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SafeLid Vision: Machine Learning for Helmet Detection

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ABSTRACT

With the development of large vehicles, traffic accidents have become a big problem in big cities. The law in India currently faces many problems that can be solved in different ways. Riding a motorcycle without a helmet is illegal and leads to accidents and deaths in India. The current system only uses CCTV footage to monitor traffic violations. When a passenger is not wearing a helmet, the traffic police must zoom in on the driver's license and see the violated frame. Combine integration and distribution to create a way to find helmets. An important but overlooked task is finding a helmet. It is important for many applications. It is important for many applications, including vehicle maintenance. The three steps of our planning strategy are prioritization, extraction, and classification. This research examines various techniques and strategies used to achieve goals. Recent works include CNN, R-CNN, LBP, HoG, HaaR, etc. successfully completed this task using the features

Keywords— CNN, ORC, YOLO3, Machine Learning, Helmet Detection.

INTRODUCTION

Indian law requires motorcycle riders to wear helmets. Additionally, wearing a helmet is important for the safety of the motorcycle rider. Until now, it was the traffic police's responsibility to ensure that cyclists wore helmets. But the limitations of people's minds and the limitations of the police make the idea of tracking cyclists a bad idea. Major cities are also adopting technology based on CCTV surveillance. However, these are not automatic and require human assistance .Research in the field of transportation has increased due to the existence of motorcycles and concerns about human safety. This research proposes a system that can work on passenger monitoring. When the system detects that the driver is not wearing a helmet, the motorcycle license is withdrawn. The technology uses machine learning to detect helmetless drivers and instantly obtain driver's licenses from CCTV footage at intersections. One of the key components of computer vision algorithms is recognition and tracking. A fixed target is difficult due to different positions. Tracking objects under occlusion poses another important problem. Therefore, the technology uses the TensorFlow object detection API to detect moving objects. The purpose of traffic laws is to reduce the likelihood of death and serious injury by promoting discipline. Object recognition applications using convolutional neural networks (CNN) are very common. Due to its effectiveness, CNN has become the first choice in the fields of image classification, object recognition, character recognition and data retrieval. Due to computational complexity, boundary-based neural networks are not suitable for immediate use. The main results of the research are removal of motion blur in images using Weiner filter to improve output efficiency, driver's license recognition and character recognition in images using YOLO. The following prove its importance Features of YOLO algorithm: < br> Speed: By predicting the target in real time, this method increases the detection speed High accuracy: Yolo is a prediction method with low error; get accurate results. Learning ability: The algorithm can learn the object representation with its best learning and use it for object detection. The object tracking algorithm then retrieves the location of the found object. Dynamic target detection is done using the YOLO-based target detection method. The shot can describe objects in various lighting and shading. The frame usually provides information about the front and back. Matching the vehicle's license plate with the data is another important purpose in detecting stolen vehicles and creating challans. If the two license plates match, the vehicle will be stolen. Then send a message to the administrator with the most current address. Helmet identification is an important aspect of road safety. It involves using computer vision to determine whether cyclists and cyclists are wearing helmets on the road. Technology plays an important role in promoting safe driving and reducing the risk of head injury during an accident. License plate recognition, also known as license plate

recognition, is an application that uses optical character recognition (OCR) to read and interpret driver license plates. The device can be used for many purposes such as law enforcement, license plate collection, parking control and vehicle tracking. It helps in identifying and maintaining the right and correct tools. Penalties are fines or fees paid to individuals or organizations that violate traffic laws and regulations. These fees are usually imposed by electronic systems that can detect violations such

LITERATURE SURVEY

2.1 SURVEY EXISTING SYSTEM

Rayson et al proposed an automatic license agreement with a recognition rate of 96.8%. [3]. The YOLO algorithm also forms the basis of this study. Thanks to its high frame rate per second (FPS), it can identify four cars simultaneously in one scene. Some environmental changes, such as traffic, poor lighting and bad weather conditions, can affect the appearance of the license plate. Taking these changes into account, Hsu et al. [4] developed an in-depth study of license plate authentication based on YOLO and its YOLO-9000 model. For better results, Abdussalam et al. [5] Before using deep learning for license plate searching, images are first processed through tilt search and correction. The MDYOLO framework is based on neural networks proposed by Lele Xie et al. [6]. A comprehensive and rapid integration method of angular rotation estimation is provided for real-world situations involving complex rotations.

