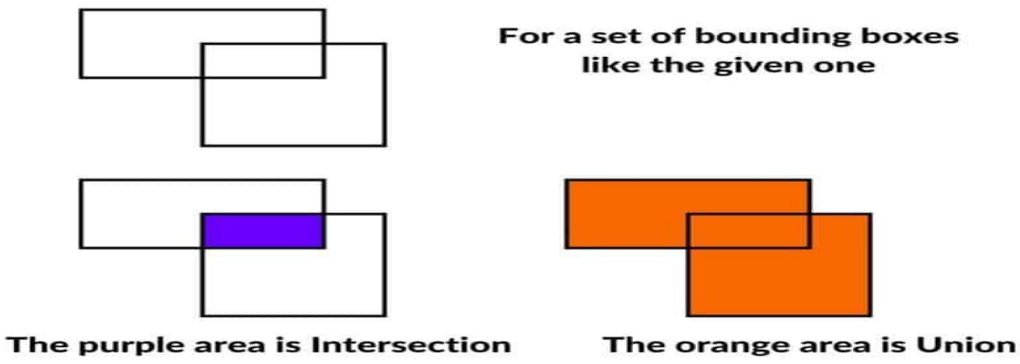


FIG : INTERSECTION OVER UNION (IoU)

1. Aiming at the problems of low detection accuracy and inaccurate positioning accuracy of light-weight network in traffic sign recognition task.
2. This proposed system based on Non-Maximum Suppression (NMS) algorithm to improve the detection accuracy and recall rate of the target.
3. The precision, recall, FPS/f/s and Mean-values are to be calculated for the extracted input dataset.
4. The calculated measurements are compared with existing methods to show the better performance of the proposed system.

IV ALGORITHM MODEL

4.1 NMS ALGORITHM

1. Select the suggestion accompanying the highest assurance score, kill it from B, and adjoin it to the final proposal list D. (Initially D is empty).
2. Now equate this suggestion accompanying all the suggestions — reckon the IOU (Intersection over Union) concerning this suggestion accompanying sporadic suggestion. If the IOU is higher in amount than the threshold N, erase that suggestion from B. IOU= Intersection / Union
3. Again, take the suggestion accompanying the highest assurance from the staying suggestions in B and away it from B, and increase it to D.
4. Once again reckon the IOU concerning this proposal accompanying all the suggestions in B and remove the boxes that have an extreme IOU than opening.
5. This process is recurrent as far as skilled are not present suggestions left in B.

4.2 PERFORMANCE MEASUREMENTS FOR NMS ALGORITHM

In this proposed system there are three measurements are calculated for 45-categories. The three measurements are as follows:

- Mean-Absolute Recall
- Mean-Absolute Precision
- Frequency of Vehicle per second –FPS/f/s

4.3 MEAN-ABSOLUTE RECALL

Recall = TP / $TP + FN$
mAR = Sum of Recall / Total No of NMS-articles.

