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AutomaticDetectors for Bikers with No Helmet using Deep Learning

[1]Mrs. Asha Rani M, [2]Preethu K R, [3]Punya U M, [4]Ranjana M S, [5]Reshma J

Associate Professor, Department of CSE, GSSS Institute of Engineering &Technology for Women, Mysuru, India[1]

Student, Department of CSE, GSSS Institute of Engineering &Technology for Women, Mysuru, India[2-5]

Abstract: The success of digital image pattern recognition and feature extraction using a Convolutional Neural Network (CNN) or Deep Learning was recently acknowledged over the years. Researchers have applied these techniques to many problems including traffic offense detection in video surveillance, especially for the motorcycle riders who are not wearing a helmet. Several models of CNN were used to solve these kinds of problem but mostly required the image pre-processing step for extracting the Region of Interest (ROI) area in the image before applying CNN to classify helmet. In this project, we proposed to apply another interesting method of deep learning called Single Shot MultiBox Detector (SSD) into helmet detection problem. This method is the state-of-the-art that is able to use only one single CNN network to detect the bounding box area of motorcycle and rider and then classify that wearing or not wearing a helmet at the same time. The results of the experiment were surprisingly good. the person who are not wearing helmet are detected and stored in the excel sheet and the mail is sent to them.

IndexTerms: CNN,Helmet Detection, Sending Mail

I. INTRODUCTION

The importance of automatic system in traffic control has been increased in the recent year. One goal is to improve the utilization of a traffic flow system, others are to reduce the cost of human labor and decrease the causes of an accident. In India, one major reason for the accident is the motorcycle biker who drive without wearing a helmet. According to the law, every motorcyclist needs to wear a helmet while riding the motorcycle. But many bikers ignored and use their vehicle without safety equipment. The policeman tried to control this problem manually but it is insufficient for the real situation. The ideal solution is to develop an electronic detection system that can be automated recognize this kind of problem without human cost.

Wearing helmets is compulsory according to the standard however the vast majority avoid it. A principal goal of the helmet is to guaranteethe safety of the riders. This application intends to make an automated system to distinguish whether a biker is wearing a helmet or not and toimpose fines to defaulters as a part of law enforcement.

Nowadays, two-wheelers are becoming increasingly popular because of their ease of handling and affordability, but unfortunately, this has caused a higher number of roadside accidents. A helmet is one of the key elements ensuring the safety of bike riders. Well aware of this fact, people still tend to avoid wearing a helmet. India being a developing economy, the 2-wheeler has taken over as the primary mode of transportation. Currently, statistics estimate that there are about 40 million 2-wheeled vehicles in India. This makes India home to the largest number of motorized two-wheelers in the world. Statistics by the Transport Ministry and Times of India survey show that as of 2016, on average, 28 two-wheeler riders die daily on Indian roads solely because of not wearing helmets. As per a survey of 2018, over 57% of Indian motorcyclists do not wear helmets despite prevailing laws. For this enforcement, the government has started introducing many systems which use real-time CCTV surveillance to capture riders without helmets, and punish them alongside issuing an e-Challan. But this system still needs human intervention to manually identify riders without helmets from the video surveillance system in the control room, hence reducing the model's efficiency as it subject to human error.

The rest of this paper is organized as follows: Chapter 2 presents the related work. Chapter 3 presents the proposed work. Chapter 4 presents the module description.Chapter 5 presents the experimental results for Automatic Helmet Detection. Chapter 6 presents the conclusion.

II. RELATED WORK

Automatic License Plate Recognition a Journal by Lokesh Allamki, Manjunath Panchakshari et al: For real-time helmet detection, there is a need for accuracy and speed. Hence a DNN based model You Only Look Once (YOLO) was chosen. YOLO is a state-of-the-art, real-time object detection system. YOLOv3 is extremely fast and accurate and

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is a huge improvement over the previous YOLO versions. It also makes predictions with a single network evaluation unlike systems like R-CNN which require thousands for a single image.

Rich feature hierarchies for accurate object detection and semantic segmentation by Ross Girshick, Jeff Donahue et al.: In this paper, we propose a simple and scalable detection algorithm that improves mean average precision (MAP) by more than 30% relative to the previous best result on VOC 2012 -- achieving a MAP of 53.3%. Our approach combines two key insights: (1) one can apply high-capacity convolutional neural networks (CNNs) to bottom-up region proposals in order to localize and segment objects and (2) when labeled training data is scarce, supervised pre-training for an auxiliary task, followed by domain-specific fine-tuning, yields a significant performance boost.