The first electronic system proposed and tested to detect vulnerable drivers was made by Chiverton [3]. The system uses an SVM classifier that learns features of images near drivers' heads. The features were chosen to capture the shape and characteristics of the helmet, with half of the helmet's surface being brighter than the other half. It also takes into account the arch shape of the helmet. This system uses an arc detection tool based on the Hough transform [20]. The biggest disadvantage of this method is that it causes many errors, because some products that resemble helmets are classified as helmets, while some helmets are classified with different numbers. Another limitation is that the driver is not identified in the first frame, which is necessary because helmets only affect passengers**.**

Thirty classes of convolutional neural networks trained by Pan Gau et al. [12], instant licensing opportunity was found. The advantages of embedded networks and dense neural networks are mixed. RDNet is a well-designed and efficient system for validating licenses. Diego M. F et al. [13] used the small YOLOv3 architecture to identify and verify the Brazilian license. The second convolutional network is used for character recognition and optimization using real license images and trained using synthetic data. Weishan Zhang et al. Application has been made for the ability to obtain technology knowledge certification and licensing. [14]. In this method, YOLO network is used to find the license plate, and CNN with multiple labels is used to complete the license plate recognition.

Vitalii Varkentin and colleagues achieved an accuracy of 73%. [15] used a YOLO-based method for license plate authentication and authentication. Using YOLO V2 convolutional neural network to identify license plate and helmetless passenger [17]. MJ Prajwal et al. described various combinations of neural network algorithms for helmet detection and license plate verification [16]. In this application, the invisible function of the entrance image is due to advertising. Motion blur can be removed from images using the Wiener filter and point spread function. A custom dataset was created from various Indian font characters. The data set is converted to the appropriate format and fed into the neural network, which will identify the individual font. High results are achieved by combining the YOLO V3 model to obtain the region of interest, which is passed to neural network training to detect the presence of marks.

License Plate Recognition and Vehicle Identification: The system can recognize and verify the license plate number of each vehicle captured on the front camera. Character recognition, character analysis and licensing license extraction are its threemain functions. Stolen vehicles can be located by comparing them with the RTO's stolen vehicles.

Then it will send SMS to the administrator

For automatic vehicle license number plate recognition, one of the most recent work was by B. V. Kakani et al. [16]. Their approach was based on improved Optical Character Recognition (OCR) using neural network. The steps involved were locatingnumber plate, segmenting individual characters and then applying OCR on the characters.

2.2.1 Problem Statement

Create a system that can check whether the motorcycle driver is wearing a helmet and verify his license plate. The system should be able to collect fines from those who violate the helmet law or have registration problems. The aim is to improve

road safety and increase the effectiveness of lawenforcement..

PROPOSED SYSTEM

3.1 The system concept has separate modules that determine the functionality of the system.

1. Real-time camera images: Images of the vehicle captured by CCTV or camera.

2. Check for the presence of bikes: CNN distributors then took these images as input and divided them into two groups: cyclists and non-bikers. Non-cycling items have been removed, leaving only items expected to be cycling.

3. Helmet detection: Using another CNN classifier, we detect whether the motorcycle driver is wearing a helmet. Assuming the head is at the top of the image, we place it in the upper quadrant of the image. A second CNN was then trained to distinguish between helmeted and unhelmeted drivers. According to the strategy, the knight took the position of head. Haar Cascades uses machine learning techniques to train functions on positive and negative images. This process in the algorithm is feature extraction. In feature extraction, algorithms use training data to determine the best features that can be considered as faces. Here we take a photo of a cyclist as input and then determine whether the rider is wearing a helmet. Determines whether the hat is worn or not using the Haar Cascade method Otherwise, the process ends. If not, the license document is scanned using text recognition and OCR technology and a receipt inquiry is created.

3. Check the license in the captured image: To verify the license in the image, we must use the input image as input. We also presented the work permit application form for permit control.

