Integrated Framework for Helmet Detection and License Plate Recognition in Traffic Control System

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Abstract: At the present circumstances, there are a variety of traffic regulation issues in India, which can be addressed using various approaches. Riding a motorbike or scooter without a helmet is a traffic offence that has increased the number of accidents and deaths. The current system largely monitors traffic offences through CCTV records, in which traffic cops must zoom into the frame where the traffic violation is occurring and look at the license plate on the off chance that the rider isn't wearing a helmet. However, because traffic offences are common and the number of persons riding motorcycles is growing day by day, this will take a lot of labour and time. Hence, this paper proposes a device that uses CNN to identify bike drivers who are not wearing helmets. Bicycle distinguishing proof, helmet versus no head defender, and bicycle label affirmation are all featuring parts of the system. The bikes are filtered using the HOG component vector. When CNN recognises a cruiser, it checks to see if the rider is wearing a protective headgear. Tesseract OCR is used to recognise the bike's tag if the motorcyclist isn't wearing a helmet. Keywords: Protective cap Detection, Convolutional Neural Network (CNN), Tesseract Optical Persona Cognizance (OCR), License Plate Extraction, Histograms of Oriented Gradients (HOG)

1. INTRODUCTION

Because of their accessibility and ease, two-wheeler vehicles such as scooters and motorbikes are the most popular in India. According to figures supplied by the Government of India's Department of Statistics and Implementation Systems, they are owned by a large portion of the country's population. According to data produced by theDepartment Transportation and Highways, road accidents claim the lives of more than 37 percent of

individuals (56,136) or six two- wheelers. To lessen the danger of harm, two-wheeler users are strongly advised to wear a safety helmet. Riding a two-wheeler without a helmet is illegal, people every hour on average - including Currently, the police officers must manually record the image of the bike rider'snumber plate if he or she is not wearing a helmet or face mask. The fact that such rulebreakers frequently speed up and flee without being punished is a significant downside of this strategy. Therefore, an automated approach has been developed to overcome the shortcomings of the existing system, which is more precise and requires minimalhuman work. This system'sprimary purpose is to catch all motorcyclists who are without helmets. Using YOLOv3, the system divides the traffic footage into several images (frames)[4], from which it can distinguish bike riders from an image containingboth two-wheelers and other vehicles. Once the bike riders havebeen identified, the system can determine whether the and several hand-to-hand measures have been used to catch violators due to its importance. As a result, real-time automation of this procedure is essential, as it allows for more accurate monitoring of passengerswho disobey the regulations while also reducing the number of human interventions[1][2][3].

motorcyclist is wearing a helmet or not. Moreover, it can also determine whether the biker is wearing a mask or not using YOLOv3.

2.RELATED WORK

J.Chiverton, [1], proposed a method to classify the presence of helmet with motorcycle detection and tracking. The author suggests that, head protectors are essential for a bike rider's wellbeing, yet upholding cap use is a tedious and work serious assignment. Accordingly, a framework for consequently characterizing and following bike riders wearing and not wearing protective caps was portrayed and tried [5]. The framework utilized support vector machines that have been prepared on histograms created from head locale picture information of cruiser riders, just as individual picture outlines from video film. The learned classifier was utilized in a global positioning framework that utilizes foundation subtraction to automatically segment motorcycle riders from video data [6]. The riders' heads weresegregated, and the trained classifier was used to classify them. Each motorbike rider created a track, which is a series of areas in neighbouring time frames. The individual classifier outputs were then averaged to classify the

tracks as a whole. The classifier accurately distinguished whether riders are wearing helmets or not on static pictures, according to the tests. The categorization approach's validity and utility are also demonstrated by tests on the tracking system.

