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Helmet, Number Plate Detection and Stolen vehicle recognition using Machine Learning

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***Abstract* -- Traffic congestion is one of the major problem in major cities due to increase in number of vehicles. In current situation, we come across various problems in traffic regulations in India which can be solved with different ideas. Riding motorcycle without wearing helmet is a traffic violation which has resulted in increase in number of accidents and deaths in India. Existing system monitors the traffic violations primarily through CCTV recordings, where the traffic police have to look into the frame where the traffic violation is happening, zoom into the license plate in case rider is not wearing helmet Helmet detection method is a combination of classification and cluster. Helmet detection is an important, yet challenging vision task. It is a critical part in many applications such as traffic surveillance. Our proposed method work is as follows, Pre-processing, Feature Extraction and classification. In this paper the survey is done on many methods and technologies used to perform the objectives. Recent research has successfully done this work based on CNN, R-CNN, LBP, HoG, HaaR features, etc. In this research work, a Non-Helmet Rider detection system is built which attempts to satisfy the automation of detecting the traffic violation of not wearing helmet and extracting the vehicles' license plate number. The main principle involved is Object Detection using Deep Learning at three levels. The objects detected are person with motorcycle at first level using YOLOv3, helmet at second level using YOLOv5, License plate at the last level using YOLOv3. Then the license plate registration number is extracted using OCR (Optical Character Recognition). All this techniques is useful to detect the stolen vehicle from the database and using this traffic police officer would know about the stolen vehicle. Using this system officer are able to track the stolen vehicle using location report.**

Keywords - Helmet Detection, Number plate Detection, Stolen Vehicle Identification.

I. INTRODUCTION

In India, wearing helmet for motorcyclists is mandatory by law. Also, considering safety of people using motorcycles, wearing helmet is paramount. Currently, in practice, Traffic Police are entrusted with the task of ensuring that motorcycle riders wear helmet. But, this method of monitoring motorcyclists is inefficient due to insufficient police force and limitations of human senses. Also, all major cities use CCTV surveillance-based methods. But those require human assistance and are not automated. Due to the increasing number of motorcycles and the concern for human safety, there has been a growing amount of research in the domain of road transport. The system proposed in this paper automates the task of monitoring motorcyclists. The system detects motorcyclists not wearing helmets and retrieves their motorcycle number plate in real time from videos captured by CCTV cameras at road junctions by making use of Machine Learning.

The object detection and tracking is the important steps of computer vision algorithm. The robust object detection is the challenge due to variations in the scenes. Another biggest challenge is to track the object in the occlusion conditions. Hence in this approach, the moving objects detection using Tensor Flow object detection API. Traffic rules are there to bring a sense of discipline, so that the risk of deaths and injuries can be minimized significantly. Convolution neural networks(CNN) is excessively being used for object detection applications. CNN is preferable for image classification, character recognition, object recognition and in information retrieval domains due to its effective results. Region based Convolutional Neural Networks is unsuitable for real time applications due to its computational complexity.

The main contribution of the work includes motion deblur of the image using Weiner filter for increasing the output efficiency, using YOLO for detection of license plate in an image and an algorithm to recognize the characters. YOLO algorithm is important because of the following reasons:

- Speed: This algorithm improves the speed of detection because it can predict objects in real-time.
- High accuracy: YOLO is a predictive technique that provides accurate results with minimal background errors.
- Learning capabilities: The algorithm has excellent learning capabilities that enable it to learn the representations of objects and apply them in object detection.

Further the location of the detected object is pass to the object tracking algorithm. A YOLO based object tracking algorithm is used for robust object detection. The proposed approach is able to detect the object in different illumination and occlusion. Usually, frame contains background and foregrounds information.

Detection of stolen vehicle and challan generation is another important objective in which comparison of the number plate of the vehicle with the database. If both number plate matches, then the vehicle is stolen. After that send the nearest location to the admin as a message. If both number plate does not match, then the vehicle is not stolen.