4. Character Segmentation: This method uses character segmentation where we break down each character of the plate into their numbers and symbols to determine the pattern of characters. We also run character recognition. 6. Character recognition: We use OpenCV and optical character recognition to use all the characters in the image and recognize the characters using the license and license from the image.

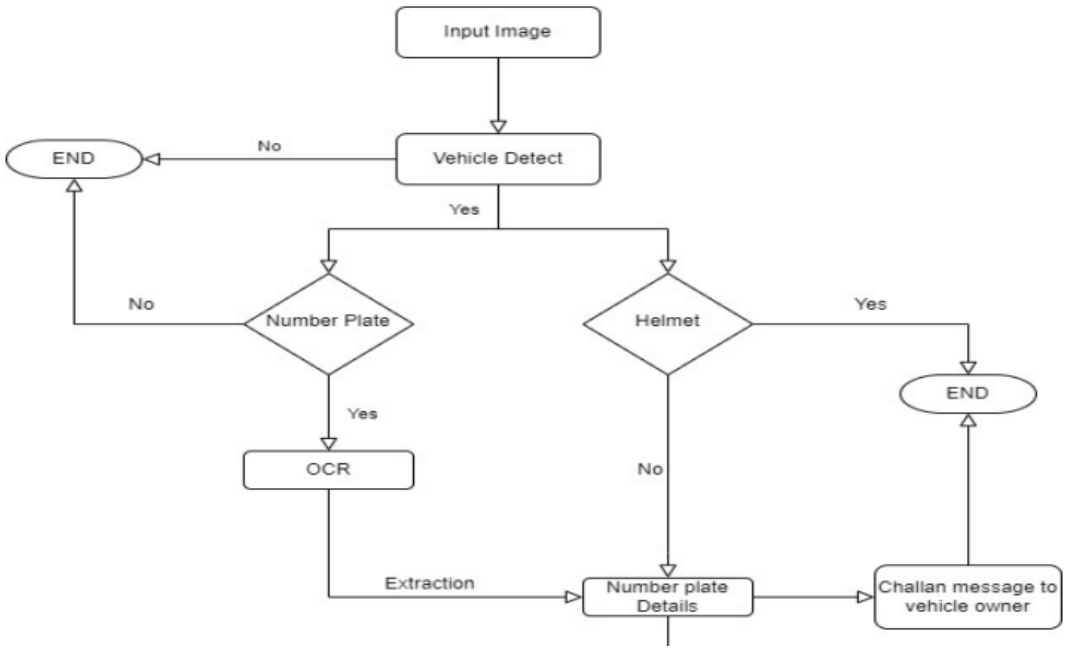

Fig 3.1 –Flowchart of how the model works

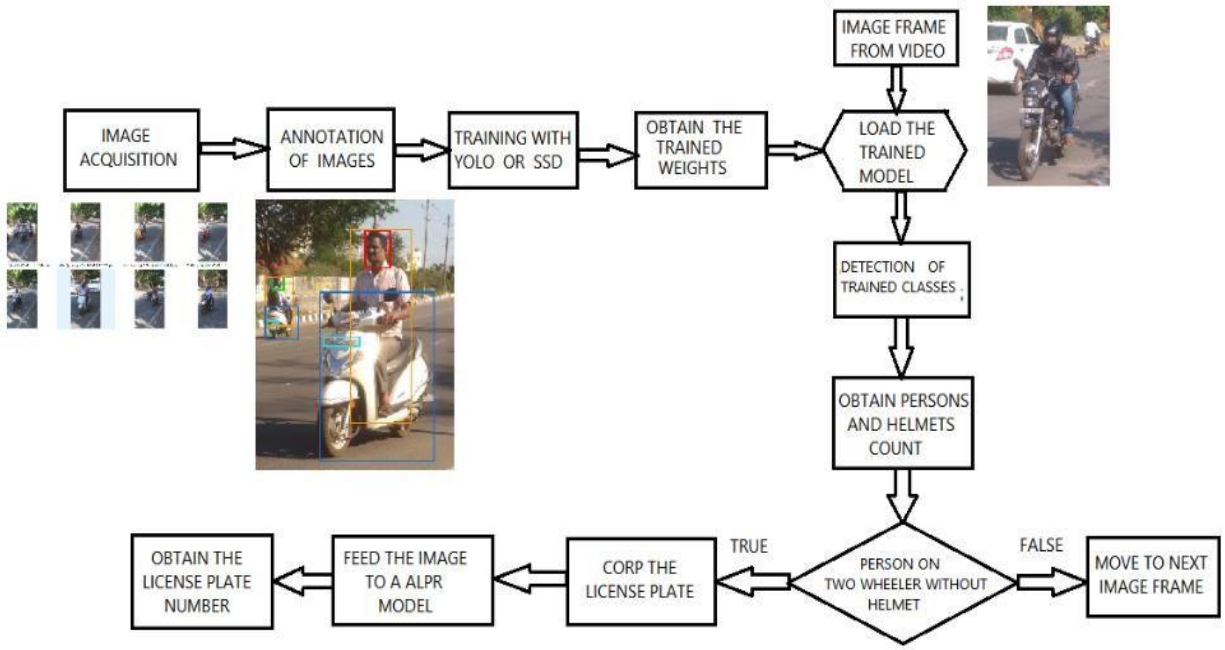

Fig – 3.2 Detection Cycle

3.2 DETAILS OF HARDWARE AND SOFTWARE

3.2.1 Software Requirements

- Language: Python
- IDE: Jupiter notebook
- Tools: Machine Learning, CNN, Tensorflow, Yolo, OpenCV ,numpy Pandas
- OCR: Easy OCR
- Database: MySQL

3.2.2 Hardware Requirements

- Processor: Intel i3/i5
- RAM: 4GB or more 512 GB HDD

ALGORITHM USED

4.1 CNN:

A convolutional neural network is a deep learning method that uses images as input and assigns importance (i.e. weight and bias) to various features or objects in the image and different capabilities. This algorithm requires more prioritization than other classification algorithms. There are many other neural networks that can be used for detection in deep learning, but for recognizing and identifying objects the CNN algorithm is the preferred network architecture. This makes them ideal for computer vision tasks and applications where object recognition is critical, such asdriverless cars and facial recognition. Here's a simple explanation of how CNN is used for helmet testing:

Data collection: First collect image data with good examples (images with helmets on) and negative examples (images without helmets). Preprocessing: Resize all images to be the same, convert to grayscale or RGB format as necessary, and normalize pixel values to a ratio (usually between 0 and 1). CNN architecture for helmet detection. Typically this involves stacking convolutional layers to extract features from the image and then pooling the layers. You can include other layers, such as layers for continuous processing and full layers for distribution. The training method is used to

train the CNN by feeding the network image and adjusting the weight of the network as the error (difference between predicted and actual text). Use validation techniques to tune hyperparameters and prevent overfitting. Metrics such as precision, accuracy, recall, and F1 score can be used to evaluate how well the CNN detects helmets. helmet. This is often used to train models in an application or process that processes real-time or batch data.