Dharma Raj KC, et al., [21], processed the head protector violation using Deep Learning. According to the author, traffic accidents are one of the top causes of death. Motorcycle accidents are one of the most prevalent types of traffic collisions, and they often result in significant injuries. The rider's primary method of protection is a motorbike helmet. Motorcycle riders are required to wear helmets in most nations, although many people do not comply for a variety of reasons [7]. The paper discussed the development of a system that uses photo handling and deep CNNs to detect motorcyclists who are not wearing safety hats. The framework required cruiser identification, a protective cap vs no-head protection arrangement, and cruiser tag recognition [8]. The system obtained a high score based on its precision and quickness. The system has been placed in a number of locations in Bangkok and Phuket,Thailand, since 2016. According to preliminary data, motorcycle helmet laws are being followed more closely. Yogiraj Kulkarni, et al., [22],developed a programmed number platerecognition system for motorcyclistsriding without helmet. Motorcycleshave traditionally been the major modeof mobility in most of the countries. In latest years, there has been an upsurge in motorbike accidents. The incapacityof the rider to put on a

protecting helmet is one of the fundamental reasons of fatalities in bike accidents. Traffic officers manually inspect motorcyclists at street crossings or via CCTV photos and penalise those who do no longer put on a helmet. It

does, however, demand human involvement and effort. The paper provided an automatic method for detecting non-helmet motorcyclists in CCTV pictures and gathering their motorcycle licence plates. To get transferring items, the counselled method first got rid of the video's background.

Motorcyclists and non-motorcyclists were then classed as shifting objects. For categorised motorcyclists, the head issue was labelled as helmet or non-helmet.

Xinhua Jiang et al., [8] extracted facets with the use of a gray stage cooccurrence matrix and LBP. Jie Li and his buddies proposed an approach based totally on

Histograms of Oriented Gradients (HOG)highlights for recognizing pedestrianswith the use of SVM. Helmet discerning was the ultimate innovation. To differentiate helmets, Hou ghmodifications primarily based on shadingand circle adjustments are used [10]. Perceiving shading highlights is any other option. Shade spacing alternate and shading spotlight segregation had been used to make it less complicated to discover helmets.

3. PROPOSED WORK

The authors recommend a feature extraction approach primarily based on HOG. Various sorts of objects can be detected and categorized by the use of the YOLOv2 datasets. The supposed pursuits are motorcycles, motorcyclists, pedestrians, and employees. A motorcycle's helmet and tyres have several colors that needs to be noticed.

Combining a microcontroller and an accelerometer, two-wheeler accidents can be reduced. Pedestrians are often the actual victims of the accidents, so their safety is crucial.

In this work, whether a two-wheeler rider is wearing a helmet or not is figured out, and if he is not carrying a helmet, the twowheeler's number plateis retrieved. The

YOLO CNN mannequin with some annotation is used check images to extract a variety of number plates. The following modules are put into effect in the above strategy.

1) At first, the image is uploaded to the application and using YOLOV2 it is checked whether the image contains a person with a motorbike. If the YOLO model detects
2) In this module, the YOLOV3 model is used to detect whether the rider wears a helmet or not. If he wears a helmet, then the application will stop hearing itself. If the rider does not wear a helmet, then the application proceeds to step 3.
3) In this module, the number plate data is extracted using python Tesseract OCR