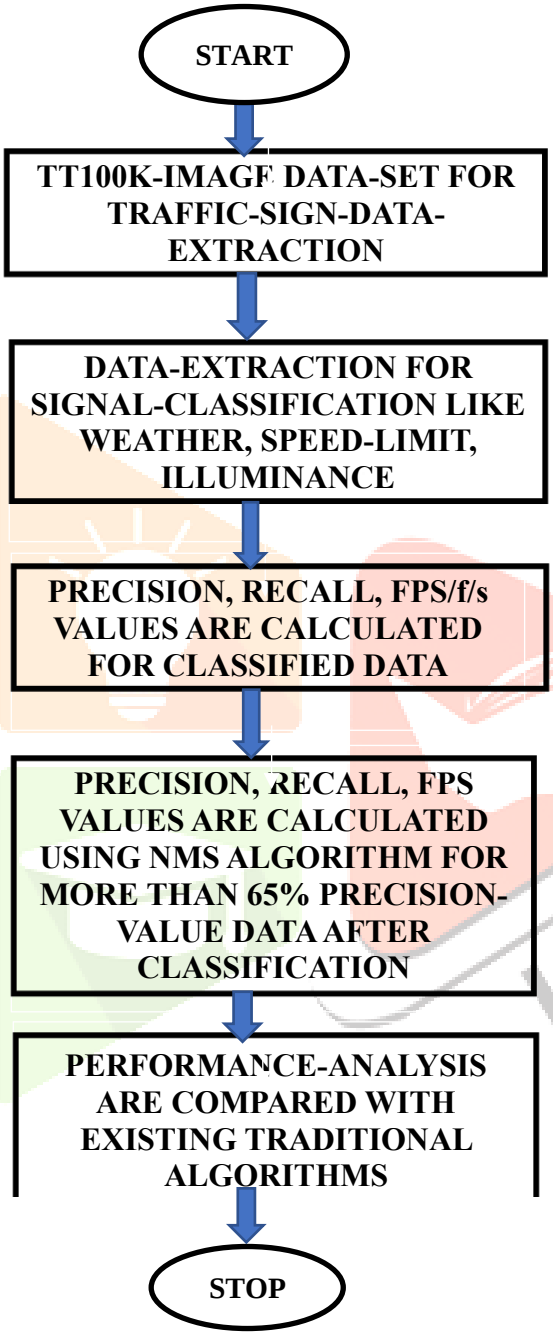
4.4 MEAN-ABSOLUTE PRECISION

Precision = TP / $TP + FP$
mAP=Sum of Precision / Total No of NMS-parts.

4.5 FREQUENCY OF VEHICLE PER SECOND –FPS/f/s

The number of vehicles crossed per second is to be calculated.
FPS= No of Occurrences of Vehicle per second

V. IMPLEMENTATION AND ANALYSIS



5.1 TRAFFIC-SIGNALS

There are 9176 pictures in TT100K data set in China, with 221 kinds of annotation categories. The resolution of the images is 2048 x 2048. Because of the high resolution of the original image, the original image is cropped in this experiment. Due to the serious imbalance of data amount among various categories in the data set. Only 45 categories of traffic signs with a large amount of data are selected for recognition in this experiment. It shows the traffic sign category in the TT100K data set.

5.2 EXTRACTED SIGNALS

The traffic sign category in the TT100K data set has the following symbols extracted. The following symbol ``" is used to represent other numbers of signs of the same type. The speed limit sign ``pl " includes pl25, pl30, pl35, etc. The weather sign start with``W " includes W1 W2,W3,W4… W67 etc. The illuminance sign start

with letter ``il ‘‘includes i1,i2,il100,il150, etc. The images with the above symbol datasets are extracted and stored in the database table. All datasets are converted into text format for processing.

5.3 SIGNAL-CLASSIFICATION

This work proposes an improved traffic-signal-based NMS algorithm to screen the prediction box, this is used to avoid deleting the prediction results of different targets. It also further improves the detection accuracy and recall rate of the target. This module is used to classify the dataset like Weather-Sign, Speed-limit, and light illuminance-level.This classification gives fast processing and the greatest accuracy.

5.4 NMS-OPTIMIZATION

Considering the overlap of stop light goals in the basic document file, the Non-Maximum Suppression invention is introduced in this projected arrangement. Because of the NMS veracity of the model is further revised. It may be visualized that the NMS invention has a beneficial effect on the veracity of model bettering. In The revised NMS plan, the drawing advantage reaches above the original YOLOV4-Tiny.The average accuracy of in addition 65% of the 45 types in the TT100K dataset has happened upgraded to variable scopes, and the AP principles are upgraded in addition original YOLOV4-Tiny.As may be visualized from the, the NMS invention model has attained good discovery depiction fully the traffic sign classifications, that is top-secret by weather, speed limit, and illuminance of the stop light.

5.5 PERFORMANCE EVALUATION

The overall detection performance and some other evaluation indicators of the improved YOLOv4-Tiny algorithm, YOLOv3-Tiny, and YOLOv4-Tiny are compared. The proposed NMS algorithm is better than the other three algorithm models. Among them, FPS/f/s is the frequency of vehicle occurrences per second. The two indicators of precision and recall are integrated to measure the quality of the algorithm model. The higher the FPS/f/s value, the more effective this algorithm model was shown in this module. The Graphical representation of a comparison of this algorithm is also displayed.

The following formulas are used for the measurements.

mAP=Sum of Precision / Total No of NMS-items

mAR=Sum of Recall / Total No . of . NMS-items.