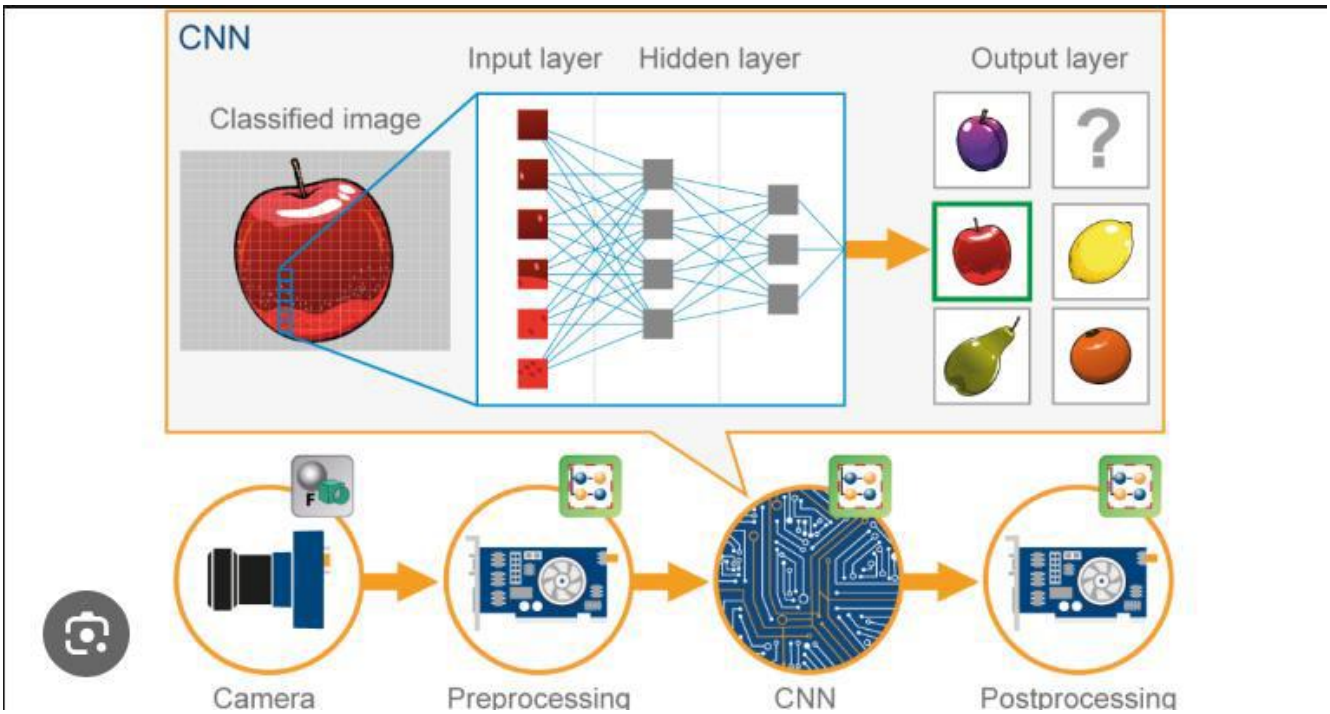

Fig 4.1 – Image Classification using CNN

4.2 OCR:

OCR (Optical Character Recognition) is often used to recognize and extract text from images or documents. This isn't directly related to checking the helmet, but if you want to use OCR when checking the text on the helmet (like a serial number or label), here's how it works: Image Preprocessing: Step One of these is to create a front image of the helmet and paper. This may include resizing the image, converting it to grayscale, applying filters to reduce noise, and increasing contrast to improve visuals. In the picture. Text analysis may rely on techniques such as edge detection, visual analysis, or deep learning to identify regions of interest (ROIs) that may contain text. For helmets, this may include finding the serial number or the area where the label will always be located. OCR technology can range from traditional methods such as pattern matching and inference to deeper learning-based methods such as convolutional recurrent neural networks (CRNN) or Transformer-based models such as BERT for text. Post-processing: Once text is recognized after OCR, post-processing steps can be used to improve accuracy and correct errors. This may include spelling, grammar, or content correction if the OCR system misunderstands certain characters. For example, if the goal is to identify helmets with a specific number or label, the extracted text can be compared to a library or a pre-ordered list to determine whether the helmet meets the standard. OCR is more difficult than traditional OCR functions because it not only recognizes text but also finds the position of the text on the helmet. Additionally, factors such as text size, font, orientation, and background compression will affect OCR performance, and special equipment is required to achieve good readable text.

