International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 06, 2020
ISSN: 1475-7192

DESIGN AND IMPLEMENTATION OF HELMET DETECTION

[1]M Senthilraja, [2]Yash Nigam, [3]Prashant Chaturvedi

ABSTRACT

Motorcycle safety helmets are used to prevent head injuries while riding bike. In many countries, due to the lack of police power to successfully implement helmet laws, many bike riders don't wear helmets. This paper presents an Automated helmet detection system which automatically detects whether motorcycle riders are wearing safety helmets or not. Number of motorcycle accidents have been rapidly increasing throughout recent years in many countries. Motorcycle is becoming increasingly popular because of various social and economic factors. The helmet is the very important safety equipment for motorcyclists but for some reasons they do not want to use it. An accident can be fatal if motorcyclist isn't wearing helmet because it causes head injury. For image processing, at first we detect vehicles that are moving in real-time by doing background extraction from the image. Background Subtraction is used for the extraction process. After that the resulting image is enhanced using peak and morphological method. Feature extraction is done using appropriate methods and Neural Network is used for image classification. At last, a helmet is detected using the Hough Transform method.

Keywords: helmet detection system, accidents, motorcyclists

I. INTRODUCTION

The role of automation in today's world has increased in recent years. Automation is very important in traffic control. The purpose of automation in the traffic control system is to reduce manual labor and time. It also increases efficiency of a traffic system. In India, the most common traffic violation is bikers drive without wearing helmets. This results in major traffic accidents. Approx

30% accidents are caused by small vehicles according to a recent survey. For traffic policemen to catch every violator is impossible. The ideal solution is to have a system which will detect the helmet and send the fine to the violator. Number plate recognition will be used to identify the violator. This will also help in finding the lost and stolen vehicles.

[1] *Assistant Professor Department of Computer Science and Engineering, SRMIST, Kattankulathur,Tamilnadu, India.*
[2] *Department of Computer Science and Engineering, SRMIST, Kattankulathur,Tamilnadu, India.*
[3] *Department of Computer Science and Engineering, SRMIST, Kattankulathur,Tamilnadu, India.*

Received: 22 Dec 2019 | Revised: 13 Jan 2020 | Accepted: 05 Feb 2020

India today published an article which states:

- Every 60 minutes 4 deaths are recorded in India because of helmet defaulters.
- 47,567 bikers were dead in 2017 and 70 % of them were not wearing helmets.

Despite of the facts stated above still people are not wearing or using helmets. It can reduce the chances of severe head injury in case of an accident. In India, many bikes are ridden every day but still we are not able to find any effective methodology to increase safety awareness. There are still rural and semi urban areas where traffic laws are inactive which is the major cause of these accidents.

According to a Report on road safety 2018" released by the world health organization a comprehensive action plan has to be set up in order to save lives. India is ranked number one as far as road crash deaths are concerned. Rapid urbanization, avoiding helmets, seat belts and other safety measures while driving are some of the reasons behind this trend according to analysis done by experts.

In this project we are finding the vehicle without the helmet detection and captured that number plate and send the mail to the respective department. Without human work the system will analyze and send the messages. So, the system will reduce the human work.

II. METHODOLOGY AND ALGORITHM

In this section we explain different processing steps. At the initial phase, frames are collected at regular intervals from images file. The collected frames are stored in a folder. They are named such that they include the frame number in their name. TO Prevent Bike Accident through the helmet wear. To find out through the stolen vehicle based on Camera. We will be using MACHINE LEARNING for Helmet Detection. The captured image will be sent to the particular mail id

The primary stage of this project is to classify every pixel of a given image for feature extraction, this step will help us to find whether there is a helmet in the image or not. Our intermediate step is to define the regions where the helmet can be detected. Our final step is to define if the helmet detected is full helmet or half helmet. Classified positive and negative sample training images with a given set of defined features can be used by any machine learning techniques to define the given feature. A type of neural network is used to train the classification algorithm and define a varied set of features. Neural networks are generally used to increase the speed of classification and boost the performance of the algorithm.

Our project uses many mathematical equations of a simpler Neural Network model. Number of input nodes in our model is 4 out of which 1 node is a bias node. There is only one output node in our model. There is also a hidden layer that has 4 nodes in it. Hidden node too has a bias node.

