Detecting helmet using YOLOv2 and YOLOv3

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***Abstract*—In the current circumstances, we are confronted with a variety of traffic regulation issues in India, which can be addressed using a variety of approaches. Riding a motorbike or scooter without a helmet is a traffic offense in India that has resulted in an increase in the number of accidents and deaths. The current system largely monitors traffic offenses through CCTV records, in which traffic cops must zoom into the frame where the traffic infraction is occurring and look if the rider is not wearing a helmet. However, because traffic offenses are common and the number of persons riding bikes is growing by the day, this will take a lot of labor and time. What if there is a system, which would automatically look for traffic violation of not wearing helmet while riding motorcycle/moped. Recent research has successfully completed this task using CNN, R-CNN, LBP, HoG, HaaR, and other characteristics. However, these efforts are limited in terms of efficiency, precision, and the speed with which objects are detected and classified. A Non-Helmet Rider Detection System is constructed in this study effort in order to satisfy the automation of detecting the traffic infringement of not wearing a helmet.**

I. INTRODUCTION

According to a study published by the World Health Organization titled "The Global Status Report on Road Safety 2018," about 1.35 million people die and 50 million people are injured each year due to road accidents around the world. In order to save lives, a detailed action plan must be developed, according to this report. The fact that India ranks first in terms of road accident deaths is concerning. According to expert research, rapid urbanization, the avoidance of helmets, seat belts, and other safety measures while driving are some of the reasons for this trend. India signed the Brasilia Declaration on Road Safety in 2015, pledging to reduce road accident deaths by half by 2020. When a two- wheeler is involved in an accident, the rider is thrown from the vehicle due to sudden deceleration. When the head collides with something, the motion of the head stops, but the brain continues to move due to its own mass until the object reaches the inner part of the skull.

This form of head injury can be fatal in some cases. Helmets save lives in such situations. Helmets limit the risk of the skull decelerating, thereby reducing head motion to almost zero. The force of a collision is absorbed by the cushion within the helmet, and as time passes, the head comes to a stop. It also disperses the effect over a wider area, protecting the head from serious injuries. It also serves as a mechanical barrier between the rider's head and the object with which he or she came into contact. If a good quality full helmet is worn, injuries can be reduced.

II. LITERATURE REVIEW

A helmet detection process involves some steps such as moving object detection, background subtraction, collection of data set, object classification using neural networks [1] used the YOLOv3 target detection algorithm which is based on a Gaussian fuzzy data augmentation approach to process the data set and improve it. Algorithm for detecting targets in one step The SSD (Single Shot Multi-Box Detector) and YOLO algorithms, such as YOLO, YOLOv2, and YOLOv3, are representative, with YOLOv3 being the most effective. An image pyramid pattern based on YOLOv3 is used to acquire feature maps at various scales, and multi- scale training is used to increase accuracy. To improve the model's adaptability and the efficiency and accuracy of helmet detection Both traditional and deep learning-based methods have shown to be effective in detecting helmet wear, but there are issues with reduced accuracy and difficulty improving the upper limit of accuracy for unbalanced datasets [2] used YOLOv2 at first level to detect objects like person, 2-wheeler. At second level used YOLOv3 to detect helmet and at last level used YOLOv2 to detect license plate. After that used OCR (Optical Character Recognition) for extracting the license plate registration number. All of these techniques, particularly the license plate number extraction part, are subjected to predefined conditions and constraints. The speed with which this work is completed is critical because it uses video as its input. They built a holistic system for both helmet detection and license plate number extraction using the methodologies mentioned above [3] used KNN classifier for moving object extraction and classification. Following that, projection profiling is used to count and segment the heads of the riders on the identified motorcycle. Other techniques for object detection like a single- object class detector that has been especially trained to recognize occluded objects from numerous views that have been obscured by a variety of occludes and an explicitly trained hierarchical double-object detector for accurate occlude bounding box localization[4]. Moving objects can be detected using adaptive background subtraction [5]. ViBe background modelling algorithm can also be applied to detect motion objects[6]. Canny edge detection algorithm is

used to get segmented moving objects[7]. [8][9] proposed a methodology for feature extraction using LBP based hybrid descriptor, HOG and Hough transform descriptors. Whereas [6] incorporated grey level co-occurrence matrix along with LBP for feature extraction. YOLOv2 and COCO dataset can be employed to detect different types of objects and classify them accordingly[10]. The intended objects are motorcycle, motorcyclists, pedestrians and workers. Helmet and tyre colour exhibits different characteristics, this can be exploited to detect motorbikes[11]. [12] used background subtraction and object segmentation in order to detect the bike rider. Others used CNN to select motorcyclists only [5][2]. Wearing helmet in construction sites is an important safety measure. For that HOG can be used[13]. [6] deployed colour space transformation and colour feature discrimination for detecting the helmet. GLCM statistical features and Back- Propagation artificial neural network is used to detect helmet more effectively [14].

