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Traffic Violation Detection by Using Image Processing

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Abstract: *Detection of helmeted and non-helmeted motorcyclists is mandatory nowa-days in order to ensure the safety of riders on the road. The main goal of helmets is to protect the drivers head in case of an accident. In case of an accident, if the motorcyclist does not use a helmet, it can cause fatal injury. Today violation of most of the traffic and safety rules are detected by analysing the traffic videos captured by surveillance cameras. This paper aims to propose a system for detection of motorcyclists without helmet. In this paper, we introduce an approach for automatic detection of helmeted and non-helmeted motorcyclists using Deep learning algorithm. In this paper, motorcycle riders are detected using the YOLOv4 model which is an incremental version of the YOLO model, it is a state of method for object detection. The proposed model is evaluated on traffic videos and the obtained results are promising in comparison with other CNN based approaches. Motorcycle accidents have been rapidly growing throughout the years in many countries. Due to various social and economic factors, this type of vehicle is becoming increasingly popular. The helmet is the main safety equipment of motorcyclists, however many drivers do not use it. The main goal of helmet is to protect the drivers head in case of accident. In case of accident, if the motorcyclist does not use can be fatal. This paper aims to propose a system for detection of motorcyclist without helmet. For this, we have applied the circular Hough transform and the Histogram of Oriented Gradients descriptor to extract the image attributes. Then, the MultiLayer Perceptron classifier was used and the obtained results were compared with others algorithms. Traffic images were captured by cameras from public roads and constitute a database of 255 images. Indeed, the algorithm step regarding the helmet detection accomplished an accuracy rate of 91.37%.*

Keywords: Helmet-detection, YOLO, Deep Learning, traffic violation

I. INTRODUCTION

Road fatality rates are very high, especially in developed and middle-income countries. One of the major reasons for traffic accidents is not using motorcycle helmets. Active law enforcement may help to improve compliance, but ubiquitous enforcement involves a lot of police officers and may trigger traffic delays and safety problems. The goal is therefore to show the efficacy of computer vision and machine learning approaches to improve conformity with the helmet by means of automatic helmet violation detection. This chapter addresses the relevance, motivation, problem definition and objectives behind the project. Motorcycles are a common means of transport in nearly all countries. However, the elevated risk is involved in two-wheelers due to less safety. To decrease the risk, it is highly desirable for two-wheeler riders to use a helmet. The majority of fatalities in incidents in the past few years are due to head injuries. Riding a bike without a helmet is a criminal crime, and because of its meaning, many manual methods have been implemented to catch violators. Automation of this system is the need for the hour to track these abuses in real-time and reliably, as well as greatly reducing the amount of human interference. In several countries, devices involving security cameras have been mounted in public areas, so using the current infrastructure is a cost effective method for identifying violators of traffic laws. Road collisions, mostly motorcycle crashes, are one of the leading causes of unnatural deaths today. Among all road fatalities, motorcycle accidents accounted for 9% in Europe, 20% in the United States, and 34% in the countries of the Western Pacific and Southeast Asia. For motorcyclists, helmets are the primary safety device, so

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where compliance is poor, automated processing has the ability to significantly improve compliance, saving human lives

II. RELATED WORK

Auto-Generate Scheduling System Based on Expert System: G. Sasikala et al. proposed a system which is based RF transmitter and receiver that enhance the feature of helmet and provide extra protection while accidents. It may increases the cost of helmet and does not provide a solution that could mandate the use of helmet for every riders or non riders. Narong Boonsirisumpun et al. proposed a system which is based on convolutional neural network. System is able to classify the helmet and motorcycle using CNN, but CNN is limited with training samples that restricted if a person is using different kind of helmet or if girls cover her face may detected as helmet that may increases the false recognition rate. Liang-Bi Chen et al. proposed a system which is based on IR sensors that proposes an intelligent helmet with heavy vehicle detection to aware the riders to not to be a part of any casualties. Here system uses camera on helmet's back side for recognizing heavy vehicles that approaches. Mario Andres VaronForero et al. proposed a system which is based on convolutional neural network and background subtraction approach that may highlight the riders with helmets. Helmet has been classified using support vector machine and samples of training data. The accuracy of the system is bit good but system may not work for various situations specially that encounters in India such as use of clothes over face, passengers with no helmet etc. Rohith C A et al. proposed a system which is based on CNN that is able to detect two wheelers with helmet and no helmet. So as per the earlier discussion CNN is limited with the samples and most of the distinct situation cannot be handled using this technique. Detecting multiple helmet and persons head along with motorcycle is a challenging task evaluation words from the contribution dataset.