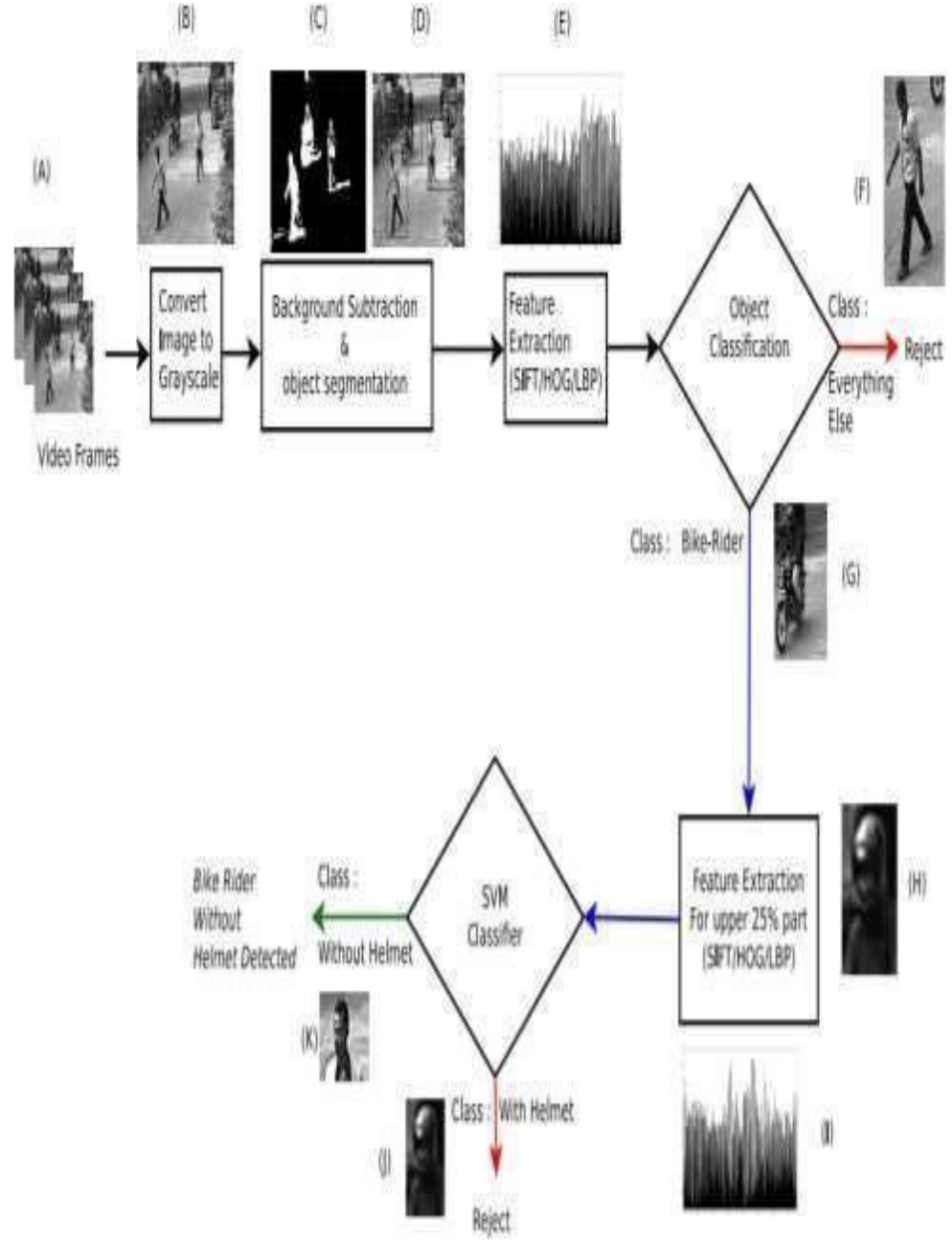

Fig. 1. Proposed approach for detection of bike-riders without helmet. A) Input frame sequence, B) A sample frame, C) Foreground mask for sample frame, D) Bounding box around foreground objects, E) Sample features of objects from D, F) Object classification as non-bike rider, G) Object classification as bike-rider, H) Localized head of the bike-rider, I) Sample Features of objects from H, J) Bike-rider classified as 'with helmet' class and, K) Bike-rider classified as 'without helmet' class.

Fig. 1 Framework of the proposed approach

Dataset Used to be the most well-known deep learning engineering. The immense renown and Own data has been acquired from the adequacy of convnets has sparked

a fresh monitoring system at Indian Institute of wave of interest in this profound learning. Technology, Hyderabad because there is no he interest in CNN began with AlexNet in public dataset accessible for this purpose.