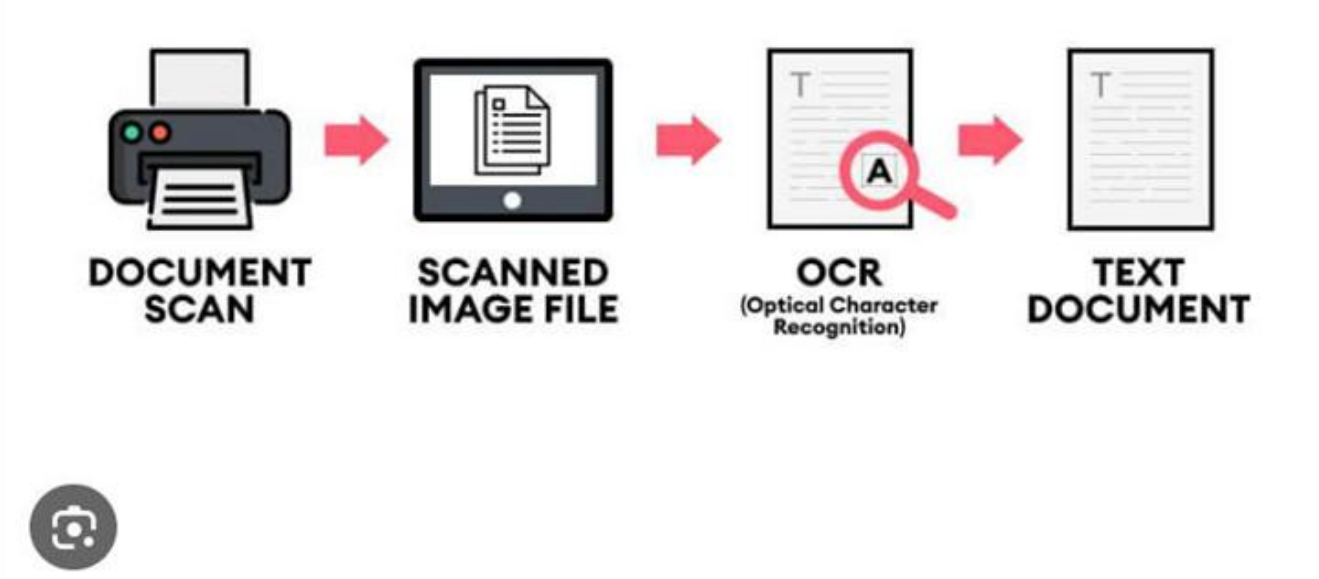

Fig – Text Recognition using OCR (Used for Number Plate Detection)

4.3 YOLO:

YOLO is the meaning of the phrase "You're Only Seeing the One". This is an algorithm that captures and identifies (on the fly) multiple objects in images. Object detection in YOLO is done as a regression problem and provides the resulting classes of observed images. The YOLO algorithm uses convolutional neural networks (CNN) to detectobjects in real time. As the name suggests, this algorithm only needs to go one step further than the neural network to identify objects. This means that all images are predicted in a single algorithm run. CNN is used to predict multiple class features and bounding boxes simultaneously. There are many variations of the YOLO algorithm. Some include the smaller YOLO and YOLO4.

Grid Cells - The image is divided into S x S grid cells. Each grid cell has n anchors whose locations are in the grid cell. The S value can be any number, but the most common cell line value is 13 x 13, as shown in Figure 1, and for larger images of many items that need to be checked, makes 19x19.