Received: 22 Dec 2019 | Revised: 13 Jan 2020 | Accepted: 05 Feb 2020

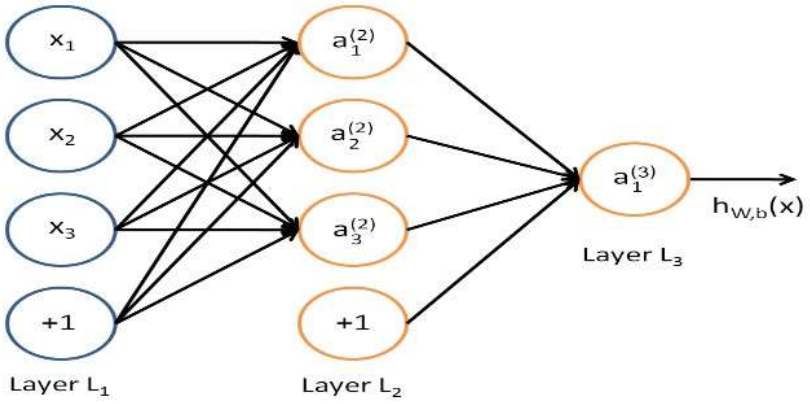

Fig1: Simple Neural Network

We will use two vectors to store input nodes and nodes from hidden layer. Vector storing input nodes is represented by X and the vector with hidden layer nodes is represented by A. The first element in each of the vectors is a bias node. They are marked as x_0 and a_0 respectively.

$$X = \begin{bmatrix} x_0 \\ x_1 \\ x_2 \\ x_3 \end{bmatrix} \qquad A = \begin{bmatrix} a_0^{(2)} \\ a_1^{(2)} \\ a_2^{(2)} \\ a_3^{(2)} \end{bmatrix}$$

Fig2: X (Input Nodes Vector) and A (Hidden Layer Nodes Vector)

Either θ or W can be used to represent the weights between the two nodes. In our project, we are using θ. We are creating a matrix with 3 rows and 4 columns to store the weight between input nodes and hidden layer nodes. Another matrix with 1 row and 4 columns is used to store the weight between output and hidden layer nodes. Another 1x4 matrix will be used for representing the weights between the hidden layer and the output.

Received: 22 Dec 2019 | Revised: 13 Jan 2020 | Accepted: 05 Feb 2020

The dimension of θj depends on the number of units present in the layers of the network. Suppose

Number of units in layer j is **a** and number of units in layer j+1 is **b** then

Dim (θj) = b×(a+1)

$$\theta^{(1)} = \begin{bmatrix} \theta_{10} & \theta_{11} & \theta_{12} & \theta_{13} \\ \theta_{20} & \theta_{21} & \theta_{22} & \theta_{23} \\ \theta_{30} & \theta_{31} & \theta_{32} & \theta_{33} \end{bmatrix}$$

Fig3: Layer 1 Weights Matrix (θ)

In the next step, we will compute the "activation" nodes for the hidden layer. The activation is computed by multiplying the vector ***X*** with the weight matrix $\boldsymbol{\theta^1}$ for each layer. Calculate the value of activation function g by passing the result of multiplication as a parameter to it. After that we get activation value for each node in hidden layer:

$$a_1^{(2)} = g(\Theta_{10}^{(1)} x_0 + \Theta_{11}^{(1)} x_1 + \Theta_{12}^{(1)} x_2 + \Theta_{13}^{(1)} x_3)$$
$$a_2^{(2)} = g(\Theta_{20}^{(1)} x_0 + \Theta_{21}^{(1)} x_1 + \Theta_{22}^{(1)} x_2 + \Theta_{23}^{(1)} x_3)$$
$$a_3^{(2)} = g(\Theta_{30}^{(1)} x_0 + \Theta_{31}^{(1)} x_1 + \Theta_{32}^{(1)} x_2 + \Theta_{33}^{(1)} x_3)$$

Similarly, Hypothesis function is calculated by the multiplication of vector A matrix $\boldsymbol{\theta}$ for the second layer:

$$h_\Theta(x) = a_1^{(3)} = g(\Theta_{10}^{(2)} a_0^{(2)} + \Theta_{11}^{(2)} a_1^{(2)} + \Theta_{12}^{(2)} a_2^{(2)} + \Theta_{13}^{(2)} a_3^{(2)})$$

