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TRAFFIC SIGNAL DETECTION AND RECOGNITION FOR SELF-DRIVING CARS USING DEEP LEARNING

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ABSTRACT

One of most important technology of automated driving system is to detect traffic signs in various environment conditions. Due to various environment changes it is difficult to detect the traffic signals more accurately. In this paper, a deep neural network is used for different traffic signal recognition. The presented method uses convolution neural network which extracts more features from input image dataset to carryout recognition. The neural network trained using German traffic sign dataset and achieves quality outcomes on recognizing traffic signs. In the German data sets, we are able to identify the circular symbol with more than 99.5% accuracy.

Keywords:CNN, convolutional neural network,deep learning, traffic sign detection, traffic sign recognition

1. INTRODUCTION

Research on traffic sign identification using deep learning techniques is important research field in both developed countries and developing countries. As growth in the population, the number of usage also increased. Every year a lot of people are injured due to accidents. In the most of the cases it is caused by driver errors. Autonomous vehicles are the key solutions which reduces the rate of accidents.

In the recent years, a lot of companies are invested to develop an autonomous cars with immense available resources. Many autonomous methods are developed in order improve safety of the driver.

Traffic sign assistant system helps driver to drive more comfortably. For example, if there is sign of speed limit it notifies the driver about the current speed and alert the driver to not cross the limited speed.

The image processing techniques have limitations to identify the various environment conditions. In this paper, a real time traffic detection and recognition method purposed using deep neural network. Deep convolution neural network is specialized in computer vision applications. For this reason, this paper aims to develop and improves reliability of traffic sign identification system.

The rest of the paper structured as follows: section 2 presents literature review, section 3 covers information regarding dataset and explain the methodology used. Section 4 covers results and discussions, section 5 with conclusion and future scope.

2. RELATED WORK

The last decade shows a growth advancement in the development of intelligent transportation systems

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(ITS) and especially Advance driving system and Self-Driving Cars (SDC). In these systems, traffic signs detection and recognition is one of the difficult tasks that confront researchers and developers. This issue is addressed as a problem of detecting, recognizing, and classifying objects (traffic signs) using computer vision and still be a challenge until now.

The task presented in this paper, subject to detect and recognition of different traffic signs. The task is divided into two parts that is detection and recognition. In the first method various methods are used including edge detection [1]. In [1] a multi-layer convolution network is purposed to classify the images.

The [2] describes the creation of large bench mark dataset and that will advance object recognition in various condition. ImageNet large scale recognition provides a scale invariance feature (SIFT). Similarly for first step several other methods are also purposed like speeded-up robust feature (SURF) [3], Histogram of gradient (HOG) [4] and others.

In [5], Bag of Words (BOW) exploiting SURF which is the counts of a vocabulary of local image features and k-means classifier was used.In [6], the HOG feature and support vector machine is used for traffic sign classification. In the pre-processing, the main content is the RGB color is converted into HSV (hue-saturation-value).In [7][8], the authors concentrate on object categorization and pattern recognition. In [7] they encounter about 15fps video sequences in real time pre-processing.

In [9], the author used LeNet5 network. The LeNet5 network perform effectively on large scale images. They achieved 95.3% of accuracy at 120th iteration.The [10] purposes a fast R-CNN network which classify signs using Robot Operating System (ROS). Currently, Convolutional networks are gradually replaced traditional computer vision algorithms for different applications such as object classification and pattern recognition [7] [8].

3. METHODOLOGY AND IMPLEMENTATION

The current approach used in paper is based on convolution neural network. Methodology is divided into two section, first is to develop new database and second is to develop a CNN architecture for available dataset. The flowchart for training and testing module is shown in Fig.1.

