TRAFFIC SIGN BOARD RECOGNITION AND VOICE ALERT SYSTEM

[1]Sneha George, [2]Ayana Sudhan, [3]Jeleetta Shajan, [4]Sreelakshmy A R, [5]Jerit Richa Joy

[1]Assistant Professor,Department of Computer Science and Engineering ,Universal Engineering College Vallivattom,Thrissur,India.

[2345]B.Tech Student,Department of Computer Science and Engineering ,Universal Engineering College Vallivattom,Thrissur,India.

Abstract: There is a huge number of road accidents occurring day by day, Traffic sign play a important role in this. This become very helpful for the pedestrians and also drivers. This reduce the risk of road accidents and accident death. Here the proposed system work in real time and produce a voice to the driver by detecting a traffic sign, and this will be very helpful for the drivers for advance knowing the traffic signs.

Keywords: Traffic Sign Recognition, Convolutional Neural Network, You Only Look Once.

I. INTRODUCTION

There is huge number of increasing road accident in across the world day by day. This may be due to the ignorance of traffic signs. The main goal of the propose system to produce a voice alert to the driver and then give a sign of upcoming traffic signs. It will be very helpful to the drivers and pedestrian's .Two models are mainly used in there CNN and YOLO V3.CNN is used to classify the images. Several layers are present in it, convolutional layer, pooling layer and ReLu function. YOLO is to detect the images and predict the signal. So it became very full for safety of pedestrians and people get awareness about the signs. This application detect traffic sign like turn right, curve, stop, low speed, no entry, hump etc.

II.THEORY

You Only Look Once

It is an object detection algorithm. Image detection is done in this .Here use yolo y3 algorithm. It has an advantage of detecting multiple images on a screen. Prediction of image is done through a single algorithm run. YOLO work mainly based on three techniques. Residual box, Bounding box regression, Intersection Over Union. In residual blocks the images is been divided in to various grids. Every grid detect the images. Then followed by Bounding box regression, It is outline that highlight the object. Each bounding box has dimensions like width, height, class, bounding box center.IOU describe how the object have been overlapped. IOU provide an output box that surround the object perfectly. By the combination of three technique can easily detect the image. YOLO has high and speed and accuracy compared to other algorithms.

Convolutional Neural Network

CNN is deep machine learning algorithm, are mainly for classifying images It used in many purposes Especially in traffic sign classification. CNN are made up of neurons with learnable weight and biases .CNN recognise the images. Object detection is complicate when multiple images present .CNN has no of layers. There are mainly three layers present in it. Convolutional layer, pooling layer, fully connected layer. Convolutional layer contain a convolutional filter, which remove impurities from the image such as noise etc. After that pooling layer reduced the size of the image without reducing its features. Then the input is fed in to the fully connected layer where mathematical operational take place and classification process begin. It has additional methods such as dropout, activation function, ReLu is the activation function used here. Dropout drop few neurons in order to reduce overfitting.

III.RELATED WORK

Here we are introducing some paper that are related to our survey.

In this paper [1] they show that deep neural network perform better than traditional algorithm for object detection. For this the problem of object detection has been compared with traditional algorithms (traditional computer vision) and deep neural network. Computer visions now become the integral part of robotic applications. There is arising in the feature descriptors in 90's as primary technique to solve a host of computer vision problems. SVM and K-Nearest Neighbours to solve mentioned computer vision problem. In this paper problem of object detection are considers as mobile robot, then we compare with the two approaches. The traditional computer vision used features such as (SIFT,SURF,BRIEF).In this paper faced some running object detection on a moving robot .Here the performance of algorithm increase dynamically using the modified exploration procedure .To extend the project add an additional feature of object localization which encourage the robot to move closer to the object when it see it. And it guarantee that we will get close to the object to achieve the result. Smaller object detection was very difficult such as keyboard and balls. The traditional vision algorithm represents the quick and dirty method for computer vision. They are limited by the accuracy and the object they are detected.