FPS= No. of . Occurrences of Vehicle per second.

Sl.NO	ALGORITHMS	mAP
1	YOLOV3-TINY	44.45
2	YOLOV4-TINY	46.34
3	IMPROVED-YOLOV4-TINY	52.07
4	NMS-Algorithm	73.69

Sl.NO	ALGORITHMS	mAR
1	YOLOV3-TINY	50.34
2	YOLOV4-TINY	57.23
3	IMPROVED-YOLOV4-TINY	64.52
4	NMS-Algorithm	75.39

Sl.NO	ALGORITHMS	FPS/f/s
1	YOLOV3-TINY	56.29
2	YOLOV4-TINY	59.65
3	IMPROVED-YOLOV4-TINY	67.23
4	NMS-Algorithm	77.50

FIG: MAP VS MAR VS FPS/f/s COMPARISON

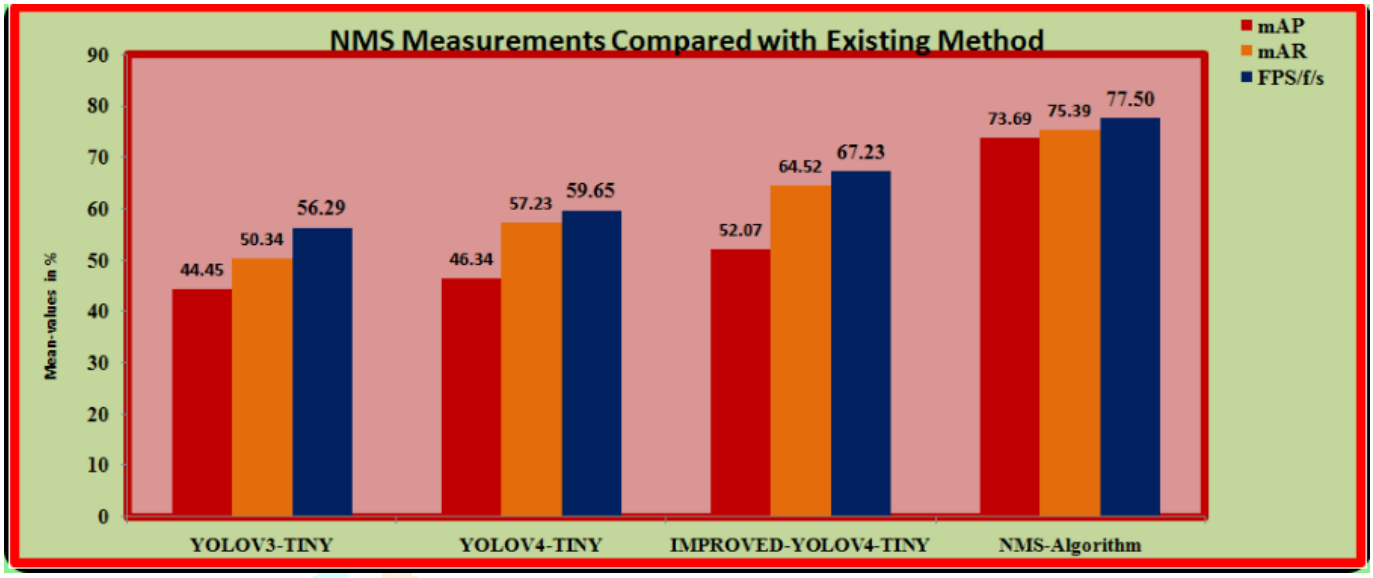


FIG: NMS MEASUREMENTS COMPARED WITH EXISTING METHODS

VI CONCLUSION

In this arrangement, based on the foundation of the NMS algorithm, disposed of the traits of the traffic signal data set, and the shortcomings of the original YOLOv4-Tiny invention. In traffic signal discovery, three possible bettering strategies are projected and to upgrade the discovery veracity on the premise of guaranteeing real-time traffic signal acknowledgment. The experiment shows that the mAP, mAR profit, and FPS/f/s profit of the upgraded NMS treasure in the TT100K basic document file are higher than the original YOLOv4-Tiny algorithm model individually.