Object Detection/Recognition Using Machine Learning Techniques in AWS by Akhil Addapa: This system recognizes any object(s) that is trained from the data sets available (or by creating our own data sets) and the model built after the training. The data sets are generally available in the web where we can use those data sets, build the model and then perform any task on that data according to our requirements. The resulting system is fast and accurate, thus ailing those applications which require object detection.

Machine learning based pattern recognition and classification framework development by BatyrkhanOmarov: In this paper we describe implementation of several step pattern recognition framework. Pattern recognition is the main aspect for different important areas such as video surveillance, biometrics, interactive game applications, human computer interaction and access control systems. These systems require fast real time detection and recognition with high recognition rate. In this paper we propose implementation of the pattern recognition system. In order to increase recognition rate of the system we apply image preprocessing and neural networks.

Deep Neural Networks for Object Detection by Christian Szegedy Alexander Toshev Dumitru Erhan: In this paper we go one step further and address the problem of object detection using DNNs, that is not only classifying but also precisely localizing objects of various classes. We present a simple and yet powerful formulation of object detection as a regression problem to object bounding box masks. We define a multi-scale inference procedure which is able to produce high-resolution object detections at a low cost by a few network applications. State-of-the-art performance of the approach is shown on Pascal VOC.

Multi-object Detection and Tracking (MODT) Machine Learning Model for Real-Time Video Surveillance Systems by M. Elhoseny: This paper introduces a new MODT methodology. The proposed method uses an optimal Kalman filtering technique to track the moving objects in video frames. The video clips were converted based on the number of frames into morphological operations using the region growing model. After distinguishing the objects, Kalman filtering was applied for parameter optimization using the probability-based grasshopper algorithm.

Object Detection Using Convolutional Neural Networks by Reagan L. Galvez et al.: In this paper, Convolutional Neural Networks (CNN) is used to detect objects in the environment. Two states of the art models are compared for object detection, Single Shot Multi-Box Detector (SSD) with MobileNetV1 and a Faster Region-based Convolutional Neural Network (Faster-RCNN) with InceptionV2. Result shows that one model is ideal for real-time application because of speed and the other can be used for more accurate object detection. © 2018 IEEE.

III. PROPOSED SYSTEM

This section presents the proposed approach for real-time detection of bike-riders without helmet which works in two phases. In the first phase, we detect a bike-rider in the video frame and detect weather the person wearing helmet or not. In the second phase, we are going to send mail who are not wearing helmet

Advantages of the Proposed System:

- This application helps in identifying the weather person is wearing helmet or not, if not sending email to him.
- This project aims to decrease the accidents caused due to not wearing the helmet.
- It also ensures whether the law is violated or not
- The algorithm used here is the Faster RCNN which is faster and accurate when compared to the other one

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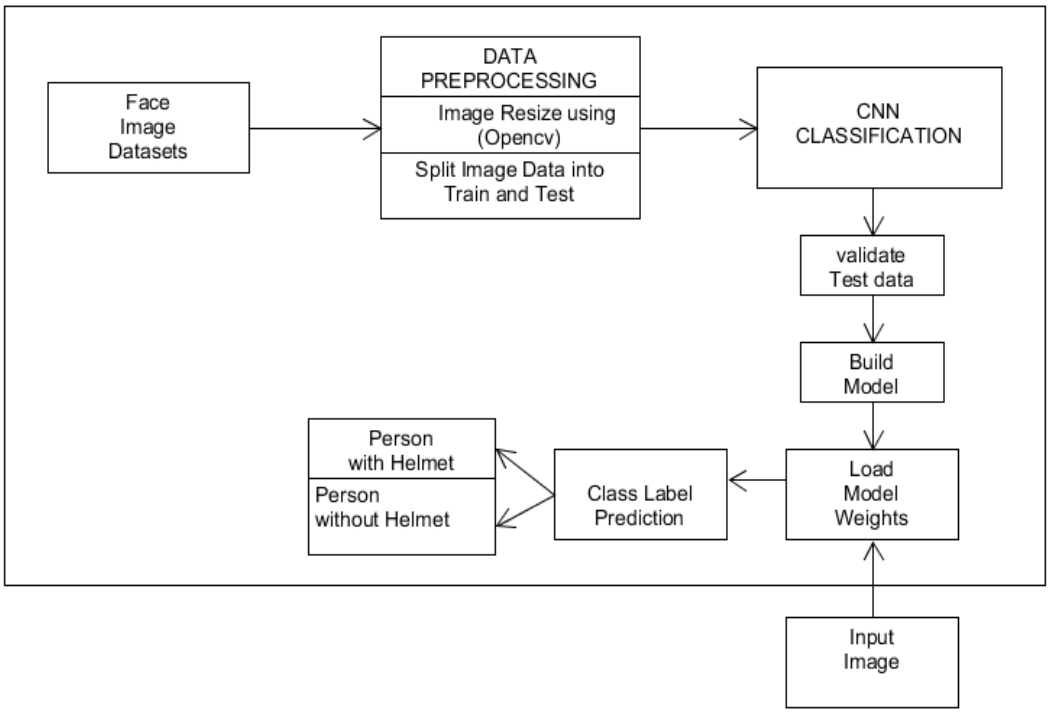