In paper [2] a robust end-to-end convolutional neural network that can simultaneously detect and classify traffic signs is demonstrated. A large proportion of image occupy object are target by CNN image processing solutions. The bounding box occupies about a 20% of the image. Benchmark source code is also introduced in this paper. This paper is about image detection and classification in the wild. Object classification and detection is very important task in the scene. There are many deep learning method that show good performance in image classification and recognition. Mainly two benchmark are widely used to evaluate the detection performance, PASCAL VOC and Image Net ILSVRC. The target object normally occupies a large portion of the image on these dataset. The traffic sign divided into many categories and each category divided into subclasses with similar generic shape and appearance but have different in detail. The traffic sign classification is done mainly by two phases, classification and detection. CNN achieve a precision rate of 99.65 which is better than human performance. A more realistic traffic sign bench mark is created, it contain 111 times as many images and 32 times image resolution. The CNN I used here for evaluate the performance of vehicle detection and lane. For this they use an Over Fit framework with a bounding box regression. In this work they create a benchmark simultaneous detecting and classification. The benchmark contains more data than the previous benchmark.

The aim of the paper [[3] propose a Multi-Scale DE convolution Networks (MDN) which flexibly combine the multi-scale convolutional network with the DE convolution sub-network; It is an effective traffic sign modelling training. It is developed to solve the issue of amount of time taken to compute the complicate algorithm and also low rate of detecting blurred image of localized traffic sign. Object recognition is one of the critical step for object collectors. Object recognition has been recently increased in the recent years. CNN is widely used for object recognition. Classification and detection are the two important task for autonomous driving system.MDN consist of three stages, In the first stage using CNN and German Traffic Sign Benchmark (GTSRB) we train the classification stage. Follow by this, take an example on localized traffic sign recognition, by adding redundant DE convolution networks refine and make decision on recognising dataset on Chinese Traffic Sign Dataset. Images derived from upper level are detected, and integrate the multi-way detector. In this proposed paper traffic sign in long distance are detected, and German and Chinese dataset traffic sign are trained and compared.

In this paper [4] an efficient way to set the hyper parameters that significantly reduces training time and improve performance. This paper also discussed about the how to increase/decrease the learning rate/momentum to speed up training. In case of deep learning it already show and create significant improvement in computer vision, speech recognition etc. Years of experience are needed to choose the optimal hyper –parameter, network architecture. Random search or grid search for hyper-parameter space is expensive and time consuming. There is no simple way to set hyper-parameter. Several methodologies are proposed in this paper for finding optimal settings for hyper-parameters. Approach on hyper-parameter is valuable interdependence of all those factors. It examine about the learning rate, batch size, momentum, architecture and dataset.

The aim of the paper [5] to introduce a technique for MR image denoising using Deep Convolutional Networks and anisotropic diffusion (AD) and refer as Deep CNN-AD. The method is tested on the BraTS MRI datasets. Magnetic Resonance is one of the effective and non-invasive image methods that help physicians to diagnosis and cure diseases.
MRI technique is one of common method to use by the doctors for the treatment of tumors.MR imaging technology generates the images of the brain internal structure and tissues. During transmission phase and image acquisition noise are generated. Thermal noise, salt and pepper noise are included in noise of MR images. In this paper a multi-step for MR demonising and smoothing with an enhanced brain tumour segmentation is proposed.in pre-processing the input MR denoisd using deep CNN method. Anisotropic diffusion method is applied to reduce the noise in the image. The image is converted to frequency domain when Dimensional Fast Fourier Transform (2F FFT0 is applied to it. Gaussian low pass filter smooths the input MR image and remove the irreverent details, Fast Fourier Transform is applied to covert back the image to its domain representation. Segmentation function is performed by the gradient magnitude, and also watershed transform is applied to it for tumour segmentation. The proposed method maintains the quality of image and key feature in demonising process.

In the paper [6] Traffic sign recognition is used to reduce the risk of pedestrians, occupants, and drivers. The additional level of driver assistance is provided by traffic sign recognition. Each method has its own advantages and disadvantages or limitations. In real time environment the visibility of traffic sign is difficult task with several reasons. Because of weather conditions, rain, fog etc. Sign recognition can face more than one problems .The ELM classification framework is using with HOG, CLBP, and Gabor. The major 3 steps involved in these are pre-processing, Feature extraction and classification. In pre-processing step the normalization of the image occurs. The size and contrast of images are different so the GTSRB and BTSC datasets are used. By increasing the pixel intensities. The image is divided into overlapping blocks is the basic feature of HOG. In the field of computer vision and image processing Gabor filter extraction technique is used. Combination of the most successful features like CLBP, Gabor and HOG with ELM classifier used for Traffic sign recognition.