III. PRESENT RESCENT RESEARCH QUESTION

The aim of traffic rules is to maintain a sense of order such that the risk of fatalities and injuries is dramatically reduced. In practice, however, strict adherence to these laws is rare. As a result, effective and practical solutions to these issues must be devised. A method for manually monitoring traffic using CCTV already exists. However, in order to achieve the goal, a large number of iterations must be completed, which necessitates a large amount of human resources. As a result, cities with millions of people and a large number of vehicles on the road cannot continue to use this ineffective manual form of helmet detection. So here we propose a methodology for full helmet detection using YOLOv2, YOLOv3.

IV. RESEARCH METHODOLOGY

Speed and accuracy are required for real-time helmet detection. As a result, the DNN-based model YOLO (You Only Look Once) was chosen. This algorithm detects a variety of objects in real time. Object detection in YOLO is done as a regression problem, and the identified photos' class probabilities are provided. It is necessary to construct a custom object detection model capable of identifying helmets in order to implement helmet detection. For this, we'll require a set of photos containing the objects of the classes to be detected, and we'll be able to extract useful information based on the data's features, which will help us generate a better training dataset. The authors of [8] presented a method called background subtraction to remove moving objects and classify them using characteristics extracted using Local Binary Pattern[15]. To detect the item, background subtraction is also proposed, followed by connected component labelling to segment the item. The labelling of the dataset that can be used to train the custom model in Fig 1.

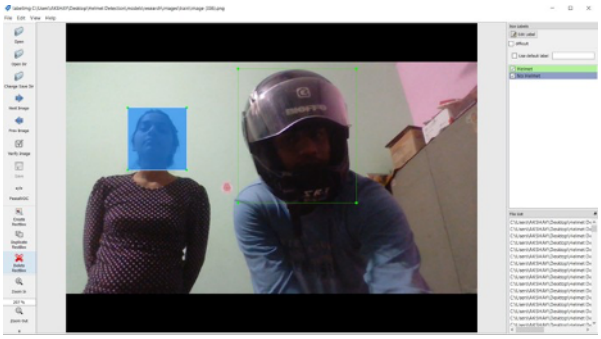

Fig. 1.

A. Helmet Detection

After obtaining the motorbike picture, the top 1/5 of the image is cropped to create the helmet selection displayed in fig 2 and fig 3 then classified using HOG, Hough Transform, and LBP descriptors.

Fig. 2. Cropped Image

Fig. 3. Cropped Image

With advancements in computer vision technology, a CNN-based LP extraction for non-helmet bikers was presented, based on a circular arc detection method based on the modified Hough transform for the detection of a helmet. They employed two YOLOv2 models for motorcyclist and helmet detection in this technique, as illustrated in fig 4.

Fig. 4.

B. System Overview

Figure 2 depicts the flow chart that we have used in this paper. We utilized YOLOv2 to identify LP in real time for a non-helmeted motorcycle rider. The video frame is utilized as an input video in this system, after which the Background Subtraction approach is utilized to detect the object, followed by blob analysis to detect the moving object. In addition, if the object is not a two-wheeler, the procedure will stop existing, however if the object is a two-wheeler, the process will continue and crop the head region. If the rider is wearing a helmet, the outcome will be 'Rider is wearing a helmet,' and if the rider is not wearing a helmet, the process will end.

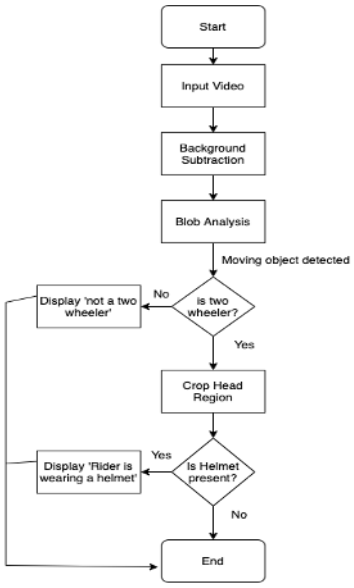

Fig. 5. Flow Chart

V. RESULT

Firstly, based on helmet wearing detection requirement, four typical image scenes of driving vehicle with and without helmet and test with different scale network model are selected. The detection results of YOLOv2 are shown below.