VII. REFERENCES

[1] Lanmei Wang, Kun Zhou, Anliang Chu, Guibao Wang, And Lizhe Wang, ”An Improved Light-weight Traffic Sign Recognition Algorithm Based On Yolov4-tiny”, Proc. In. IEEE.Trans, Digital Object Identifier 10.1109/Access.2021.

[2] Ashish Rajeshwar Kulkarni, Narendra Kumar, and K. Ramachandra Rao,” Efficacy of Bluetooth-Based Data Collection for Road Traffic Analysis and Visualization Using Big Data Analytics”, BIG DATA MINING AND ANALYTICS ISSN 2096-0654 03/10 pp139 –153 Vo lme 6 , Numb e r 2, J u n e 2 0 2 3.

[3] Vu-Hoang Tran, Le-Hoai-Hieu Dang, Chinh-Nghiep Nguyen, Ngoc-Hoang-Lam Le, Khanh-Phong Bui, Lam-Truong Dam, Quang-Thang Le, Dinh-Hiep Huynh and Ho Chi Minh, “Real-time and Robust System for Counting Movement-Specific Vehicle at Crowded Intersections,”

[4] Y. Jin,Y. Fu,W.Wang, J. Guo, C. Ren, and X. Xiang, ``Multi-feature fusion and enhancement single shot detector for traffic sign recognition," IEEE Access, vol. 8, pp. 38931_38940, 2020.

[5] Sabbir Ahmed, Uday Kamal, and Md. Kamrul Hasan, “A Deep Learning Based Framework for Robust Traffic Sign Detection Under Challenging Weather Conditions,”IEEE Transactions on Intelligent Transportation Systems (Volume: 23, Issue: 6,June20.

[6] T. Yang, X. Long, A. K. Sangaiah, Z. Zheng, and C. Tong, ``Deep detection network for real-life traffic sign in vehicular networks," Comput. Netw., vol. 136, no. 8, pp. 95_104, May 2018

[7] Z. Zhu, D. Liang, S. Zhang, X. Huang, B. Li, and S. Hu, ``Traffic sign detection and classification in the wild," in Proc. IEEE Conf. Com-put. Vis. Pattern Recognition. (CVPR), Las Vegas, NV, USA, Jun. 2016, pp. 2110_2118.

[8] F. Shao, X.Wang, F. Meng, T. Rui, D.Wang, and J. Tang, ``Real-time traffic sign detection and recognition method based on simplified Gabor wavelets and CNNs," Sensors, vol. 18, no. 10, p. 3192, Sep. 2018.

[9] A. Salhi, B. Minaoui, M. Fakir, H. Chakib, and H. Grimech, ``Traffic signs recognition using HP and HOG descriptors combined to MLP and SVM classifiers," Int. J. Adv. Comput. Sci. Appl., vol. 8, no. 11, pp. 526_530, 2017.

[10] C. Cortes and V. Vapnik, ``Support vector machine," Mach. Learn., vol. 20, no. 3, pp. 273_297, Sep. 1995.

[11] Y. Freund and R. E. Schapire, ``A decision-theoretic generalization of online learning and an application to boosting," J. Comput. Syst. Sci., vol. 55, no. 1, pp. 119_139, Aug. 1997.

[12] A. Gudigar, S. Chokkadi and U. Raghavendra, "A review on automatic detection and recognition of traffic sign", Multimedia Tools Appl., vol. 75, no. 1, pp. 333-364, Jan. 2016.

[13] A. Mogelmose, M. M. Trivedi and T. B. Moeslund, "Vision-based traffic sign detection and analysis for intelligent driver assistance systems: Perspectives and survey", IEEE Trans. Intell. Transp. Syst., vol. 13, no. 4, pp. 1484-1497, Dec. 2012.

[14] Y. Yuan, Z. Xiong and Q. Wang, "VSSA-NET: Vertical spatial sequence attention network for traffic sign detection", IEEE Trans. Image Process., vol. 28, no. 7, pp. 3423-3434, Jul. 2019.

[15] S. Houben, J. Stallkamp, J. Salmen, M. Schlipsing and C. Igel, "Detection of traffic signs in real-world images: The German traffic sign detection benchmark", Proc. Int. Joint Conf. Neural Netw. (IJCNN), pp. 1-8, Aug. 2013.