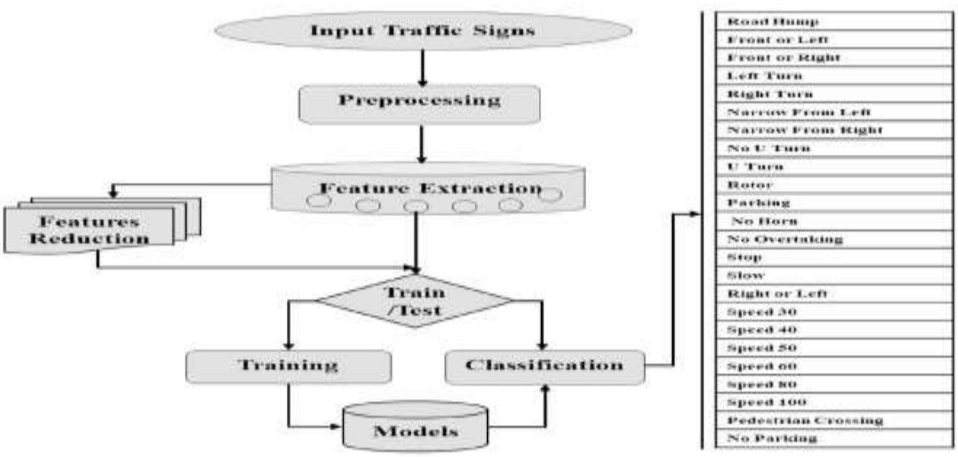

Fig.1. Flowchart

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3.1DATASET

A large dataset is needed for target recognition based on deep neural network for training and rate the system results. Inthis work we used the German traffic datasets [11].

This dataset contains 43 classes each class has more than thousand images. The distribution of training and testing of represented on Table 1.

Fig.2. Traffic signs

Category	Task	Number of images
Training	Used to train the network	22721
Validation	Allows to supervise the network performances while training it (a reduced version of testing data)	5568
Testing	Used for evaluation	6960

Table.1. Dataset distribution

3.2. PRE-PROCESSING

For every data pre-processing is required in order to get more accurate results. Frist we have to resize all images into common size, the scaling of images help to reduce the number of pixels.

The processed image is then converted into grayscale image. Grayscale image enhance the appearance of an image. The grayscale image usually normalized from 0 to 255. The normalization is normally used in deep neural techniques in order to put image into common statistical distribution. The image are transforms into particular set of dimensions, orientation and resolution.

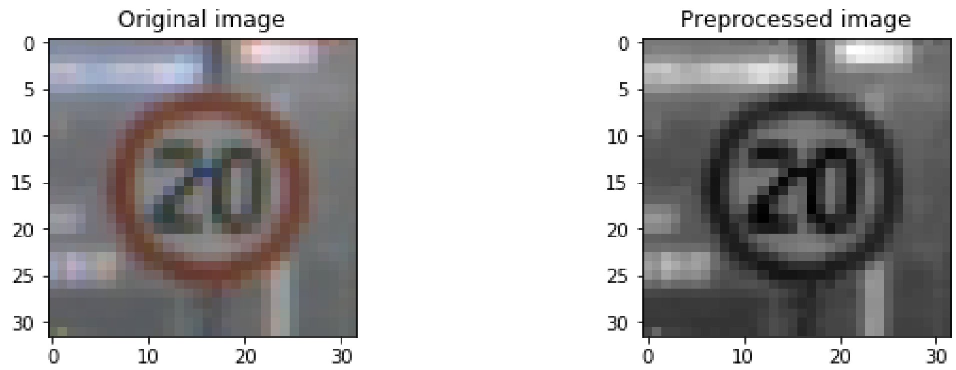

Fig.3. Pre-processing

3.3 DETECTION MODEL

The best suited algorithm for computer vision application is CNN. It is deep learning algorithm which accepts the input image, extracts the features/objects from the image and classifies the different images. The CNN usually uses the kernel filter which extracts main features from image inputted.

The traffic signs detected should be recognize and classified. In this section, CNN is mainly used for classification. The most important method of the training and testing of CNN, in this paper, the GTSRB data set is used to train and test CNN.

CNN is a several layered network, it is very similar to brain neuron network. CNN is composed of input layer, output layer and many hidden layers. Compared to other machine learning technics, CNN has better performance.