Fig - 13x13 Grid cells

RESULTS

Fig – 5.1 Input Image

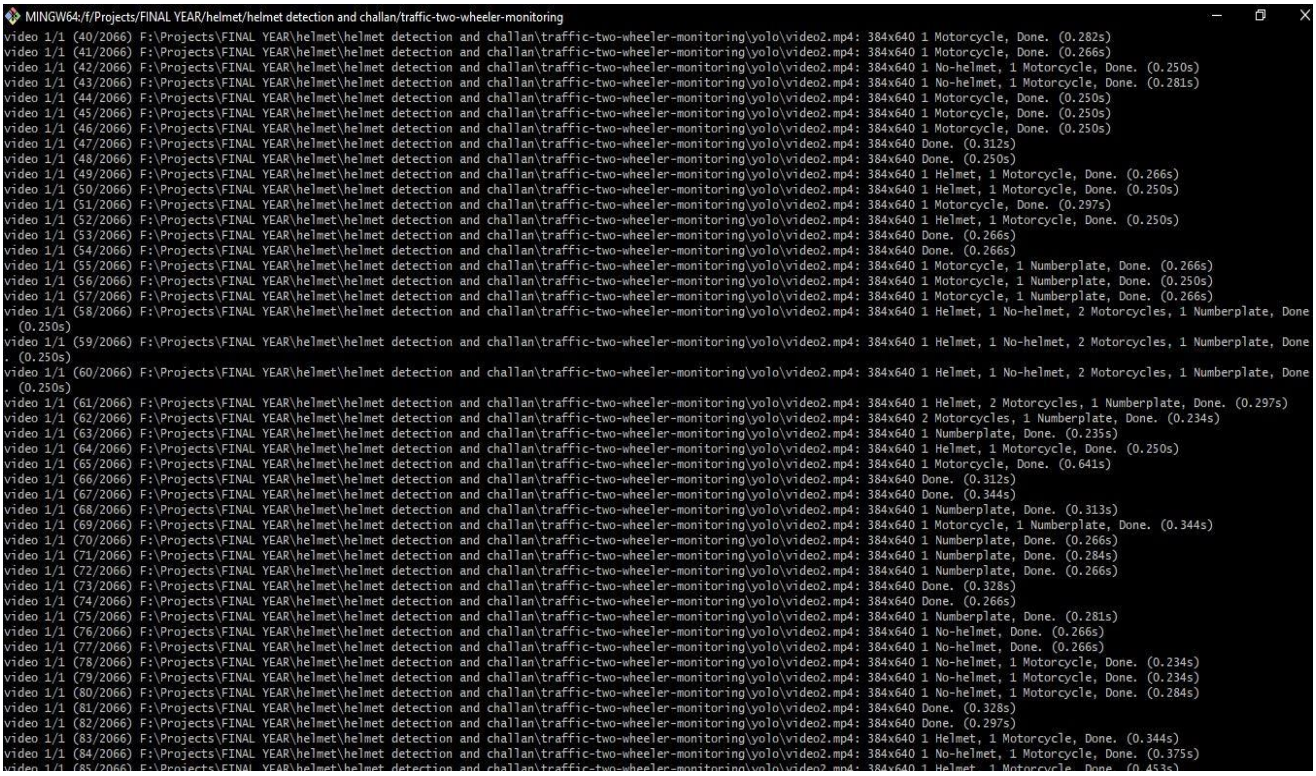

Fig 5.2 – Server Log

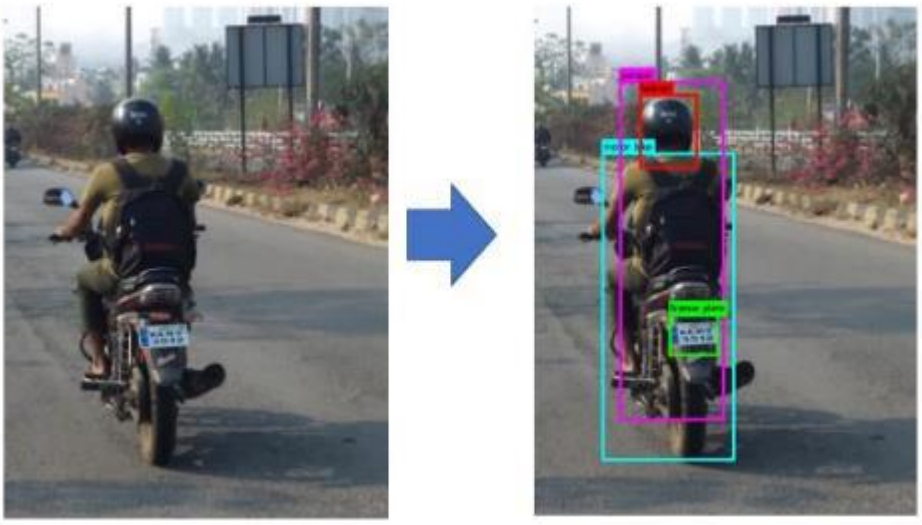

Fig – 5.3 Helmet detected

Fig – 5.3 Helmet detected

Plate #1

	Plate	Confidence
-	KA41EM0395	89.353058
-	KA41M0395	80.161301
-	KA416M0395	79.876579
-	KA41KM0395	79.874893
-	KA41BM0395	79.874687