Image 7: Hypothesis function (Output node value)

The above equations are for a specific Neural Network Model with a single hidden layer in it. We have to modify the equation in order to use for model with multiple hidden layers. The modified equation is

Received: 22 Dec 2019 | Revised: 13 Jan 2020 | Accepted: 05 Feb 2020

$$a_n^L = \left[\sigma\left(\sum_m w_{nm}^L \left[\cdots\left[\sigma\left(\sum_j w_{kj}^2 \left[\sigma\left(\sum_i w_{ji}^1 x_i + b_j^1\right)\right] + b_k^2\right)\right]\cdots\right]_m + b_n^L\right)\right]_n$$

A. Activation Functions

Activation function determines the state of a node. State of a node can be "activated" or "not activated". This decision is taken on the basis of weighted sum. Suppose this weighted sum value to be ***z***. Activation functions like "Step Function" and "Linear Function" will not work in our case. In our project, we are using a efficient activation function "*Sigmoid Function*" as our activation function. There are many activation functions in a neural network, but we will leave them aside for now.

B. Sigmoid Function

Sigmoid function is one of the most efficient activation functions. Sigmoid function is represented by the below equation

$$S(x) = \frac{1}{1+e^{-x}} = \frac{e^x}{e^x+1}.$$

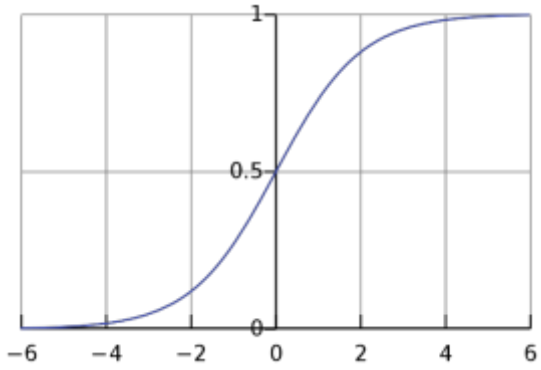

Fig4. Sigmoid Function

It is popular because:

- It is an exponential function.
- Value of sigmoid function is always between 0 and 1.
- Function tends to classify values as either

1 or 0 because of the steepness between

(-2,2) on the X- axis.

Because of the above properties only the nodes take values between the range (0,1). In the case, there are multiple output classes, each output class will have its different probability of "activation". The output class with the highest activation value will be the chosen output.

III. EXPERIMENTAL RESULTS

Algorithm used in this project was evaluated using image sequencing. Images were captured at the rate of 30 frames per second. The dimensions of captured images are 480 x

640 pixels. Despite the fact that the proposed algorithm is implemented using MATLAB, it can be performed in real time on standard PC.

Results obtained after evaluation contain manually segmented characters. This model was trained on an existing algorithm of character segmentation, which is based on binarizing the images and analyzing connected components in license plates.

Finally it identifies the number plates without helmet person and catch those vehicle send the mail to the department.

IV. CONCLUSION

Our Project used a feature detection method to solve traffic violation problems and increase safety parameters through automation. Our project Neural network for segmentation. This project was tested on different busy roads and the results show that it can detect a person without helmet in different conditions.

REFERNCE

[1] O. Russakovsky et al., "ImageNet large scale visual recognition challenge", International Journal of Computer Vision (IJCV), Dec 2015, 115

[2], 211–252. [3] M. Jaderberg, K. Simonyan, A. Vedaldi and A. Zisserman, "Reading text in the wild with convolutional neural networks", International Journal of Computer Vision (IJCV), 2016, 116(1), 1–20.

[3] Y. Jia et al., "Caffe: Convolutional architecture for fast feature embedding", In Proceedings of the ACM

International Conference on Multimedia, 2014, pp. 675–678.

[4] Narong Boonsirisumpun, Wichai Puarungroj, and Phonratichi Wairotchanaphuttha: Automatic detectors for bikers with no helmet using deep learning,2018

[5] Fan Wu1,3, Guoqing Jin 2, Mingyu Gao 1,3, Zhiwei HE *, Yuxiang Yang : Helmet detection using YOLO V3 deep model college of Electronic Information,Hangzhou Dianzi University Hangzhou Xujian Technology Co., Ltd. Zhejiang Provincial Key Lab of Equipment Electronics, Hangzhou, China,2019