In this paper, CNN is used to label the different traffic signals and a suited classifier is designed. The light CNN includes four convolution layers, two max pooling layers and two fully connected layers. In this section, the kernel size is first set to 5x5 that move around the image to get the features. The size of filter is 2x2 this would remove 2 pixels from each border when using 32 32 image. The size of the max pooling layer is 2x2 which scale down all feature map to generalize more, to reduce overfitting. The number of hidden layer contain in the first two convolution layers is 64 and in next two layers is 32. The starting value of learning rate can be set as 0.001. Two dropout layers are used. Sometimes it randomly drops some nodes in order to prevent the network from the overfitting. Dropout drops some inputs nodes with each update 1 all and 0 none. The ReLU function is used which is simple and does not include any kind of heavy computation. In in text, we are trained for twenty epochs and in each epoch 2000 steps validation occurred. After training we got approximately 99% accuracy.

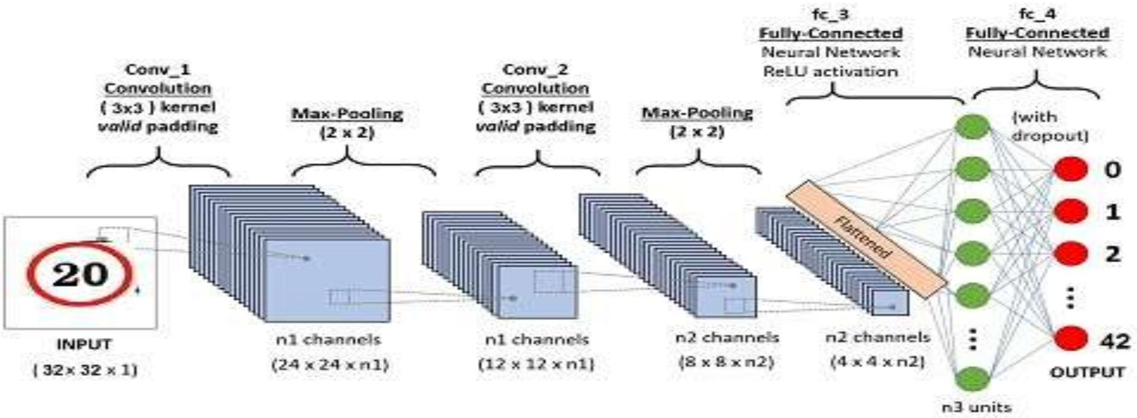

Fig.4.CNN model architecture

4. RESULTS AND DISCUSSION

The test result of the trained CNN shows that the accuracy of the model in detecting and recognizing traffic signs is 99.5%.See fig.5.The experimental result shows that the network model has good recognition accuracy for traffic signs detection and recognition.