Figure 3.1: Automatic Helmet Detection Architecture

Collection datasets:

- We are going to collect datasets for the prediction from the face
- The data sets consist of person

Data Pre-Processing:

- In data pre-processing we are going to perform some image pre-processing techniques on the selected data
- Image Resize
- And Splitting data into train and test

Data Modelling:

- The splitted train data are passed as input to the CNN algorithm, which helps in training.
- The trained skin image data evaluated by passing test data to the algorithm
- Accuracy is calculated

Build Model:

- Once the data is trained and if it showing the accuracy rate as high, then we need to build model file.

IV. MODULES DESCRIPTION

The various modules of the proposed system include Pre-processing, Segmentation, Feature Extraction, Classification, Post-preprocessing.

- Pre-Processing
- Video has been live detected
- Frames are extracted from video
- Each frame is converted from RGB to Gray conversion
- Objects are detected in images and feature extraction
- The extracted and google trained datasets are compared using TensorFlow
- The completed data is predicted using CNN
- The predicted data is stored in the excel sheet

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Figure 4.1: Process of Helmet Detection

Type of Input:

- Live images from Camera to detect the faces from a trained set of data.
- Addition of Person information manually by the authorized person in the system.

Feature Extraction

Without spending more time and effort for utilizing the capacity of deep learning in the feature extraction process. Because it only needs one pass over the training images, it is especially helpful if you do not have a GPU. To remove learned image feature using a network, and then use those features to train a classifier. The feature extraction process is done by convolution neural network (CNN). The CNN composed of layers such as input layer which describes the input dimensions. The resolution of the input image for 64-64.

Classification

The feature extraction and classification are the two basic parts of Convolution Neural Network. Feature extraction composed of many convolution layers, max-pooling layers and finally activation layer. For classification having only fully connected layers.

CNN:

Convolutional Neural Networks have a different architecture than regular Neural Networks. Regular Neural Networks transform an input by putting it through a series of hidden layers. Every layer is made up of a set of neurons, where each layer is fully connectedto all neurons in the layer before. Finally, there is a last fully-connected layer — the output layer — that represent the predictions.

Convolutional Neural Networks are a bit different. First of all, the layers are organized in 3 dimensions: width, height and depth. Further, the neurons in one layer do not connect to all the neurons in the next layer but only to a small region of it. Lastly, the final output will be reduced to a single vector of probability scores, organized along the depth dimension.

A. **Module 1:** Region Proposal. Generate and extract category independent region proposals, e.g., candidate bounding boxes.

B. **Module 2:** Feature Extractor. Extract feature from each candidate region, e.g., using a deep convolutional neural network.