2012, and it has grown significantly since The images are collected from 2 hours of then. Scientists went from an 8-layer surveillance data at a frame rate of 30 lexNet to a 152layer ResNet in just three frames per second. The first hour of years. footage is utilized to train the model and NN is becoming the go-to source for any the remaining time to test it. The training image-related topic. They eliminate rivalry video includes 42 bikes and 40 people. In in terms of precision. It's also useful for contrast, the testing video has 63 bikes and 66 people. recommender frameworks, regular language handling, and a variety of other applications [11][12]. The elements without the need for human fundamental advantage of CNN over its intervention. counterparts is that it detects the important

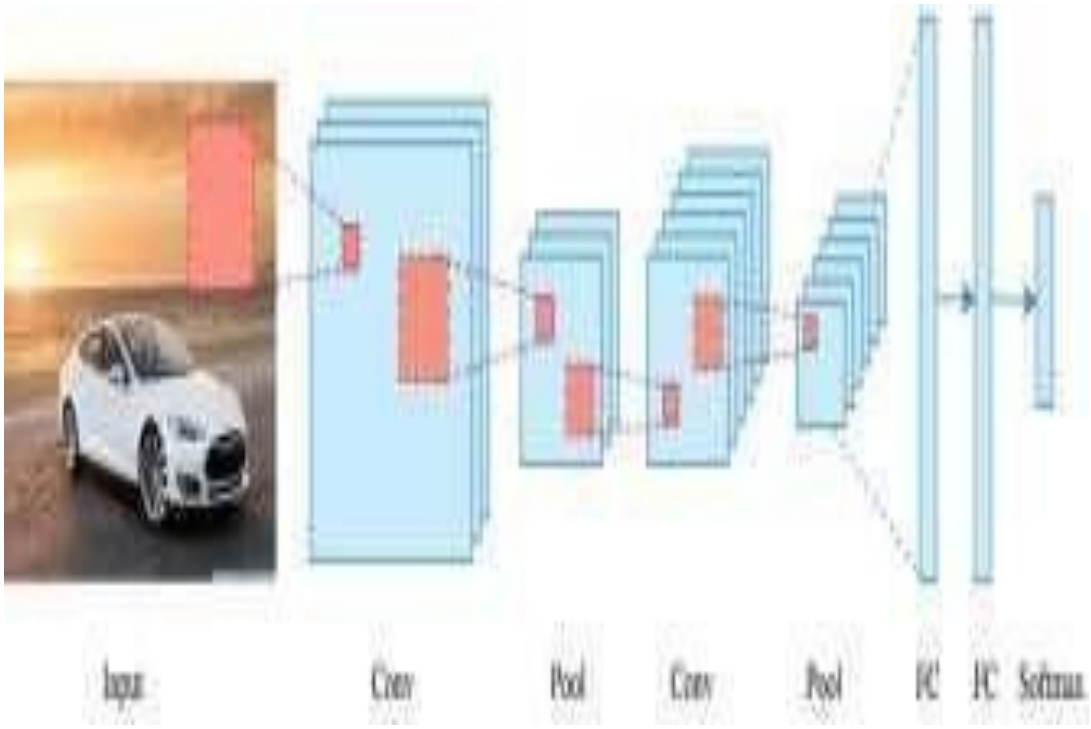

Fig 2: CNN Architecture

4.RESULTS

The below figure shows the screen page where the image is to be uploaded.

Fig. 3 'Upload Image' screen page

In the below figure, the screen page 'Open' button is clicked to load the where an image '5.png'

is selected and the image, has been shown.

Fig. 4 Screen page to open an image

Now, the 'Detect Motor Bike & Person' or not. Screen YOLO has detected that button is chosen to detect whether the the image contains person and bike as image contains a person with a motorbike depicted in the below figure.

