IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 09, Issue 6 (June. 2019), ||S (IV) || PP 21-24

Helmet Detection and License Plate Recognition Using CNN

Emy Barnabas[1], AmrithaB.J[2]
Department of Electronics and Communication Engineering, MBCET, Thiruvananthapuram, Kerala
[1]M.Tech student
[2]Assistant Professor

Abstract: Nowadays, road accidents are one of the major causes that leads to human death. Among them, motor bike accidents are common and causes critical injuries. Helmet is one of the main protection unit for a motor bicyclist. However, many fail to conform to the law of wearing helmet. Here, to detect the motorcyclists who are violating the helmet laws, a system using image processing and convolutional neural network is implemented. The system consist of motorbike detection , helmet vs no helmet classification and motorbike licence plate recognition. The motorbikes are detected using the feature vector HOG. Once the motorbike is detected, by means of convolutional neural network, it is determined whether the motorcyclist is wearing a helmet or not. If the motorcyclist is identified without helmet, then the license plate of the motorcycle is detected using tesseract OCR.

Keywords: Helmet Detection, Convolutional Neural Network, Tesseract OCR, License Plate Extraction

---

Date of Submission: 11-06-2019 Date of acceptance: 27-06-2019

I. INTRODUCTION

Road accidents are one among the major causes that leads to cause of human death. There is a speedy increase in motorbike accidents owing to the fact that majority of the motor bicyclist fail to wear helmet that makes it an ever-present danger. Within the last few years, most of the accidents are caused because of the head injury. Due to this, wearing helmet is made necessary by means of traffic rules. But most of the motor bicyclists never obey the rule. Many cities make use of a surveillance network to monitor the motorcyclists violating the helmet laws. But such a system will need human intervention. Today's surveys say that human interventions prove ineffective, due to the increase in the time of monitoring and also due to the errors made by human during monitoring. Different methods are there for detecting the motor bicyclist who does not wear helmet. Identifying the actual rate of motor bicyclists without helmets is challenging due to obstruction, illuminance, poor quality of videos etc. The system that first proposes for the automatic detection of motorcyclist for not wearing the helmet which was done by Chiverton [1]. In this system the head portion of the motorcyclist is taken and features are derived from this image, those features are trained on a SVM classifier. The features taken here is the shape and reflective property of the helmets because the top portion of the surface of the helmet is found to be more bright. It also takes the circular arc shape of the helmet too. But this method leads to lot of miss classifications that is the objects looking similar to helmets also get classified as helmet. Also it does not identify the motorcycle first is also a limitation of this work. Silva et al [2] , [3] introduces a method to remove the problem of miss classification. For that, the system identifies the motorcycle from the frame. The features from the frames are extracted by local Binary pattern descriptor and using SVM classifier these features are trained. Then helmet classification is performed on SVM using the features created by the combination of circular hough transform, histogram of gradients and local binary patterns. In [4] ,Doungmala et al introduces a system for the detection of half helmet and full helmet. It is done by using a decision tree classifier with AdaBoost. For this method, it first uses the features of haar for detection of face and classifies it as without helmet and full helmet. Also it uses circular hough transform for the classification it as without helmet and full helmet. But the system shows its own limited scope as it acquires the video from the sparse traffic. Also this method does not take any initiative on detecting the motorcyclist. Instead of that it directly enters into the helmet detection. In [5], K. Dahiya introduces a method that helmet detection can be done from surveillance videos. Here it uses an SVM classifier for the classification of motorcyclist and non-motorcyclist. Also it uses another SVM classifier for the classification of helmet and non-helmet. Both these classifiers implemented the system using the features like HOG, SIFT and LBP. And each ones performance were compared with the other two features which leads to the conclusion that, HOG descriptor achieves its best performance than the other two. In [6], C. Vishnu , uses convolutional neural network for classification. Here they create their dataset from the surveillance network of videos. And it achieves better accuracy. In [7] B. V. Kakani , most recent work is the detection of the number plate system. His approach is based on the optical character recognition using neural networks.

II. METHODOLOGY

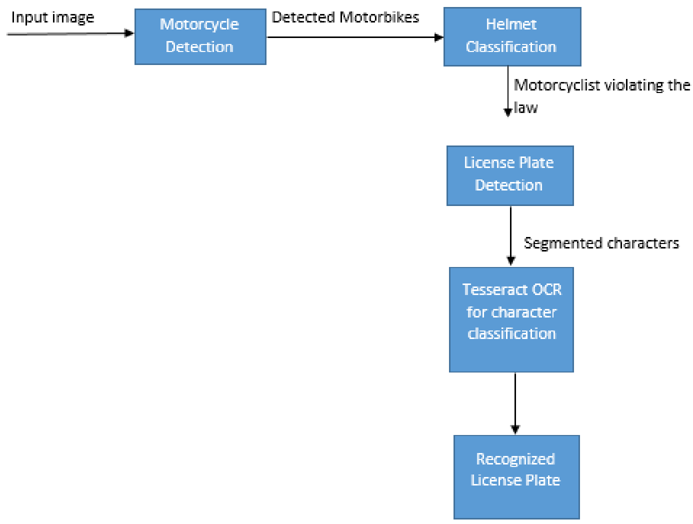

Figure 1: *Block diagram of the system*

The various units involved are as follows:

I. Motorcycle Detection using HOG.
II. Helmet Classification using CNN.
III. Detection of License Plate.
IV. Character Classification using tesseract OCR

A block diagram of the helmet violation detection system is shown on figure 1. It consist of detection of motorbike, classification of helmet vs. no-helmet, and motorbike identification of plate. Once the image gets captured on to the camera, the first step is to detect whether there is a motorcycle is present in the captured image. For that the technique normally used is to calculate the histogram of gradients from the image [8]. It is a feature descriptor normally used for object detection which describes the shape and appearance of the image. Once the image with a motorcycle is detected, whether the person is having helmet or not is identified. For detect that one has to determine the region of interest of the person[9]. Region of interest is selected because it reduces the area and only a particular region is concentrated, which reduces less processing time. The head portion of the motorcyclist is selected completely inside the region of interest. The grey scale image of the head portion is determined and calculated. After that the obtained images of head and helmet is fed to a convolutional neural network (CNN) thereby classifying helmet and non-helmet motorcyclist. CNN learns the common hidden features in the set of trained data and differentiate among the helmet and head [10]. Next if the motorcyclist is not wearing a helmet then the next step is to recognize the license plate of the motorcyclist. This can be achieved by using tesseract OCR [11] were a training data set is created from the images, it is converted into frames and further used for vehicle number identification.

In order to determine whether the captured image is having a motorcycle or not, histogram of gradients of an image is calculated. It divides the source image into blocks and calculating the magnitude and direction. It can be achieved by using a 1D centered mask that passes vertically and horizontally. The magnitude and direction added to an 8 x 8 pixel representing in 9 bin histogram. The image which is divided into blocks is concatenated with histograms to form an element vector. These vectors are concatenated to form a giant vector that is 3780 feature vectors. After the feature vectors are obtained, these feature vectors are fed on to an SVM classifier then it is classified as “motorcycle” or “non-motorcycle”.

After the bike riders are detected the next step is to determine if the rider is wearing a helmet or not. To locate the head of the motorcyclist using the fact that the appropriate location of helmet will probably be in the upper areas of bike rider. For that the upper one fifth part of the image is cropped which is the region where the motorcyclists’ head is mostly located. Use of this technique will reduce the area where the search will be performed. Then there by building a CNN model to separate with helmet and without helmet images. The features obtained from the model illustrate that the CNN learns the common hidden structures among the helmets in training set and thus is able to distinguish between a helmet and head. The image cropped is fed on to a set of convolutional layers. The input image is convolved with a filter to obtain a feature map. Along with the convolution the stride is set to be 1 and padding is zero. In order to remove the non-linearity on the feature map a rectified linear unit operation is performed. Max pooling performed reduces the dimension of the feature map. Finallysoftmax function is performed on the fully connected layer to make the predictions that it is a "helmet" or "no helmet".

Once the helmet classification predicts as no helmet, the image of the motorcyclist is passed for number plate detection. Tesseract is an open source optical character recognition system used for number plate detection. The images of the number plate is of high contrast which makes it easier for the people to read. Therefore , it can be separated as background and foreground. Once the image of the motorcyclist is given as an input image it will be first converting its image into its binary image which is called adaptive thresholding. If the pixel values are said to be above the threshold, then it is said to be the foreground part of the image. And if the pixel values are said to be below the threshold level then it is said to be the background part of the image. Connected component analysis of the number plate performs the task of extracting the outlines of the characters that is, the character to be recognized is given in white text and rest of the portion of the image is of black . Once the outlines of the characters are extracted, then the particular image is converted into blobs. Blobs are small regions of scanned image that differs in property like brightness or colour compared to surroundings region. After extraction the extracted character component region are chopped into words and these words are separated with spaces proportionally. The recognition of the text in the extracted area of the image is the next step it is said to be a two pass process. The first part is to recognize each word on the text. The words that are recognized are accepted and now a second pass is started as same as done on the first pass, the second pass is used to gather the remaining words that couldn't collect during the first pass. Adaptive classifier handles the role of this two pass process. The adaptive classifier then classifies the text in its more accurate manner. In order to work accurately the classifier should be trained. Whenever the classifier receives any data, it has to console the issue and assign the text in its proper place.

III. PERFORMANCE EVALUATION

The system uses Python-2.7.12 along the libraries such as OpenCV-3.3.0 for computer vision and image processing, Tensorflow-1.4.1 backend for building CNN, scikit-learn-0.19.1 for machine learning and numpy-1.14.0 for multi-dimensional arrays, mathematical functions and linear algebra. The experiments are performed on a 64 bit Windows 10 Operating System. The specifications of the system are 4 GB RAM, 4 Intel PENTIUM Quad core processors and no GPU.