C. **Module 3:** Classifier. Classify features as one of the known classes

V. EXPERIMENTAL RESULTS

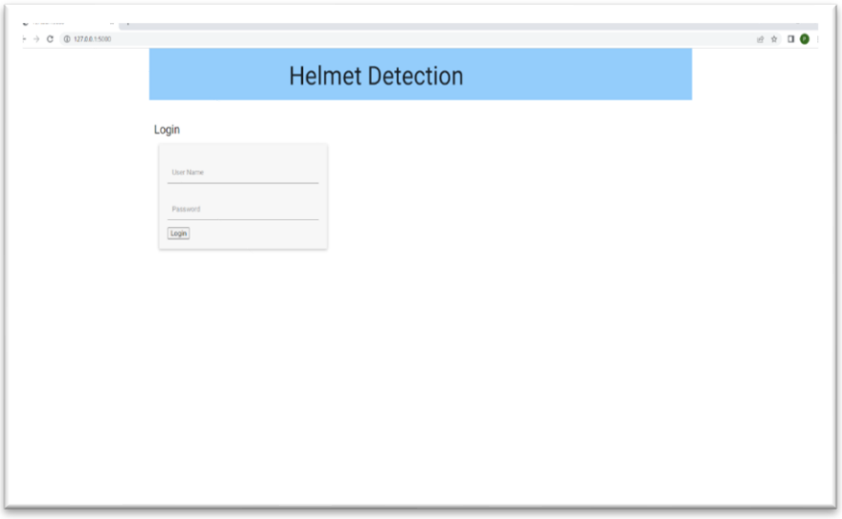

Figure 1: Login Page

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The snapshot given above shows the login page of our project. Here admin can login using login credential such as username and password. If all login credential given by the admin is valid it directs to the main page or else it redirects to login page.

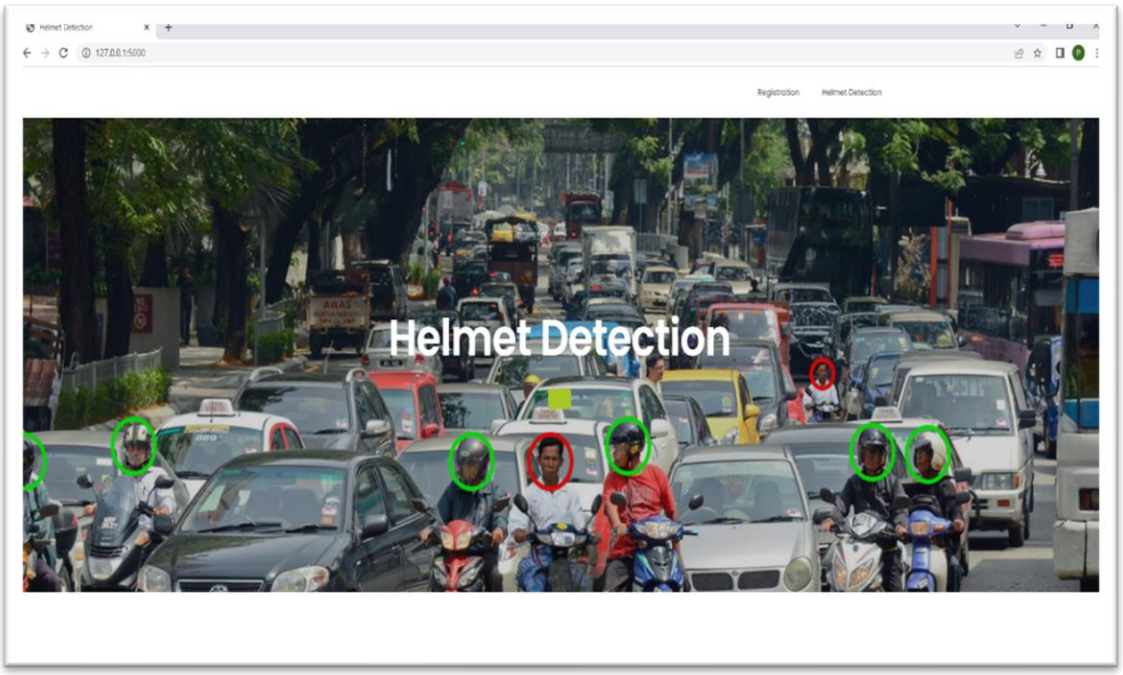

Figure 2: Main Page

The snapshot given above show the Main page of our project. Where we can get a options such as ‘Registration’ and ‘Helmet Detection’.