III. PROBLEM IDENTIFICATION

Rohith C A et al. [2] uses traffic cameras in the desired location for shooting or detecting the motorcycle. System creates bounding boxes over the two wheelers around it and crops the frames then CNN has been applied for classifying whether the rider is with helmet or not. If helmet has been detected then system will consider there is no violation at all. System has been trained with various samples of helmets and bikes. Caffe model has been used for detecting objects from video frame. System is lacking when a rider comes with clothes over his face without helmet. System may get confuses because there is no training for classifying head and helmet at all

IV. PROPOSED WORK & IMPLEMENTATION

The proposed system is capable of identifying motorcycle with helmet and no helmet. System uses tensorflow for recognizing helmet and motorcycle at real time with high level of accuracy. Tensorflow is precompiled library developed by Google Brain team that is capable enough to classify various objects in a single frame. System also uses Keras API that is running over Tensorflow. Both Tensorflow and Keras work with python effectively. Keras also compiles model with loss and optimizer functions, training process with fit function. System is able to detect head also for classifying motorcyclist with no helmet. Here, system may lead with various situations such as- a motorcyclist may or may not have helmet whether he is not with any passenger, a motorcyclist may have passengers with helmets or may not and a motorcyclist may cover his face with some cloth that should be considered as no helmet.

YOLO is the fastest to train and detect a wide variety of objects. We need to think about the scenario where we are going to use it. Especially when it comes to the image, there are several factors that affect the accuracy of the object detection model. This can be the intensity of light, the camera angle from where the image / video is being captured, the background of the images, and more. So the first step is to identify the problem and think about its use case.

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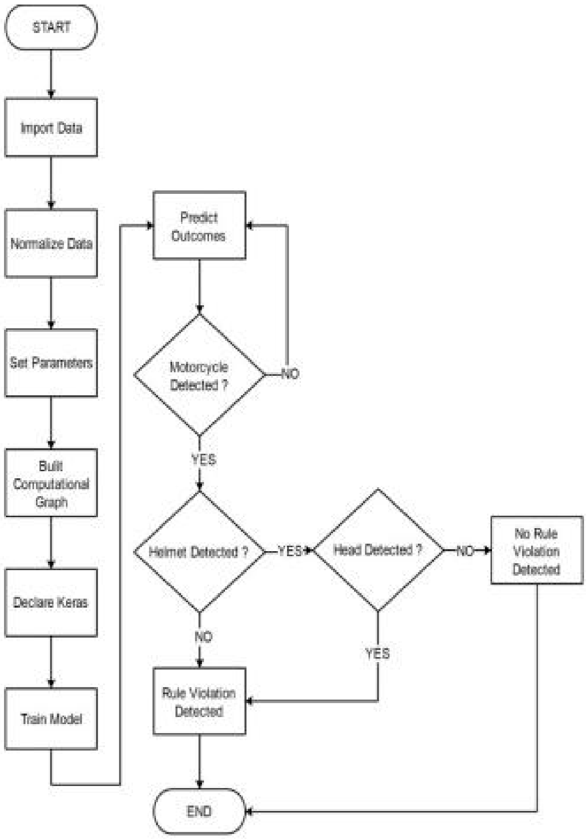

Figure 1. System Architecture

Output: Probability

Step 1. Import or generate data

$D = \{x_n, y_n\}$ is a dataset

Step 2. Transform and normalize data by mean, standard deviation and float to integer

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

$$\textit{Where } \mu \textit{ is mean}, N \textit{ is total no. of dataset}, x_i \textit{ is an individual value}$$

$$(1 - 2s) \times (1 + f) \times 2^e$$

$$s \textit{ is the sign bit } (0 \textit{ or } 1), f \textit{ is the mantissa and } e \textit{ is the biased exponent}$$