The aim of the paper [7] is using Deep network image classification and object detection. Support Vector Machines (SVMs) learning algorithm is used in it. There is a large amount of data without training. The data getting training with models. This is called "UNSUPERVISED PRETRAINING "stage. These pre-trained models have good initialization such as supervised tasks,

image classification. Convolutional neural network (CNN) it is not new concept. The CNN has different layers Max-pooling, Non-linearity etc. In traditional scenes the convolution operations are not applicable. So the CNN is used to train the networks on RBG images. The size, dimension of the image adjust with RGB channels. The algorithms are used for the computer vision of CNN and deep learning networks. In this paper mainly focus on the image of computer vision using the algorithms.

The main of the paper [8] discussed about low technical knowledge or high level domain knowledge to achieve the CNN baseline. The challenging situations like re-identification of person with different postures or human body pose variation, camera view, camera variation etc...Using the deep convolutional neural network (CNN) the features are leveraged. The main advantage OF the CNN is extract the features of visuals, learning of metric and end to end learning by classification jointly. Image giving as input and observed by colour, dress etc. The advantages of deep convolutional models are taken. The pre-trained images and re-identification using the datasets. With pre-trained data it performs better performance so the backbone network is used as leverage for the identification. The pooling layer represent the image using batch normalization feature directly identify the person identity using the fully-connected layer. Finally the Adam optimizer to train the CNN model or architectures and the supervision signal as softmax loss is used. In these the pooling layer and the fully-connected layer is used. For the re-identification of persons with effective CNN baseline model.

In paper [9] author introduced traffic sign recognition system based on convolutional neural network (CNN) and Support Vector Machines (SVM).The model used both Support Vector Machines (SVM) and convolutional neural network (CNN) individually for the detection and recognition of traffic sign. The model captures the image using a video camera. The captured images are preprocessed and then the signs are detected and recognized using classification algorithm. To reduce the error that happens during car driving a driver alert system is used in the final state. The main goal of the system is to recognize traffic signs and directions and to direct the driver into a safe drive.

In this paper [10] the author proposes a traffic signal recognition system that recognize traffic signs from collected images of different sizes in a fast and accurate manner. The model is designed in such a way that it uses two CNNs one for classification of each region and other one for region proposals of traffic signs. In order to achieve scale variant detection a fully convolutional network with dual multi scale architecture is proposed. To suppress the false positives the model adopts a scheme called OHEM scheme and the model also have adopted a inception module for efficiency. The system includes two output branches one for small scale objects and other one for large scale objects. The output from the dual multi scale network are inputted to classification network which is designed to be capable of fusing multi scale feature. The system is faster and more light weight than the state of the art deep learning network for traffic sign reorganization. The system obtained 99.88 percent in precision and 96.61 percent recall STSD.

In this paper [11] author suggested a traffic sign recognition system using CNN. The model uses a computer vision technique which is based on colour segmentation technique, CNN and fast CNN. Using CNN method a region of interest will be selected search space is reduced by applying thresholding to the input image. By using a trained CNN model RoI can be classified to check whether it contains traffic sign or not. Then another CNN with same architecture recognise the detected sign. System uses Fast RCNN methods in order to improve the training and testing speed. It also increase detection accuracy, finally a German traffic sign dataset is used to check the performance.

In this paper [12] author proposed a system that recognise traffic signs efficiently by extracting variants HOG features of traffic sign. According to the proposed model there are two modules one is feature extraction module and the other one is ELM module and it consists of two levels a training level and recognition level. Training is achieved using an ELM algorithm that estimates the output weight of SFNN giving all training image in a batch learning model. The ELM module outputs the class label giving the HOGv features of R test image during recognition stage. The model include image pre-processing, gradient accumulation, normalisation, dimensionality reduction and concatenation. The main objective is to achieve an optimal and generalized solution for multicladd traffic sign recognition in system ELM based classifier. It also balance the accuracy and cost of computation.