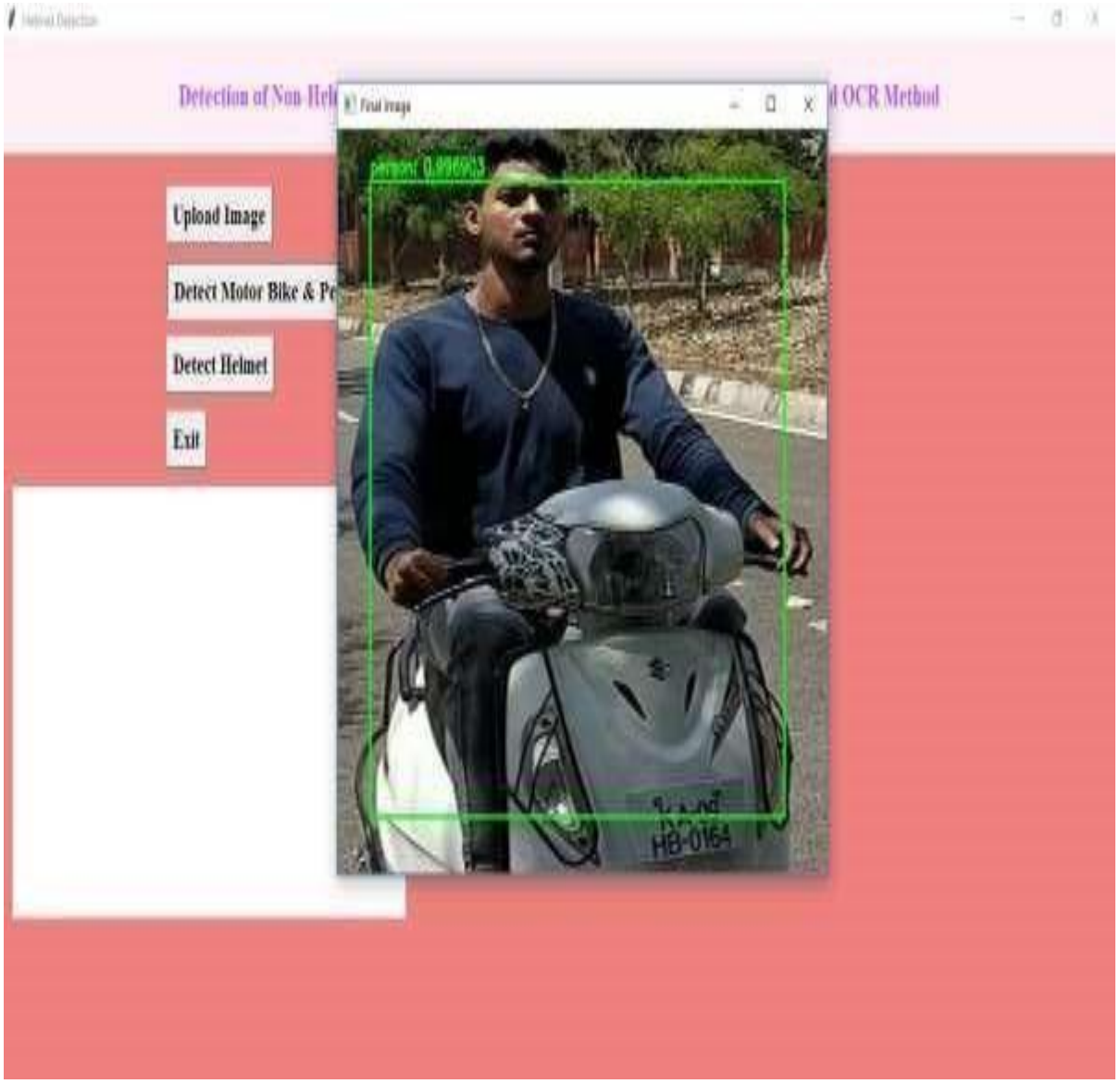

Fig. 5 Screen page where YOLO has detected the person and bike

Now the 'Detect Helmet' button is clicked person is not wearing a helmet and it has to detect whether he is wearing a helmet extracted the number from the vehicle's or not. The application detected that

number plate and has displayed it in the text area.

Fig. 6 Screen page displaying the vehicle number when no helmet is detected

The above procedure is repeated with another image where the person is wearing a helmet.

