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Analysis of Helmet Detection Using LENET and Transfer Learning

Sreehari Ravindran¹, Roopa K¹, Sarika P R¹, Nevline Jose T¹, Jyothish Krishna P G²

UG Scholar, Dept. of Electronics And Communication Engineering, NSS College of Engineering Palakkad,

Akathethara, Palakkad, Kerala, India¹

Assistant Professor, Dept. of Electronics And Communication Engineering, NSS College of Engineering Palakkad,

Akathethara, Palakkad, Kerala, India²

ABSTRACT: Nowadays the most preferred means of transport is two wheelers. The main reason behind it is two wheelers are economical and flexible. This increase in usage of two wheelers has also increased the number of road accidents. This is due to traffic rule violations like over speed, not wearing helmet, drunken driving etc. Implementing an effective automatic helmet detection system helps in decreasing two wheeler accidents to an extent. This paper aims to implement a real time helmet detection system in which license plate is extracted if the bike rider is not wearing helmet. This paper also compare two approaches, LeNet and Transfer Learning, used for detecting helmet. Convolution Neural Networks are employed for implementation.

KEYWORDS: Convolutional Neural Network, Transfer Learning, MobileNetSSD.caffe model, LeNet

I. INTRODUCTION

Computer Vision is one among the latest emerging technologies and its significant part is Image Classification. Image preprocessing, image segmentation, extraction are some of the processes involved in it. It has got a wide range of applications in various fields like face recognition, security, medical field etc.. Our brain has an ability to instantly recognize objects around us. And as machines are considered it is not the case. It is not so simple for them to identify various entities and they need to be trained with sufficiently large dataset to have a reasonable accuracy. Thus it takes more time to make machines to recognize objects. Fortunately evolution of deep learning have made it easy to overcome all difficulties of object detection and feature extraction. Many models and methods are used for detecting objects in deep learning. LeNet and Transfer Learning are few examples for this. Transfer Learning approach has got some advantages over various trained models. It reduces effort, time and also it is reliable [1]. In this paper an attempt is made to compare the accuracy of LeNet model and Transfer Learning in detecting helmets.

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II. PROPOSED METHEDODOLOGY



Fig 1: Block Diagram Of proposed System

The block diagram of proposed system is shown in Fig. 1. Various steps involved are :

Step 1: Real time detection of bike riders

Step 2: Helmet Detection in the region of interest

Step 3: If no helmet, detection of number plate

1. BIKE RIDER DETECTION

First step is the real time detection of bike riders. First step is the real time detection of bike riders. There are many pre trained neural network models available that can be employed. These models can be modified for custom class detection. In this paper we use MobileNetSSD.caffe model, which is light weight object detection model that can detect objects belonging to various classes like motorbike, motorcycle, car, aero plane, chair etc. and draw bounding box over them. The only concerned class is motorbike.

Two sets of classes was defined, the first set, 'DETECT', consist of all the classes that the model can detect and the second set, 'IGNORE', consist of classes that are to be ignored. Here the 'IGNORE' set consist of all classes except 'motorbike'. So if any class other than 'motorbike' is detected, it is simply ignored and no bounding box is drawn. If 'motorbike' is detected, then bounding box is drawn over it. To this region of interest the helmet detection model is applied.

2. DETECTION OF HELMET

The next step is to detect the presence of helmet. A helmet detection neural network model was created using two approaches: LeNet and Transfer Learning. Both the model was trained on same number of dataset images. The dataset consist of 205 images of helmet and 205 images of people's face and cap.

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bike99.jpeg



bike100.jpeg



bike101.jpeg



bike107.jpeg



bike108.jpeg



bike109.jpeg

Fig 2: Dataset of Helmet



nohelmet77.jpg



nohelmet78.jpg



nohelmet79.jpg



nohelmet81.jpg



nohelmet82.jpg



nohelmet83.jpg

Fig 3: Dataset of No Helmet

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LeNet Model

LeNet includes three layers Convolution layer, fully connected layer and pooling layer[2]. Convolution Layer learns feature from input image. It extracts characteristics of different positions and 'Relu' activation function[3]. Pooling layer increases the robustness of feature extraction and reduces the feature dimension. In Max pooling highest value in the window is considered. High level characteristic features are extracted by stacking several convolution and pooling layers [4]. Fully connected layer connects all neurons of previous layer to that in the current layer. Softmax regressions which generate well performed probability distribution of output are used for classification process.