In paper [13] discussed about three techniques that successfully employ CNNs to medical image classification. In deep convolutional neural network (CNN) the availability of large scale dataset the method is recent and relevant. In computer vision the previous image dataset are used. The backbone of the object detection and image segmentation the CNN is used. The image classification applicable and very useful in other areas like medical etc. "CNN from scratch"and"off-the-shelf CNN" and "curse-of-dimensionality "are the techniques used here. The CNN architecture explains the CifarNet, AlexNet, GoogLeNet. The CifarNet is used for the recognition object contains in the CifarNet. For the evaluation and analysis of CNN architecture three pooling layers and two fully-connected layers are used. Two convolution layers, two pooling layers, and nine Inception layer are present in GoogLeNet . The inception layer consists of six convolution layers and one pooling layer. It concentrates mainly in dimensions, size and form a new single dimensions. In this paper mainly learn about CNN architecture,the applications of CNN.

In this paper [14] critical heat flux (CHF) play important role in the related thermal performance for the developing of the nuclear fuel for the pressurized water reactor. The overfitting of the data can be validated using the data they validate it. The larger training set are independently validated using smaller validation data in correlation. In this method the techniques used are hold-out cross validation, k-fold cross validation, and leave-one-out cross-validation to developing the correlation training data set. In this method first we give the input and set the initial database. Then data is validate and trained. The validated data set is then give to the run ID from the main dataset. The validation process is taking there and fit into the correct size. Extract the datas and again to the first stage to train the data. Repeat the step Run ID from main database validation, extraction and save it. These are process taking here. systematic process to fit CHF correlation with cross-validation technique and to yield 95/95 DNBR value with statistical logic and correct output will get.

In paper [15] the author proposed a novel traffic signs recognition and classification method based on CNN and SVM, the model use YCbCr colour space method for feature extraction by dividing the colour channel. SVM classifies the data based on the features extracted. The proposed model uses three traffic signs warning signs, prohibition signs and mandatory signs. The proposed model first divide the colour channels using YCbCr colour space and extract features using CNN deep network and then classifies the images using SVM. In this model testing street view image are sent to pre-processing progress. The image in the training data set are of size 48x48.The model uses PIKE F-100Fiwewire camera frame ,size of the video is 1920x1080.Size of the inputted image will be converted in5x5 convolutional kernal and generate six 44x44 feature maps. CNN training based on yCbCr colour space include CNN network, CNN training and yCbCr colour space for CNNs feature extraction. Parameter adjustment based on CNN

SVM is based on training dataset and testing street view images, thus increase training accuracy and reduce training time in training parts. Here negative impacts are removed using image pre-processing. The system has high performance and 98.6 percent accuracy.

In this paper [16] propose a system of automatic sign recognition proper traffic flow is a complex planning and designing. There is a harmony behind the flow of traffic and certain rules are there. While driving the drivers are pay more attention or concentration. The system proposed to detect the sign automatically using Advanced Driver Assistance Systems (ADAS) and Single Board Computer (SBC). Using the raspberry pi we can integrate the big things into small form. Those are very easy to fix in the computer. The algorithm used here is that HSV. The input giving and go through different stages of it and checking it whether it is valid or not. The paper say that by the harmonic flow of the traffic will helps reduce the road accidents, pedestrians and smooth flow of the vehicle.

The author proposed a model in paper [17] Author proposed a system that uses CNN and tensor flow library for multithreaded programing CUDA the entire system is executed in real time using a mobile GPU .In the proposed system a end to end technology that detect and recognise the traffic signs in real time. The system uses the speed received from the vehicle which predict the scale and it's coordinates in neighbouring frames in the video sequence. The system uses deep learning library tensor flow. The model consist of fully convolutional layer and one softmax layer that normalise the previous layer output. The model is divided into two parts stack block the convolutional block and fully connected block. in order to train and evaluate the model the dataset is split into train and test datasets

In paper [18] explain there are different kinds of traffic signs to obey the rules. These are divided into different classes of signs. The signs are important to the both driver and the pedestrians. So the rules are there the obeying of rules and signs are more important. So the easy way to obey it by any type of monitoring or gestures giving attention to the people. The system say that the signs or boards are giving to them. When the colours are giving the people will attract it. So using the datasets we classify the signs and using CNN the over fitted image and the under fitted images are grid into correct picture. So the traffic sign obey and 95% will obey it.