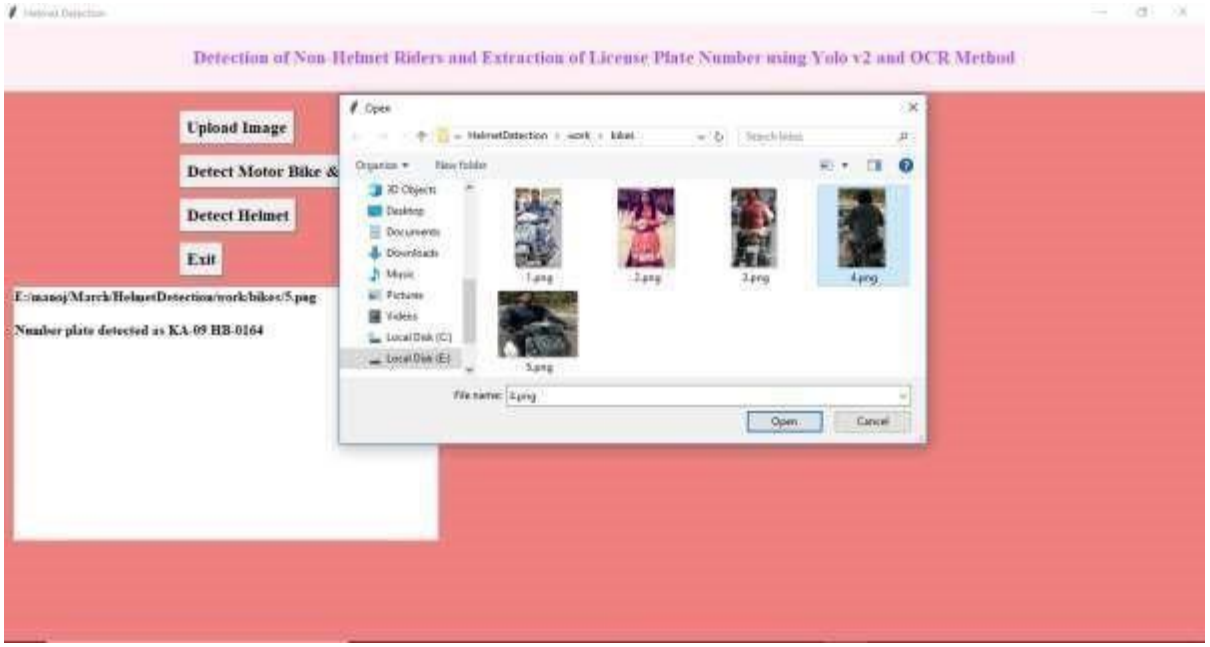

Fig. 7 'Upload Image' screen page

When uploading 4.png image, the YOLO helmet. application detects the person with the

Fig. 8 Screen page displaying the person with the helmet

In the above figure, it can be noticed that the vehicle number plate in not updated inthe text area since the image detected has the helmet.Thus this helmet detection system is trained in such a way to abide by the road safety rules of wearing helmets. The table below, discusses the accuracy various algorithms applied for helmet detection compared to that of the proposed system. that it captures all theviolators who fail carrying a helmet. The proposed system using YOLOv3 has

achieved an accuracy of 90.84% which isbetter than that of CNN, CNN basedMTL (Multi-Task Learning), YOLO and

Table 1: Accuracy of methods for helmet detection

Algorithm	Accuracy (in %)
YOLOv3 (proposed system)	90.84
YOLO [1]	81
CNN [2]	85
InceptionV3 [4]	81
CNN based MTL [10]	80.7

Inception V3. Therefore, all the project's desires have been met successfully.

5.CONCLUSION

In this paper, a Non-Helmet Rider Detection system has been proposed. object detection method of the YOLO structure is utilised to recognize motorcycles, people, helmets, and registration plates. The licence plate in a variety of the bikes from the digital camera clip is retrieved and displayed, by the use of Optical Persona Cognizance (OCR), if the rider is not

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