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Helmet Detection using Machine Learning

Archit Sarna[1], Devyani Sokhal[2], Manan Taneja[3], Yashi Rai[4]

[1,2,3,4]B.Tech, Dept. of Computer Engineering, Delhi Technical Campus, Uttar Pradesh, India
Professor[5]-Ms. Nidhi Sharma, Dept. of Computer Engineering, Delhi Technical Campus, Uttar Pradesh, India

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Abstract-*In developing nations, the most common method of transportation have always been two-wheeler. An increase in two-wheeler accidents has been recorded in the past decade. The main cause of fatal accidents involving motorcycles is the absence of protective helmets. Generally, the police have to monitor the roads and the vehicles either manually or by surveillance. However, it necessitates human effort and intervention. This system includes an automated program for identifying the people on two-wheelers who are not wearing helmets and then the program then captures the number plate from the footage. Firstly, the program will determine whether a moving object is the desired two-wheeler vehicle or not. After that, the head portion of the particular rider is captured, and the program determines whether there is a helmet or not. After that, the rider who is not wearing a helmet is finally identified. In addition, we have created a system that employs an OCR algorithm to identify and extract the characters from the number plates.*

1. Introduction

According to a WHO published report approximately 1.35 million people die annually and 50 million are injured in road accidents. It is extremely difficult to imagine that motorcyclists, cyclists, and pedestrians bear this burden in different ways. In many nations, motorcycle accidents have increased rapidly over time. Motorcyclists' primary safety gear is the helmet. In any case, numerous drivers don't utilize it. A helmet's primary function is to safeguard the driver's head in the event of an accident. The result could be fatal if the motorcyclist does not wear a helmet in such a situation. The objective of the proposed system is to guarantee complete safety for bikers. Each year, the number of deaths has been rising, particularly in developing nations. In this manner, remembering public well-being, there should be a system for programmed head protector locations which can remove the number plates of the people who don't wear caps on streets. This kind of robotization will assist the organization with giving cap infringement tickets more proficiently and at last, intends to hinder the infringement by bike riders.

2. Literature Review

S.no	Page Title	Authors	Methodology
1	Automated Helmet Detection for Multiple Motorcycle Riders using CNN	Madhuchhanda Dasgupta, Oishila Bandyopadhyay, Sanjay Chatterji, Computer Science Engineering IIIT Kalyani West Bengal, India	First detects riders using YOLOv3 and then detects whether the targeted person is equipped with a helmet or not.
2	Helmet and Number Plate detection of Motorcyclists using Deep Learning and Advanced Machine Vision Techniques	Fahad A Khan, Nitin Nagori, Dr. Ameya Naik, Department of Electronics and Telecommunication K. J. Somaiya College of Engineering Mumbai, India	The system uses YOLO to detect whether the person on a two-wheeler is with a helmet or not.
3	Helmet Detection Using ML IoT	Dikshant Manocha, Ankita Purkayastha, Yatin Chachra, Namit Rastogi, Varun Goel Department of Electronics and Communication Engineering Jaypee Institute of Information Technology Noida, India	This system first identifies motorcyclists and then checks if the person driving the two-wheeler and the person behind the rider is equipped helmets or not. Then using the