In the paper [19] author proposed a traffic sign detection and recognition system by applying deep convolutional neural network that includes traffic sign, digits, English letters, Chinese characters. The model is based on the multi task CNN which is trained to achieve effective features for localisation and classification of different traffic signs and text. The main features of the proposed model is to use multi task CNN model that learns a compact yet discriminative feature representation, where detection and classification is implemented simultaneously and it improves the famous RCNN model. There are two modules in the proposed model one which generates region proposals based on a simplified yet efficient scheme for producing candidate regions and the second one is a CNN module which is used to discriminate and classify each of the candidate regions. To detect whether the candidate region proposals is traffic sign or not and to reject false samples a trained multi task CNN is used. CNN consist of three a fully connected layer nonlinear activation layer and Max pooling layer.

In paper [20,] author introduces a system 'An in car camera system for Traffic sign detection and recognition' which consists of two subsystems mainly for detection and recognition. The model first adopts the colour information which filters out the most of non-relevant image region using road sign detection subsystem. Then the proposed model use image segmentation and hierarchical grouping to select the candidate road sign region. The model uses a CNN which classify the traffic signs for the candidate regions. The proposed system mainly focus to detect and identify the traffic signs. The system first filter out most of non-sign parts in the images and then it will extracts the region that has image blocks and then again it will extracts the candidate regions from the image block .In the final stage the system uses a deep learning to verify the candidate areas of non-road signs and identify the type of the traffic signs. The system mainly focus on to general are in the HSI colour space which then divides the candidates area into multiple small parts according to some features. The system proposes inception which is used to find and explain the dense components of the local spares structure in the convolutional layer.
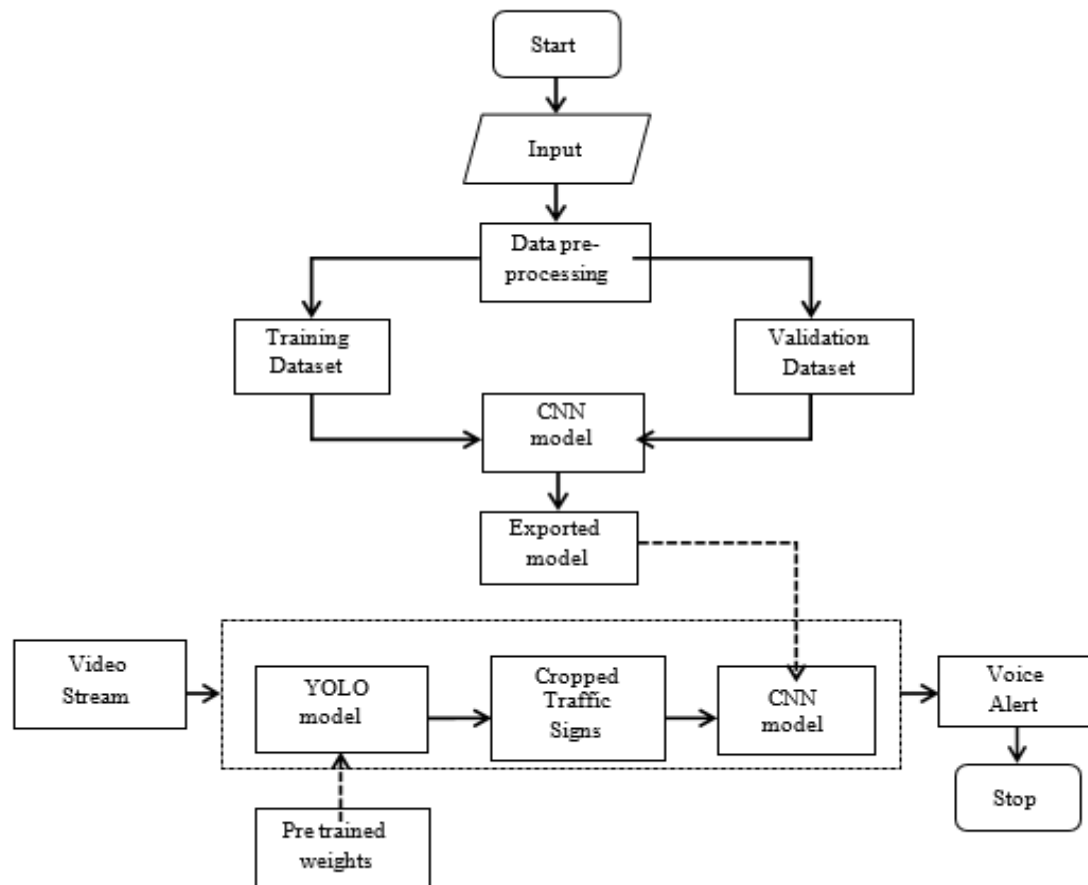
.