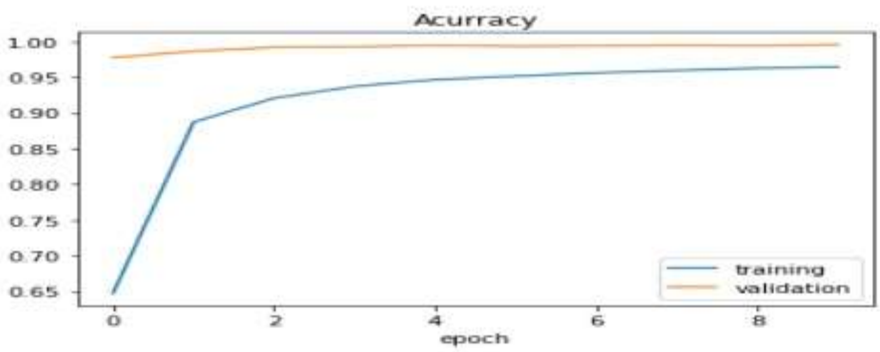

Fig.5. Accuracy

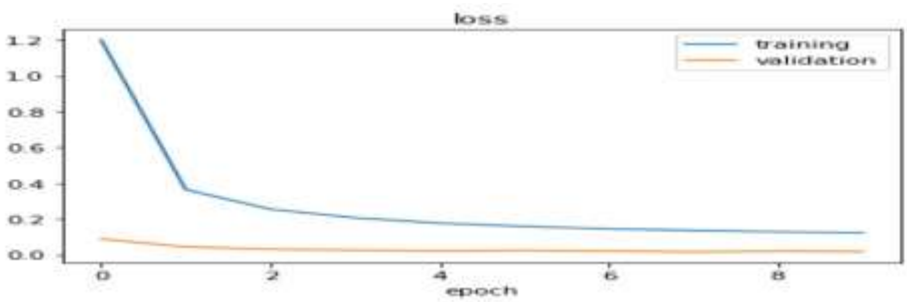

Fig.6. Loss

For further analysis in the real time, video streaming is used to detect the traffic sign name and probability of the recognition. In the fig.7, the traffic sign is detected that is go straight or left traffic sign with 99.93% probability. Similarly, in fig.8 bumpy road traffic sign detected with 100% probability.

Fig.7. Traffic sign recognition

Fig.8. Traffic sign recognition

5. CONCLUSION

In this paper, a traffic sign recognition method on account of deep learning is proposed, which mainly aims at detecting different traffic signs. By using convolution neural network, traffic sign detection, recognition and classification is effectively performed. Test result displays that the accuracy of this technique is 99.5%.

6. FUTURE SCOPE

The use of this technique has an advantageous in terms of conceiving time and hence can be embedded system in any self-driving car equipped with high resolution cameras and GPS receiver.

REFERENCE

[1] Ross Girshick, Jeff Donahue, Trevor Darrell and Jitendra Malik, “Region-based Convolutional Networks for Accurate Object Detection and Segmentation” in IEEE Transactions on Pattern Analysis and Machine Intelligence, 10.1109/TPAMI.2015.2437384.

[2] J. Deng, A. Berg, S. Satheesh, H. Su, A. Khosla, and L. FeiFei, “ImageNet Large Scale Visual Recognition Competition 2012 (ILSVRC2012),” http://www.image-net.org/challenges/LSVRC/ 2012.

[3] MariuszBojarski, Davide Del Testa, Daniel Dworakowski, Bernhard Firner, Beat Flepp, PrasoonGoyal, Lawrence D. Jackel, Mathew Monfort, Urs Muller, Jiakai Zhang, Xin Zhang, Jake Zhao, Karol Zieba, “End to End Learning for Self-Driving Cars”, NVIDIA Corporation, Holmdel, NJ 07735.

[4] R. Girshick, J. Donahue, T. Darrell, and J. Malik, “Rich feature hierarchies for accurate object detection and semantic segmentation,” in IEEE Conference on Computer Vision and Pattern Recognition, 2014.

[5] V. John, K. Yoneda, Z. Liu, Senior Member, IEEE, and S. Mita, “Saliency Map Generation by the

Convolutional Neural Network for Real-time Traffic Light Detection using Template Matching" in IEEE Transactions on Computational Imaging DOI10.1109/TCI.2015.2480006.

[6] Guo Mu, Zhang Xinyu, Li Deyi, Zhang Tianlei, An Lifeng, "Traffic light detection and recognition for autonomous vehicles" in The Journal of China Universities of Posts and Telecommunications, DOI: 10.1016/S1005-8885(15)60624-0.

[7] Zhenwei Shi, Zhengxia Zou, and Changshui Zhang, "Real-Time Traffic Light Detection with Adaptive Background Suppression Filter" in IEEE Transactions on Intelligent Transport Systems, DOI 10.1109/TITS.2015.2481459.

[8] Seokwoo Jung, Unghui Lee, Jiwon Jung, David Hyunchul Shim, "Real-time Traffic Sign Recognition System with Deep Convolutional Neural Network" in 13th International Conference on Ubiquitous
Robots and Ambient Intelligence (URAl) 2016, 978-1-5090-0821-6/16.

[9]] DjebbaraYasmina, RebaiKarima , AzouaouiOuahiba, "Traffic signs recognition with deep learning" International Conference on Applied Smart Systems (ICASS'2018).

[10] Gwang-Gook. LEE, Byung Kwan PARK, "Traffic Light Recognition Using Deep Neural Networks" in IEEE International Conference on Consumer Electronics (ICCE) 2017, 978-1-5090-5544-9/17.

[11] https://www.kaggle.com/safabouguezzi/german-traffic-sign-detection-benchmark-gtsdb