LeNet which was actually designed for handwritten digit classification can be retrained for custom image classification using custom dataset. The LeNet model employs two sets of layer blocks (Convolutional layer, Activation function, pooling layer). The first set includes 20 5*5 filters and same padding, activation function used is Rectified Linear Unit (known as 'ReLU'). Then follows a 2*2 MaxPooling layer with stride 2[5]. The second block includes 50 filters of same configuration followed by 'ReLU' activation function and MaxPooling layer. Two blocks are followed by Fully Connected layer of 500 nodes with 'ReLU' activation function. It was followed by a softmax classifier which gives the probability of prediction and here the number of classes is two. For training 80% of the dataset was used and remaining 20% for testing. Data augmentation improves the performance of the model. It the orientation of the images while training which helps in learning new features , even if we don't have a large dataset. One limitation of LeNet is that, the size of the input image is limited 28x28 pixels. So our images must be resized to 28x28 pixels, but this reduces the image to a very small object. This affects the feature extraction process.

Transfer Learning Approach

The next approach used was applying transfer learning algorithm on a pretrained model, MobileNet. Transfer learning improves the accuracy and requires less training time[6]. In transfer learning, it gains some information during the initial prediction and apply this knowledge during the next prediction. We add more dense layers so that the model learns complex features. Three dense layers having 1024, 1024 and 512 nodes respectively were added, each with a ReLU activation function[7]. Finally the fourth dense layer of two nodes with softmax activation was added, which corresponds to our two classes for prediction. The epoch value was gives as 5 and batch size 32. Here we don't have any limitation on the image size.

III. NUMBER PLATE DETECTION AND EXTRACTION

From the region of interest containing the bike rider not wearing helmet, number plate is detected using image processing techniques including contours and edge detection.

III. RESULTS

Following Results were obtained when helmet detection was done using LeNet and Transfer Learning.

Figure 4 shows the accuracy plot of LeNet and Figure 5 shows the detection of helmet using LeNet along with their accuracy in prediction.

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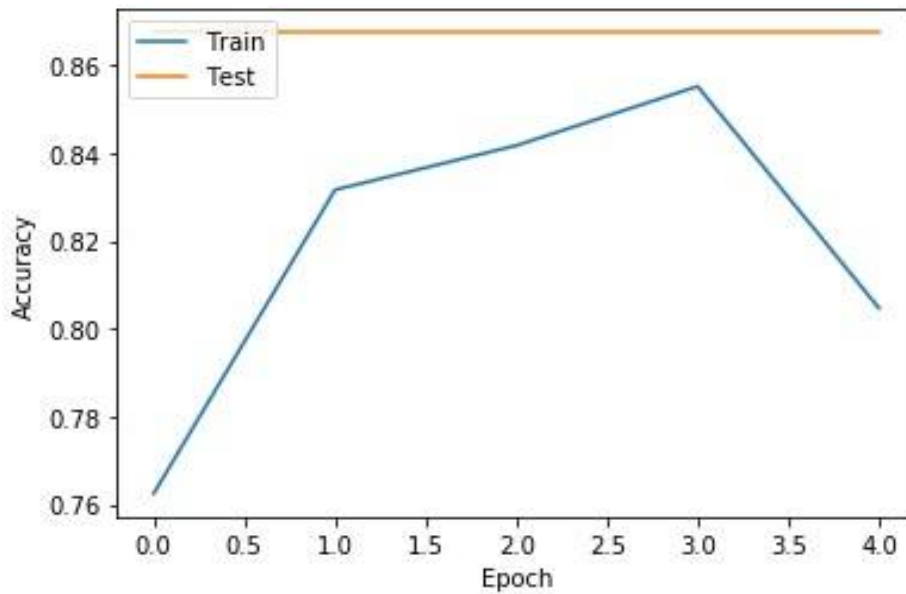