Fig 5.4 – Number Plate Detected

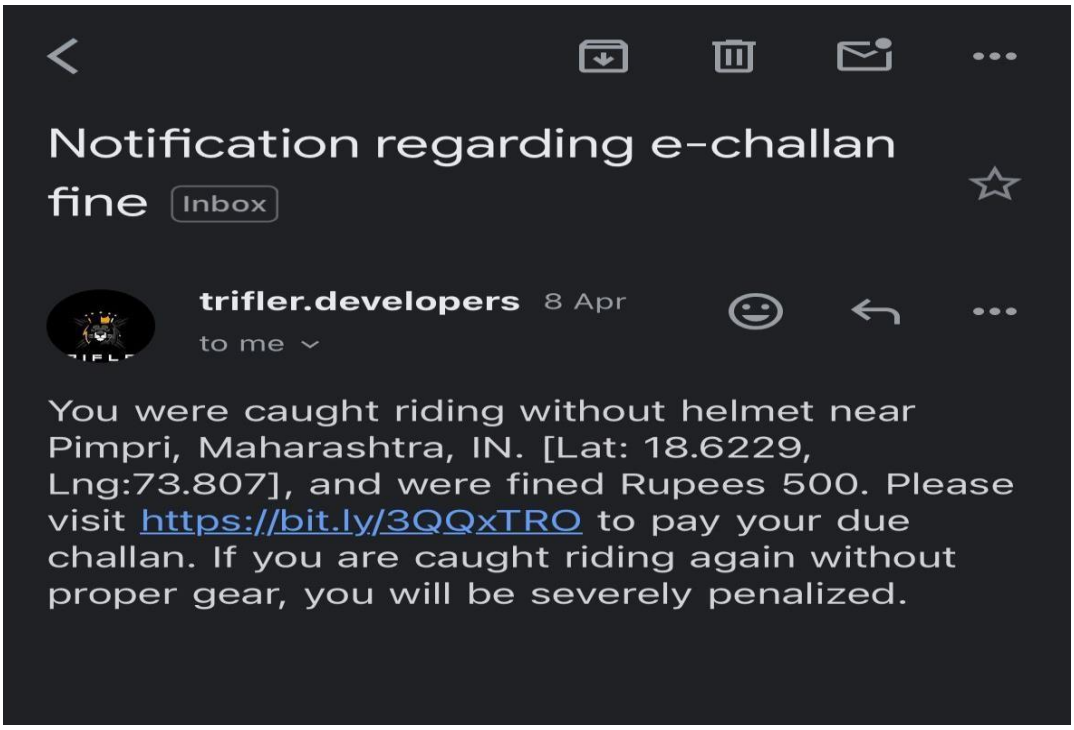

Fig 5 – Penalty Charged

CONCLUSION

In this study, we show the principles of detecting helmetless cyclists in CCTV images and obtaining a license for their vehicles. Using convolutional neural networks (CNN) with transfer learning enables accurate detection of helmetless cyclists.

But just identifying these passengers is not enough to file a lawsuit against them. Therefore, the system will also recognize and store the motorcycle's driver's license. The transportation agency can use the license repository to access its database of license vehicles and obtain information about drivers. Cyclists who show concern may be fined. We also learned how to create challan and catch stolen vehicles. Proposed a framework for automatic detection of a helmet rider using a background variable that is incompatible with various challenges (lighting, bad video, etc.). Deep learning that learns to discriminate represents the classification of tasks, improving search results and providing higher confidence by reducing negativities. Tests performed on real videos detected -92.87% of criminals in two real video frames, and the false positive rate dropped to -0.50% which shows how well the plan was made From the results shown above, it is clear that YOLO object detection is well-suited for flight operations and can identify and describe all objects. The end-to-end concept is fully complete with all features for automation and deployment for analysis. To obtain the license number, different situations are taken into account, such as many passengers not wearing helmets, and some strategies are adopted and developed to deal with most situations. Since all libraries and software used in our projects are open source, they are flexible and useful. This project is solely aimed at solving the problem of lack of traffic management skills. So finally we can say that if it is used by a traffic control center, it will make their job easier and work better

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