Fig. 6. Image 1

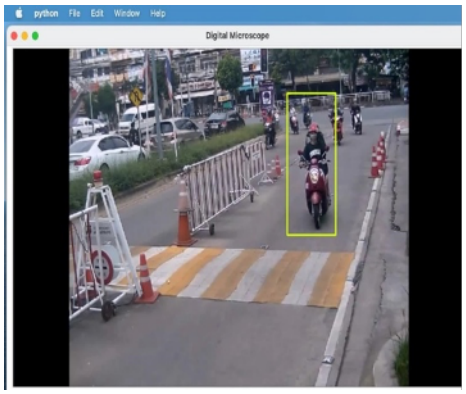

Fig. 7. Image 2

Fig. 8. Image 3

Fig. 9. Image 4

As can be observed from the above result, the outcome of helmet detection is accurate in many locations and settings. Image 1 and 2 illustrate the detection result at a random location and on a main route, respectively, and the result of helmet detection is correct in both circumstances. In image 3, both people are wearing helmets, and it detects them, however in image 4, just the second person is wearing a helmet, and the person driving the two-wheeler is not. It does not detect the person in this scenario.

This research examines the effect for single object detection, multi-object detection, and complex scenario detection based on the conclusion that YOLOv2 has the best overall accuracy.

VI. DISCUSSION

There are loop holes in human surveillance because of increasing day-to-day traffic. The traffic police cannot control each and every vehicle on the street, and individuals use them and breach regulations by not wearing a helmet. So an Automated System is needed in order to identify moving traffic helmets. So our system mainly employs computer vision algorithms for detection utilizing YOLOv2, YOLOv3.

A. Comparison with work of others

TITLE OF THE PAPER	PROPOSED METHODOLOGY	ADVANTAGES	FUTURE SCOPE
Cascade Classifier based Helmet detection using OpenCV in Image Processing **Shreya Bhagat, Dhwani Contractor, Sonali Sharma, Tanu Sharma, Ketki C.Pathak** **Electronics and Communicatio n Department Sarvajanik College of Engineering and Technology** **Surat, India**[16]	This paper presents the technique by which motorcyclists without helmet are detected. In this technique moving vehicles are detected by thresholding and then classified into motorcyclist & non-motorcyclist by area and aspect ratio. To detect helmet first ROI is determined and by cascade classifier without helmet are detected.	This technique will also be a great aid to traffic police hence ultimately reducing mortality rate due to accidents of motorcyclists.	Neural networks and deep learning can perform the same thing, which will make things easier.

Fig. 10. Paper 1

A Hybrid Approach for Helmet Detection for Riders Safety using Image Processing, Machine Learning, Artificial Intelligence **M. Swapna Research Schola,Tahniyath Wajeeh, Shaziya Jabeen, CSE** **International Journal of Computer Applications January 2019**[17]	This paper presents image processing technique by which motorcyclists without helmet can be detected. If in case motorcyclist is detected without a helmet, the number plate of motorcycle is read and noted. The recognition of number plate algorithm has five parts: image procurement, preliminary processing, fringe detection and segmentation, feature extraction and recognition of character number plates using suitable machine learning algorithms.	It generates a database of all bike riders driving without wearing a helmet along a snapshot for proof. Use of open and free technologies like tensorflow, OpenCV and tesseract makes the software relatively less expensive.	This project can be further improved by implementing advanced safety measures like to check collision detection, capturing images of vehicles with who breaks the rule by riding with high speed, capturing images of drivers while talking on phone and driving.

Fig. 11. Paper 2

An improved helmet detection method for YOLOv3 on an unbalanced dataset **Rui Geng , Yixuan Ma , Wanhong Huang, University of Technology Dalian, China** [1]	The YOLOv3 target detection algorithm is based on a Gaussian fuzzy data augmentation approach to preprocess the data set and improve the YOLOv3 target detection algorithm. We first perform feature extraction to determine the distribution and mathematical characteristics of the dataset; then we build YOLOv3 on Mxnet for training on PC; then we use a test set of 689 images with a size of 95.4 MB provided by the competition, and finally, we export the test results to a txt file.	The YOLOv3 target detection algorithm is widely used in industry due to its high speed and high accuracy.	For problems where there is not enough light in the production situation and the target occupies a small frame, we can improve algorithms such as YOLOv3 or Faster RCNN for processing such as feature fusion, multiscale detection, and increasing the number of anchor points.

Fig. 12. Paper 2

VII. SCHEDULE

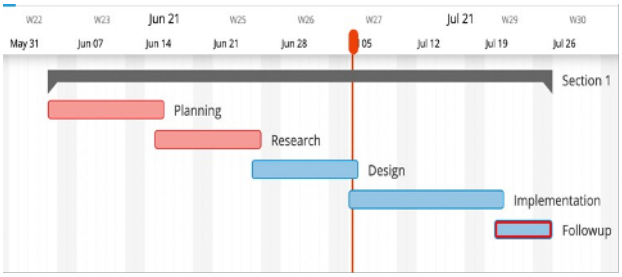

Fig. 13. Work Schedule

VIII. CONCLUSION

A video file is used as input for a Helmet Detection system that is being developed. The motorcyclist will be detected if he or she is wearing a helmet while riding the motorcycle in the video footage. For the motorcycle, person, and helmet, the object detection principle with YOLO architecture is employed. The project's objectives have all been met satisfactorily.

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