The dataset consist of 311 images used for training purpose. Among this dataset 239 images is used for training motorcycle images and 72 images is used for training non motorcycles images. A total of 131 images is used for the testing purpose. Among them 90 images are with motorcycles and 41 images are without motorcycles. Out of the 90 images, 31 images are with helmet and 59 images are without helmet. As shown in the table 1, out of 90 motorcycle images used for testing , 82 images were correctly detected as motorcycles. Thus, for motorcycle versus motorcycle classification, out of the total 131 images used , 123 images were correctly identified which gives an accuracy of 93%. Out of the 31 images with helmet , 21 images are correctly detected as "helmet detected", Out of the 59 images without helmet, 56 images are correctly detected as " no helmet detected" that makes the helmet vs non-helmet classification as 77 out of 90 which gives an accuracy of 85%.

Table 1: Testing of images

CLASSIFICATIONS	NO: OF IMAGES CONSIDERED FOR TESTING	TRUE POSITIVE	ACCURACY (%)
MOTORCYCLE VS NO MOTORCYCLES MOTORCYCLES ⟶ 90 NO MOTORCYCLES ⟶ 41	131	123	93
HELMET VS NO HELMET	90	77	85

Out of the 56 images correctly identified as without helmet, 29 license plates are recognized correctly. This gives an accuracy of 51%. Some of the images show low clarity and therefore results in poor detection

IV. CONCLUSION

In this work, a system is developed for detecting the motorcyclists who are violating the laws of wearing the helmet. The system mainly consists of three parts – detection of motorcycle, detection of helmet and recognition of license plate of motorcyclists riding without helmet. The foremost criteria is to determine whether the captured image is having a motorcycle or not using HOG, and checking whether the motorcyclist is wearing a helmet or not by using CNN. If the motorcyclist is identified without a helmet, then the license plate of the motorcyclist is recognized using tesseract OCR. The accuracy obtained for motorcycle/non motorcycle classification is 93% , helmet/no-helmet classification is 85% and license plate recognition is 51% resulting in an average accuracy of around 76% . The accuracy can be improved by increasing the training data set and image quality. .

REFERENCES

[1]. .J.Chiverton, "Helmet presence classification with motorcycle detection and tracking," in *IET Intelligent Transport Systems*, vol. 6, no. 3, pp. 259-269, September 2012.

[2]. R. Silva, K. Aires, T. Santos, K. Abdala, R. Veras and A. Soares, "Automatic detection of motorcyclists without helmet," *2013 XXXIX Latin American Computing Conference (CLEI), Naiguata*, 2013, pp. 1-7.

[3]. R. R. V. e. Silva, K. R. T. Aires and R. d. M. S. Veras, "Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers," *2014 27th SIBGRAPI Conference on Graphics, Patterns and Images, Rio de Janeiro,* 2014, pp. 141-148.

[4]. P. Doungmala and K. Klubsuwan, "Helmet Wearing Detection in Thailand Using Haar Like Feature and Circle Hough Transform on Image Processing," *2016 IEEE International Conference on Computer and Information Technology (CIT), Nadi*, 2016, pp. 611-614.

[5]. K. Dahiya, D. Singh and C. K. Mohan, "Automatic detection of bike-riders without helmet using surveillance videos in real-time," *2016 International Joint Conference on Neural Networks (IJCNN), Vancouver, BC*, 2016, pp. 3046-3051.

[6]. C. Vishnu, D. Singh, C. K. Mohan and S. Babu, "Detection of motorcyclists without helmet in videos using convolutional neural network," *2017 International Joint Conference on Neural Networks (IJCNN), Anchorage, AK, 2017*, pp. 3036-3041.

[7]. B. V. Kakani, D. Gandhi and S. Jani, "Improved OCR based automatic vehicle number plate recognition using features trained neural network," *2017 8th International Conference on Computing, and Networking Technologies (ICCCNT),* Delhi, 2017, pp. 1-6.

[8]. N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in 2005 *IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05),* vol. 1, June 2005, pp. 886–893 vol. 1.

[9]. R. R. V. e. Silva, K. R. T. Aires, and R. d. M. S. Veras, "Helmet detection on motorcyclists using image descriptors and classifiers," in 2014 *27th SIBGRAPI Conference on Graphics, Patterns and Images,* Aug 2014, pp. 141–148.

[10]. A. Hirota, N. H. Tiep, L. Van Khanh, and N. Oka, Classifying Helmeted and Non-helmeted Motorcyclists. *Cham: Springer International Publishing*, 2017, pp. 81–86

[11]. SahilBadla., "Improving The Efficiency of Tesseract OCR Engine"., *San Jose State University SJSU ScholarWorks,* spring 2014.

IOSR Journal of Engineering (IOSRJEN) is UGC approved Journal with Sl. No. 3240, Journal no. 48995.

Emy Barnabas. "Helmet Detection and License Plate Recognition Using CNN." IOSR Journal of Engineering (IOSRJEN), vol. 09, no. 06, 2019, pp. 21-24.