IV. RESEARCH METHODOLOGY

Fig 4.1 Flow chart of proposed system

The main objective of our project is to recognize the traffic signs and alert the driver through a voice alert .Above diagram shows the flow chart of our application. First out a data set is being selected, there are mainly dataset available, and we choose dataset that we need. Then we preprocess the da ta, in data preprocessing remove noise and reduce the shape of images, after it split in to training and validation. Then we can describe our project through four modules. First is the Traffic sign detection, which played by YOLO, where video stream(it can be recorded or live video) is given, it work by divided the video by frame by frame .A pre-trained YOLO model is used, because training a YOLO model is very difficult and also time consuming. Then we crop the traffic signs. Next module is the Traffic sign Classifier module, which is performed by CNN. If the CNN model is ok it is saved that is the exported model. Then give CNN model to the pre-trained YOLO model, where the decided images has been classified. Another module present in it is Distance calculator module, Line detector module and Voice alert module. Distance calculator is used to calculate the distance of the distance between the traffic sign and vehicle so it help to give voice alert with in a predefined distance.

Next is the line detector module, which is mainly used to detect the curve of roads. It is mainly using Hough line transform which is provided by the library OpenCv. It detect the straight line or shapes, if it can be represented in any mathematical form. So any change in it can be easily understand. It measure based on two parameters, the perpendicular distance from the origin to the line and angel formed by the perpendicular distance and the line. Edge detection also take place as a part of this. Line detection is done using the function HoughLines and HouseLinesP. Next module is the voice alert module which is one of the important module in this model. Here voice making is done using library pyttsx3.It covert text to speech conversion. Object detection is given as text command and it covert in to the speech module and alert the driver. It work in offline and is compatible with python 2 and 3.Pip install pyttsx3 is command to install this library. It has additional feature like can count the number of words that are said and cutoff if received input was so long. This library work on Windows, Linux and Mac. It use get Property() function. And it is very easy to use.

The language used for our implementation is python 3.8.

V. RESULTS AND DISCUSSION

Here we are developing an application to detect the traffic sign board and give voice alert to the driver. Two algorithms are used for the detection and recognition of traffic sign board namely YOLO v3 and CNN. The YOLO detect the traffic sign and CNN recognize it.

Below show the output of our application.

Fig 5.1 Given video frame

Fig 5.2 Detecting dangerous curve and speed limit

Fig 5.3 Detect the speed limit and no passing board

Fig 5.4 Showing narrows on right side and no passing

   The above figures shows the input and output of our application.In fig 5.1 is the given inputed video.Here the video is divided as frame for processing. In Fig 5.1 detection of dangerous curve and speed limit has take place,While in Fig 5.3 the speed limit and also detect the no passing board is done in there. Fig 5.4 detect there is narrows on right side of the road.By detecting all of these traffic sign and curve an voice alert is produced to the driver.The curve is using house line transform method ,that is by the detecting the direction of the lines of road.

   So this application will be an assest in future.By this way large number of road acidents can be reduced ,and also people can assist on it.In future we can add various feature.

REFERENCES

[1]. Lee, A. (2015). Comparing Deep Neural Networks and Traditional Vision Algorithms in Mobile Robotics. Swarthmore College.

[2]. Zhu, Z., Liang, D., Zhang, S., Huang, X., Li, B., & Hu, S. (2016). Traffic-sign detection and classification in the wild. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 2110-2118).

[3]. Pei, S., Tang, F., Ji, Y., Fan, J., & Ning, Z. (2018). Localized Traffic Sign Detection with Multi-scale Deconvolution Networks. arXiv preprint arXiv:1804.10428.

[4]. Smith, L. N. (2018). A disciplined approach to neural network hyper-parameters: Part 1--learning rate, batch size, momentum, and weight decay. arXiv preprint arXiv:1803.09820.