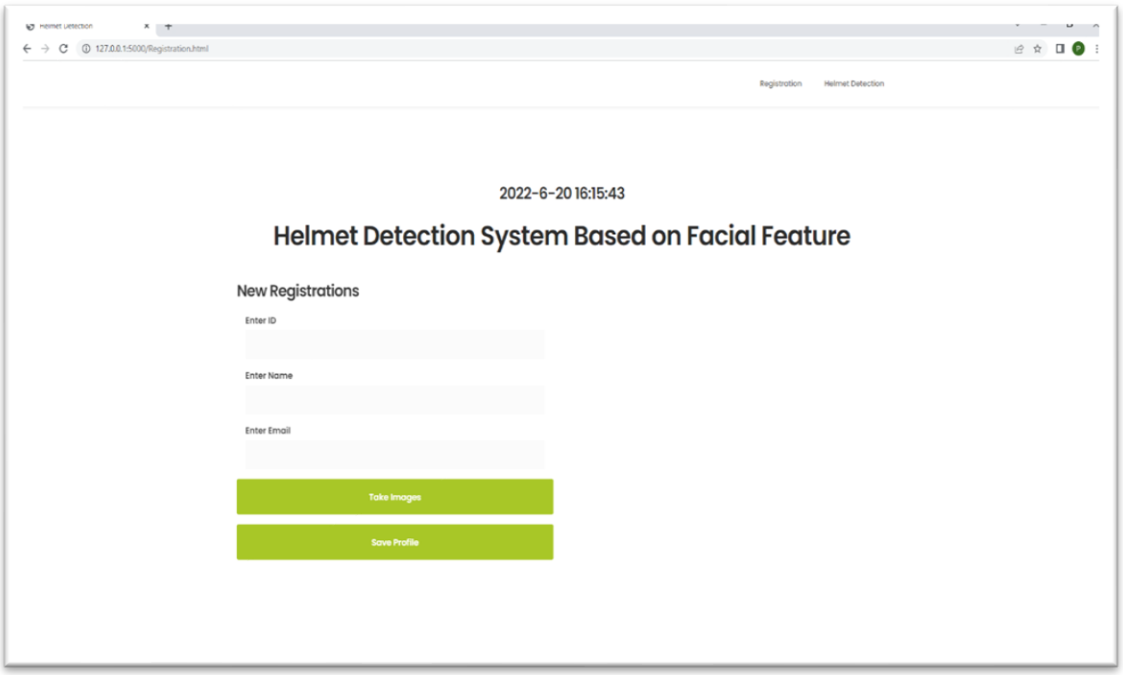

Figure 3: Registration Page

The snapshot given above show the Registration Page of our project here new registrations of people can be made. Information such as ID, name, email are collected along with their images and saved.

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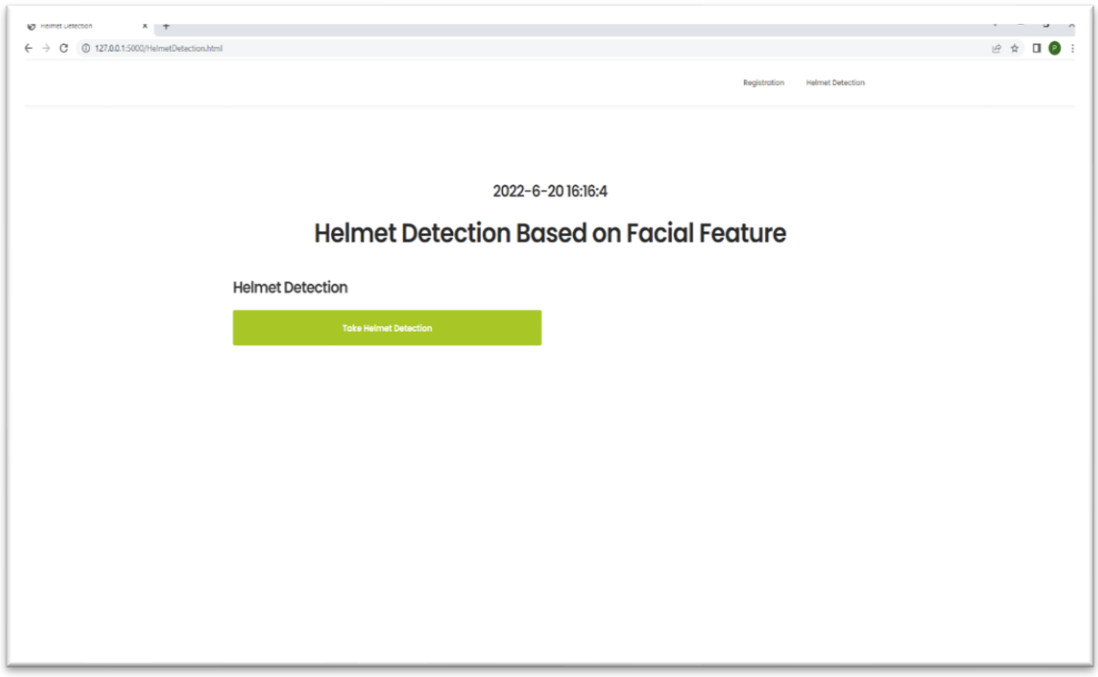