Fig 4:Accuracy Plot for LeNet

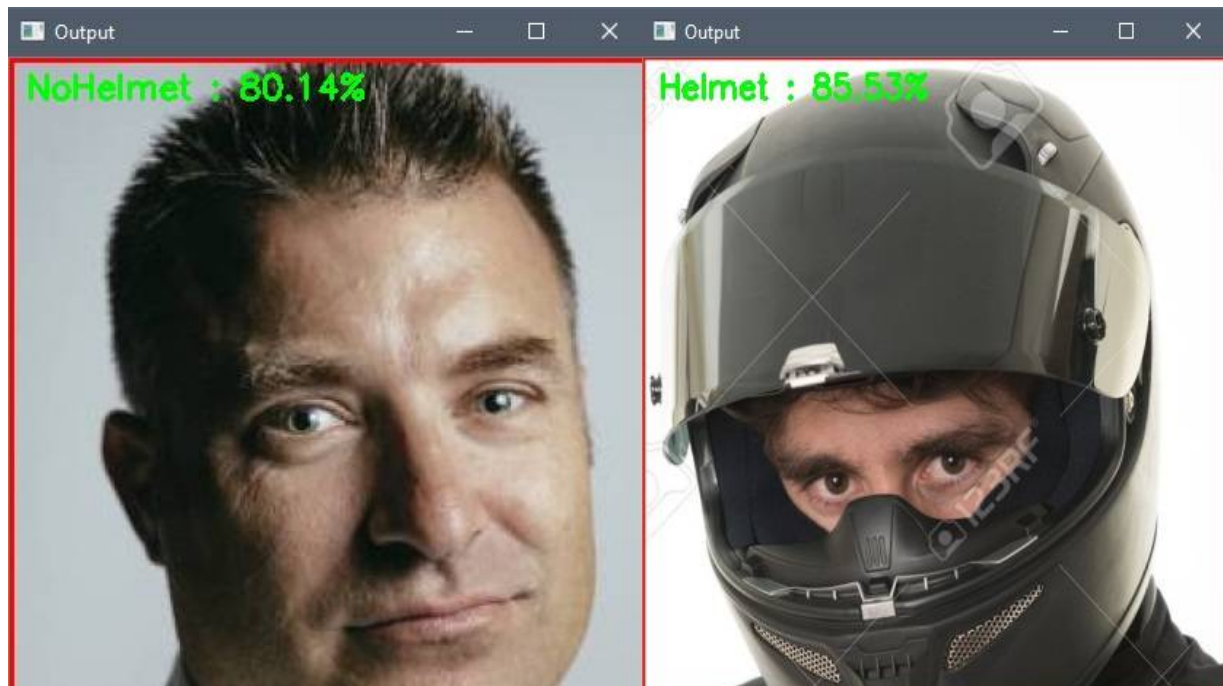


Fig 5: Helmet Prediction using LeNet

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Figure 6 shows the accuracy plot of Transfer Learning and Figure 7 shows the detection of helmet using Transfer Learning along with their accuracy in prediction.