[5]. Latif, G., Iskandar, D. A., Alghazo, J., Butt, M., & Khan, A. H. (2018). Deep CNN based MR Image Denoising Tumor Segmentation using Watershed Transform. International Journal of Engineering & Technology, 7(2.3), 37-42.

[6]. SaouliAziz ,[a]El AroussiMohamed, [b]FakhriYoussef[c], Traffic Sign Recognition Based On Multi-feature Fusion and ELM Classifier.

[7]. Srinivas,S., Sarvadevabhatla, R. K., Mopuri, K R.,Prabhu, N.,Kruthiventi,S. S., & Babu, R. V.(2016).A taxonomy of deep convolutional neural nets for computer vision. Frontiers in Robotics and AI, 2, 36.

[8]. Xiong, F., Xiao, Y., Cao, Z., Gong, K., Fang, Z., & Zhou, J. T. (2018).Towards good practices on building effectivecnn baseline model for person re-identification. arXiv preprint arXiv:1807.11042.

[9]. Traffic Sign Recognition System (TSRS): SVM and Convolutional Neural Network Nazmul Hasan1, Tanvir Anzum1, and *Nusrat Jahan2 1Computer Science and Engineering Department Daffodil International University

[10]. 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.

[11]. Boujemaa, Kaoutar Sefrioui; Bouhoute, Afaf; Boubouh, Karim; Berrada, Ismail (2017). [IEEE 2017 International Conference on Wireless Networks and Mobile Communications (WINCOM) - Rabat, Morocco (2017.11.1-2017.11.4)] 2017 International Conference on Wireless Networks and Mobile Communications (WINCOM) -Traffic sign recognition using convolutional neural networks. , (), 1–6. doi:10.1109/WINCOM.2017.8238205

[12]. An Efficient Method for Traffic Sign RecognitionBased on Extreme Learning MachineZhiyong Huang, Yuanlong Yu, Jason Gu, and Huaping Liu, ieee transactions on cybernetics, VOL. 47, NO. 4, APRIL 2017

[13]. Hoo-Chang, S., Roth, H. R., Gao, M., Lu, L., Xu, Z., Nogues, I., ... & Summers, R. M. (2016). Deep convolutional neural networks for computer-aided detection: CNN architectures, dataset characteristics and transfer learning. IEEE transactions on medical imaging, 35(5),1285.

[14]. Kim, B., Park, S., Kim, K., Lim, J., & Nahm, K. (2018). Systematic process to determine DNBR limit of CHF correlation with repetitive cross-validation technique. Journal of Nuclear Science and Technology, 1-9.

[15]. 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).

[16]. Real-Time Indian Traffic Sign Detection Using Raspberry Pi And Open Cv N Radhakrishnan1, S Maruthi2 1Assistant Professor, Dept. of EEE, CEG, Anna university, Chennai, Tamil Nadu, (India)2PG Student, M.E.[EST], Dept. of EEE, CEG, Anna university, Chennai, Tamil Nadu, (India).

[17]. A Method for Traffic Sign Recognition with CNN using GPU ,Alexander Shustanov and Pavel Yakimov Samara National Research University, Moskovskoye shosse 34, Samara, Russia.

[18]. International Journal of Future Generation Communication and Networking Vol. 13, No. 4, (2020), pp. 267–274 Traffic Signs Recognition Using Cnn & Keras Mr.K.Kalaiarasan1, J.Akilan2, M.Naveen Kumar3, M.P.Sukumar4, V.Surya Prasath5.

[19]. Robust Chinese Traffic Sign Detection and Recognition with Deep Convolutional Neural Network Rongqiang Qian, Bailing Zhang, Yong Yue Department of Computer Science Xi'an Jiaotong-Liverpool University Suzhou, China.

[20]. An In-Car Camera System for Traffic Sign Detection and Recognition Shu-Chun Huang and Huei-Yung Lin Department of Electrical Engineering Advanced Institute of Manufacturing with High-Tech Innovation National Chung Cheng University 168 University Road, Min-Hsiung, Chiayi 621, Taiwan Chin-Chen Chang Department of Computer Science and Information Engineering National United University 2 Lienda, Miaoli 360, Taiwan.