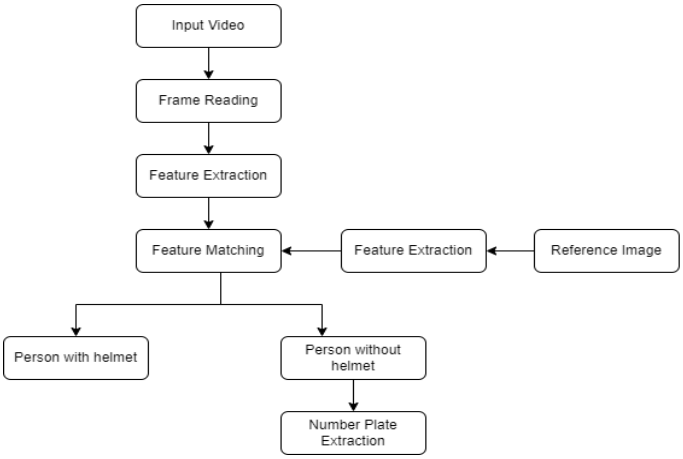
			video to extract the number plate using OCR.
4	Convolution Neural Network-based Automatic Extraction and Fine Generation	Y Mohana Roopa, Sri Harshini Popuri, Gottam Gowtam sai Sankar, Tejesh Chandra Kuppili, Computer Science and Engineering Institute of Aeronautical Engineering, Hyderabad, India	In this system rider with no helmet is detected then the respective frame is taken and the number from the number plate is extracted. Then the challan is sent to the vehicle owner's number.
5	Improved OCR-based Automatic Vehicle Number Plate Recognition using Features Trained Neural Network	Bhavin V Kakani, Divyang Gandhi, Sagar Jani, EC Engineering Department Institute of Technology Nirma University	This system is devoted to an enhanced method of OCR-based number plate identification using neural network

3. PROPOSED SYSTEM

Deep learning is a subtype of machine learning algorithm that uses many levels to accept inputs step by step and extract high-value characteristics. In image processing, for instance, edges may identify the basic layers, while the advanced layer might identify human-relevant concepts like digits, letters, and faces. The ability to abstractly represent its input data is learned at each level of deep learning. The raw input for an application that recognizes images might be a pixel matrix; Pixels and edges can be encoded and abstracted by the first representational layer; Edge arrangements may be compiled and encoded by the next layer; facial features may be encoded in the penultimate layer; and the presence of a face in the image might be recognized by the last layer. Image processing techniques like noise removal would probably be the first step in identifying objects in an image, accompanied by (limited) image retrieval to detect lines, areas, and maybe spots with certain textures. Then the image is processed using an algorithm known as a feature descriptor, which generates feature descriptors or feature vectors. Furthermore, image processing, classification, segmentation, and other auto-correlated data are handled by the convolutional neural network. It has one or more convolutional layers. Then, for automated number identification, the optical character recognition license plate recognition system uses thresholding and template matching.

4. Methodology

4.1 Architecture



In this, we take an input video that is to be analyzed in which we have to check whether the people riding two-wheeler are wearing helmets or not. Then the video is analyzed frame by frame from which the features are extracted. Then the features extracted from the input video are matched with the data set loaded for training the program. As the features match the program looks at whether the people driving the wheeler are wearing helmets or not. If somebody is not wearing the helmet then the number plate is detected and then it is extracted.

4.2 Identifying a moving object

Identifying a moving vehicle is the first step in helmet identification. It is the initial step prior to performing more intricate assignments like vehicle following or arrangement. The example starts by getting the first video frame in which the moving objects are distinguished from

the backdrop rather than immediately processing the full movie. When dealing with the video, taking care of just a few of the underlying edges helps. The next thing that can be found is the bounding boxes of each connected part that correspond to a moving vehicle. The majority of the time, more than one mass is identified that is distinct from moving vehicles like walkers, trees, canines, and other small cries. This is the only way we stay with the moving vehicle. However, due to its numerous gaps, the blob is not a single coherent entity. We increase the coherence of the blob by removing noise and filling the spaces between the identified items using the morphological opening. When the mass is found, the crude picture is removed that is taken cover behind the mass.

4.3 Classification of the vehicle

Classifying the moving vehicle from the previous section is the next step.. To determine which method is most effective for vehicle classification with limited data, we have utilized a variety of machine learning algorithms, ranging from traditional machine learning algorithms to more contemporary deep neural networks. Two-wheelers and four-wheelers are the two main types of vehicles. Because we want to determine whether or not a helmet is present, we are only interested in two-wheelers. If a two-wheeler is detected, the system only moves on to the next step. Otherwise, it tosses this vehicle and looks for other vehicles, continuing the cycle. We independently gathered the necessary training data for vehicle classification. We took pictures of a variety of vehicles positioned in various positions. For both the two-wheeler and four-wheeler categories, nearly the same number of images were collected. The issue of class imbalance is eliminated and the classifier performs better if there are equal numbers of training images from both classes. The vehicle in the training images is surrounded by interesting objects like buildings, trees, footpaths, and other noisy objects. The pictures show a car as it would normally appear on the road. Through the use of image augmentation, it is possible to create a variety of training samples, and using synthetic images is convenient. A new set of images is used to test the classifier. Although this dataset is not the most accurate representation of real-world moving objects, it is sufficient to train and evaluate the feasibility of the proposed strategy by evaluating the performance of several machine-learning algorithms. Grayscale was applied to the images. The classifier was fed pixel values in their raw form.