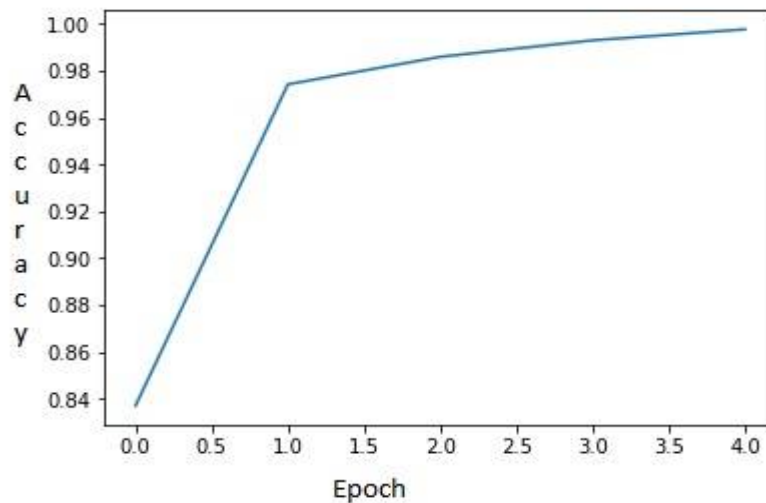


Fig 6: Accuracy Plot for Transfer Learning

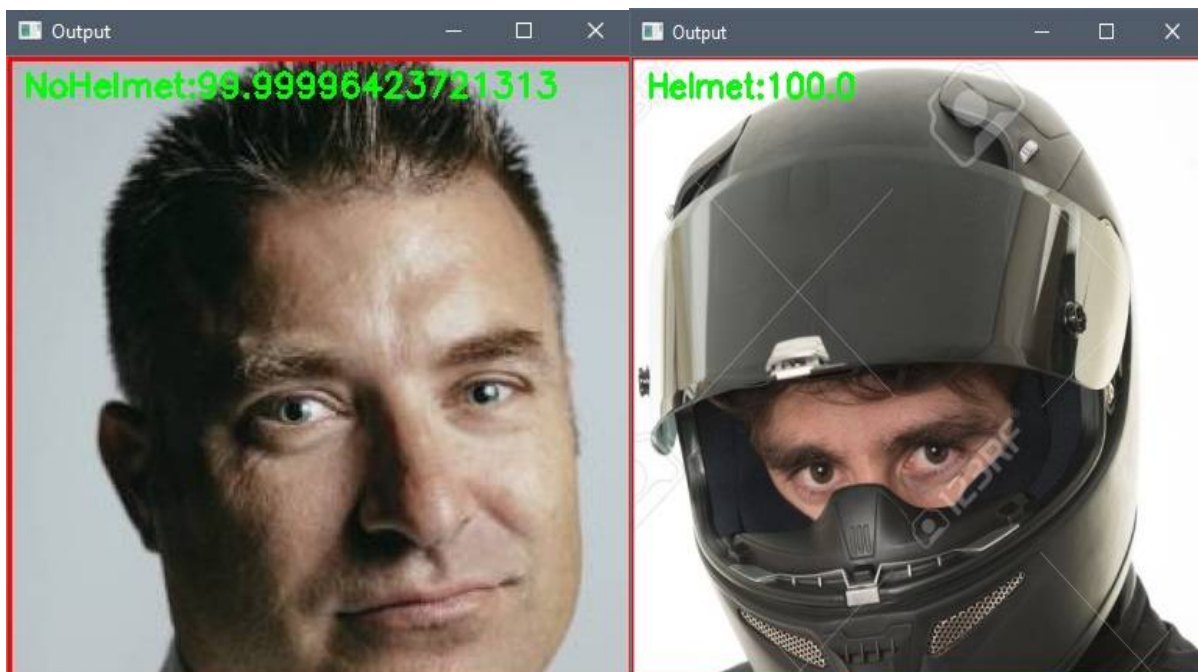


Fig 7: Helmet Prediction using Transfer Learning

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V.CONCLUSION

This paper compared two methods of detecting objects (Helmet in this case). First method involved the use of CNN Model called LeNet and the other used a method called Transfer Learning. The accuracy in case of LeNet was around 88% whereas in case of Transfer Learning the accuracy was 99%. Both the models were trained on same parameters like epoch, batch size, dataset. As expected, it was observed that accuracy is more when detection is done using Transfer Learning. In future this result can be used in many systems. A system that automatically detects helmets from real time videos can be implemented. A number plate extraction system can also be added to it. Another extension that can be made is a system that issues fine to bike riders without wearing helmets. Results can be applied to a number of applications like detecting vehicles parked in No Parking areas etc. So it is clear that using Transfer Learning method gives good accuracy than CNN models in Detecting objects. It reduces effort, time and also it has that reliability of trained model.

REFERENCES

- [1] <https://towardsdatascience.com/transfer-learning>
- [2] <https://www.quora.com/What-is-max-pooling-in-convolutional-neural-networks>.
- [3] V. Nair and G. E. Hinton, "Rectified linear units improve restricted boltzmann machines," in ICML, 2010, pp. 807–814.
- [4] https://www.researchgate.net/publication/264859599_Exploring_Convolutional_Neural_Network_Structures_and_Optimization_Techniques_for_Speech_Recognition.
- [5] <http://faroit.com/keras-docs/1.2.2/layers/pooling>.
- [6] <https://blog.fastforwardlabs.com/2018/09/17/deep-learning-is-easy-an-introduction-to-transfer-learning.html>.
- [7] <https://towardsdatascience.com/keras-transfer-learning-for-beginners-6c9b8b7143e>.