Figure 4: Helmet detection Page

The snapshot given above show the Helmet detection page of our project. By clicking on take helmet detection button, thereby webcam unlock to detect a person with or without helmet. By clicking on Q button the details of person with no helmet will be saved.

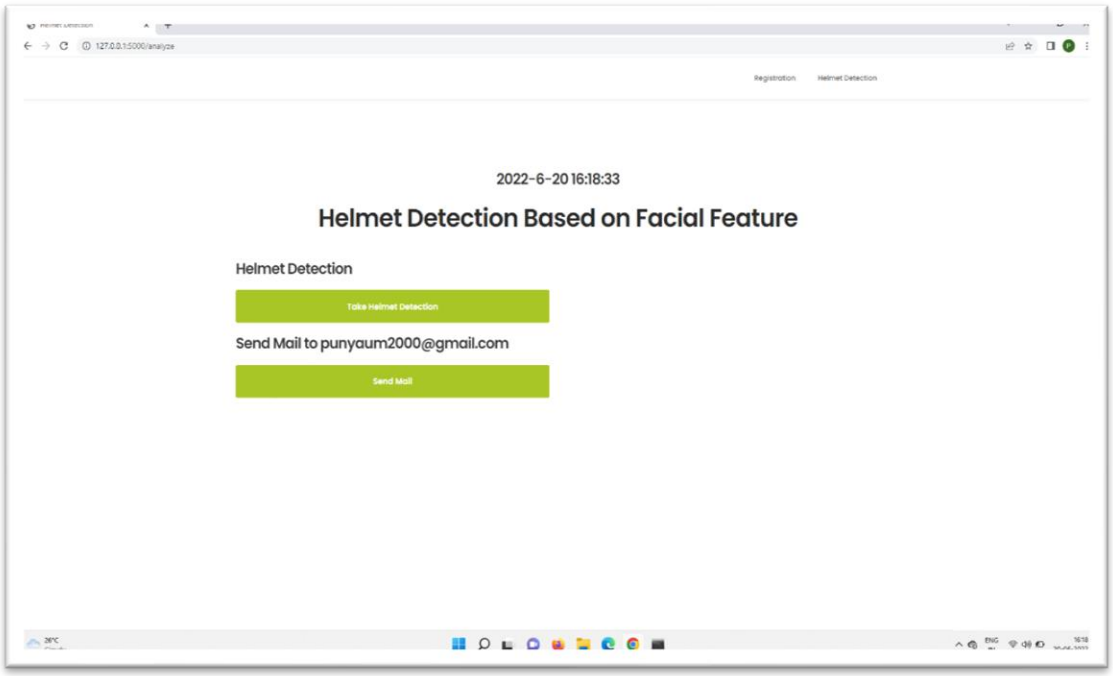

Figure 5: Page for sending mail

The snapshot given above show the Helmet detection page of our project with send mail button here mail is sent to a person with no helmet

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VI. CONCLUSION

India being a developing economy, the 2-wheeler has taken over as the primary mode of transportation. Currently, statistics estimate that there are about 40 million 2-wheeled vehicles in India. This makes India home to the largest number of motorized two-wheelers in the world. Statistics by the Transport Ministry and Times of India survey show that as of 2016, on average, 28 two-wheeler riders die daily on Indian roads solely because of not wearing helmets. This section presents the proposed approach for real-time detection of bike-riders without helmet which works in two phases. In the first phase, we detect a bike-rider in the video frame and detect weather the person wearing helmet or not. In the second phase, we are going to send mail who are not wearing helmet. This project is developed using deep learning approach. In this project we have used deep learning CNN algorithm to train the model using face image datasets. The developed project is giving the better accuracy and helps in identifying the person face.

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