Step 3. Set Parameters W and b as tensorflow variables for result

Step 4. Built Computation Graph by initializing weights and biases

Step 5. Declare Keras as Loss Function

Step 6. Initialize and Train Model to better predict our data

Step 7. Evaluate the Model //Testing Phase

Step 8. Predict Outcomes & Declare Result

Step 9. End

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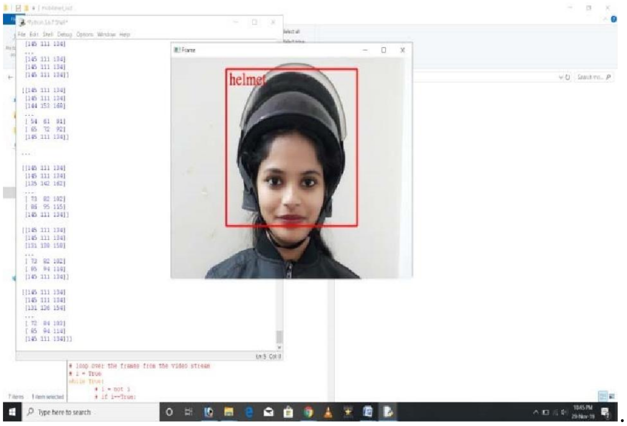
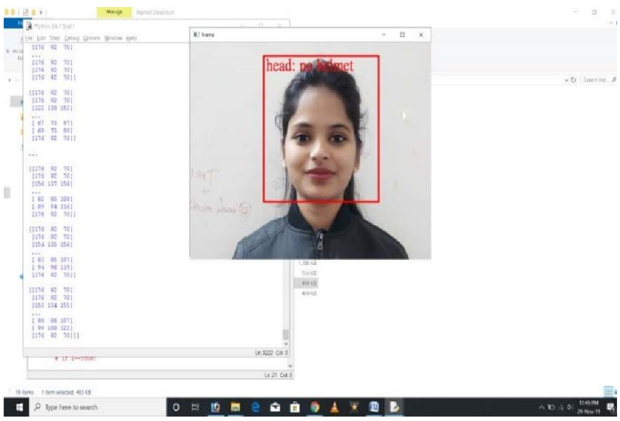
Flow chart represents the process model for recognizing helmet with optimal prediction level. First of all data has to imported for execution and once the data imported it is required to normalize data as per the system compatibility then parameters are to be declared for Tensorflow variables. Our algorithm usually has a set of parameters that we keep constant during the whole process. For example, it can be number of iterations, learning rate or other specific parameters of our selection. It is considered a good form to start it together so that the reader or user can easily find them. After we have the data, and initialized our variables and placeholders, we have to define the model. This is done by building a computational graph. We tell Tensorflow what operations must be done on the variables and placeholders to arrive at our model predictions. After defining the model, we must be able to evaluate the output. This is where we declare the loss function. The loss function is very important as it tells us how far off our predictions are from the actual values.

V. RESULT AND DISCUSSION

The system has been tested with various frames that may belong from helmet, no helmet, head, head with weft and multiple head or helmet. The simulation is as follows





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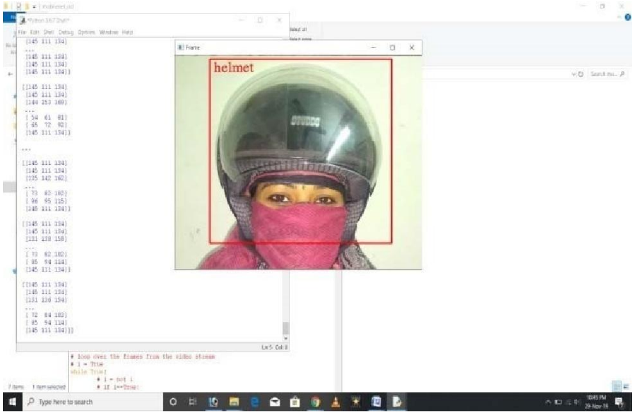

Fig. 11 shows there is woman with no helmet and her face has been covered by weft that is detected by the system precisely. Here the violation is recognized by the system.

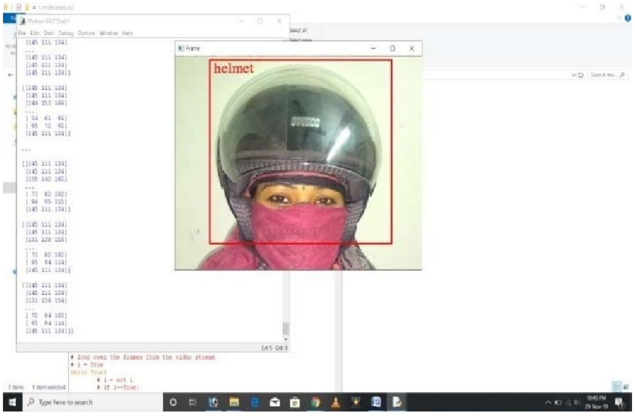

Fig. shows how a helmet has been detected by the system even face is covered. It means that if there is a single person in a frame and helmet is detected instead of head, it means that there is no violation detected by the system. But if there are more than one person in a frame along with motorcycle and head is detected with helmet; it means that rider may have helmet but passenger is without helmet that violate the rules as per the norms.
have helmet but passenger is without helmet that violate the rules as per the norms.

VI. CONCLUSION & FUTURE SCOPE

The proposed system is very much capable for detecting helmet in all certain situations with high level of accuracy. Here the system has been tested with various frames and result is effectively obtained with minimal error rate. Tensorflow and Keras are two main packages that allow to train a system with certain circumstances that affect the accuracy at very good extents. The proposed system can be practically implemented in various places such as school, colleges, offices, shopping mall, marts and various public places that mandate the person to use the helmet with their family and friends at better safety concerns. System can be enhanced in future by testing various samples and can be trained for other situations where traditional systems may become failed.

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