4.4 Helmet detection

Using the same procedure as for identifying the type of vehicle, we can tell if the rider is wearing a helmet.. Using a reduced version of two-wheeler photos that concentrate on the rider's head, a helmet detector has been trained. By employing this strategy, Using a reduced version of two-wheeler photos that concentrate on the rider's head, a helmet detector has been trained. We utilized various AI classifiers to choose the best one for this assignment.

4.5 License plate extraction

The next thing we must do is take the number plate off the two-wheeler rider if they aren't wearing a helmet.

Optical character recognition is the electronic or mechanical transformation of images of typed, handwritten, or printed text into computer text from scanned documents, document images, scene photographs, or subtitle text placed on an image. By giving the right coordinates, we can use our cropped image to extract the area of interest.

5. Module

1. **Loading Data Set**: In this module, we are loading an h5 file including the data set. This data set includes data on helmets and non-helmet. It also includes data on two-wheeler and four-wheelers. We also add the 'yolo.weights', this file is used to detect bikes and number plates.

2. **Data Analysis and Testing**: This module consists of analyzing the data from the data set and training. In this, the data will be read and trained as to which two-wheeler vehicles are to be detected. It then trains to what a helmet is and how to detect it on a two-wheeler.

3. **Detecting the Features**: In this step, we use a video as input in the program will detect the features that are helmets and bikes. This takes the video frame by frame and first identifies which two-wheeler bikes are to be detected. After detecting the vehicle, it will compare the features of the helmet and no helmet in the video. Once the features are compared, whether or not a two-wheeler driver is wearing a helmet would be displayed on the monitor. Whenever it decides that the driver is not wearing a helmet, it will capture and retrieve the license number.

Figure 1: Input Video

Figure 2: Input Video After Analysis

Figure 3; Input Video

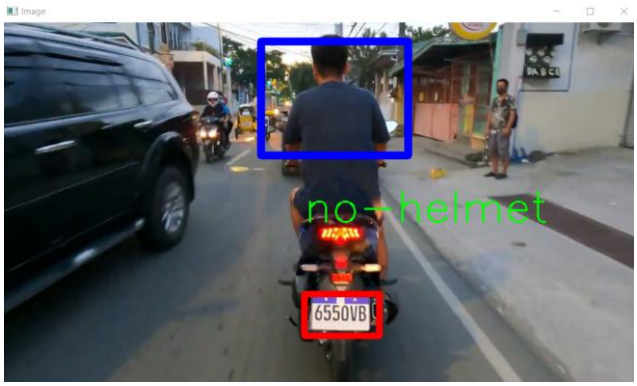


Figure 4: Input Video after Analysis

4. **Testing:** After this, the modules are tested whether they are working or not. Then complete testing is done to check whether the code is running smoothly or not and whether it is performing correctly or not.

6. Conclusion

Any person needs to maintain their health, and injuries sustained while riding a vehicle can result in serious accidents and even fatalities. In this project, we propose a framework for identifying bikers who ride without helmets and break traffic rules. The traffic police will also be able to use the proposed framework to find those who break the law in unusual environments, such as hot sun, etc. This project primarily makes use of deep neural networks to recognize people in the input, which can be in the form of a video or an image. The program immediately examines to see whether the rider and person behind are wearing helmets before scanning and collecting the number plate data in a database utilizing optical character recognition. This saves the lives of many people by requiring riders to wear helmets when riding two-wheelers. Exploratory outcomes show the exactness of the identification of bicycle riders and the recognition of violators, individually.

7. REFERENCES

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