II. LITERATURE SURVEY

Rayson, et al. [3] have proposed automatic license detection system with recognition rate of 96.8%. This work is also based on YOLO algorithm. In real time it can distinguish four vehicles in a single scene due to its high frames per second (FPS) rates. Some license plates images are affected by environmental factors like lighting, bad weather, traffic etc. Considering these factors Hsu et al. [4] have developed a method using deep learning based on YOLO and its variant YOLO-9000 for license plate detection. Before employing

deep learning techniques for license plate detection Abdussalam et al. [5] have preprocessed the image i.e., skew detection and correction for better results. Lele Xie et al. [6] have proposed MD-YOLO framework which is based on convolutional neural network. In real time scenarios for handling rotational problems, prediction the angle rotation and a quick convergence over union evaluation strategy is proposed.

Pan Gao et al. [12] have trained thirty class convolutional neural network which can execute real time license plate sensing. They have combined the advantages of Dense convolutional and resident network. The proposed and efficient network model is RDNet for recognition of the license plate. Tiny YOLOv3 architecture is employed by Diogo M. F et al. [13] for detection and recognition of Brazilian license plates. Synthetic images are used to train second convolutional network used for character recognition and fine tuning using real time license plate images. Weishan Zhang et al. [14] have proposed an algorithm for scalable and effective license plate recognition. In this algorithm localization the number plate is done using a YOLO network and recognition of the license plate is achieved using multi label CNN.

Vitalii Varkentin et al. [15] have proposed a YOLO based technique for detection of number plate and recognition and got accuracy of 73%. MJ Prajawal et al explained the different convolutional neural network techniques for helmet detection and number plate detection [16] and using the YOLO V2 convolutional neural network detect the license plate number and also non helmet riders [17]. In this proposed work, the input image has been motion blurred which was induced due to the speed. For deburring the image, point spread function and wiener filter are used to remove the motion blur. Custom dataset was developed for different font character set based upon wide range of Indian number plates. Dataset was converted into specific required format and fed into the neural network, which will train custom fonts. YOLO V3 model was incorporated to get the region of interest which will be fed into the trained neural network which detects the characters present and high accuracy results were achieved.

The Recognition and Detection System for Theft Vehicle by Number Plates: The system detect and recognize license number of captured front view image of any vehicle by camera. It contains main three processes: plate extraction, character detection and character recognition. The stolen vehicle is detected by comparing it with database of stolen vehicle provided by the RTO. After word, it sends a SMS to the Admin.

III. PROPOSED SYSTEM

There are different blocks in the proposed system to define how the system works.

1. **Real-time Image Captured by Camera:** The picture of the vehicle is collected by a CCTV or camera.
2.**Detect Bike or Not:** These images are then given to a CNN classifier as input which then classifies them into two classes, namely, motorcyclists and non-motorcyclists. After this, objects other than motorcyclists are discarded and passed only objects predicted as motorcyclist for next step.
3.**Detection of Helmet:** we determine whether the motorcyclist is wearing a helmet or not again using another CNN classifier. We will assume that the head is located in the upper part of the incoming images and thus locate the head into top one fourth part of images. The located head of the motorcyclist is then given as input to second CNN which is trained to classify with helmet vs. without-helmets. Haar Cascades use machine learning techniques in which a function is trained from a lot of positive and negative images. This process in the algorithm is feature extraction. In feature extraction, the algorithm uses training data to best identify features that it can consider a face.
Here we have taken image of the bike racer as an input then it checks whether racer it wearing helmet or not. It checks the helmet wearing or not through the haar cascade algorithm if yes then it terminates the process, and if not then it checks the number plate through the text recognition using OCR technique then after the text recognition and number plate detection it generate the challan receipt.
4. **Detect the Vehicle number plate from the Captured image: We** must utilize an input picture as an input for license plate detection from images. We also assign a number plate function for the purpose of detecting license plates.
5. **Segmentation of the characters:** These techniques use character segmentation, where we separate each character on a license plate into its component numbers and characters to determine the pattern of those characters. We also run character recognition.
6. **Recognition of each character:** These techniques use the number plate that we have derived from the image and license plate to recognize characters. Using OpenCV and optical character recognition, we use each character from an image.
7. **Detection of stolen vehicle:** In stolen vehicle we will compare the number plate of the vehicle with the database. If both number plate matches, then the vehicle is stolen. After that send the nearest location to the admin as a message. If both number plate does not match, then the vehicle is not stolen.

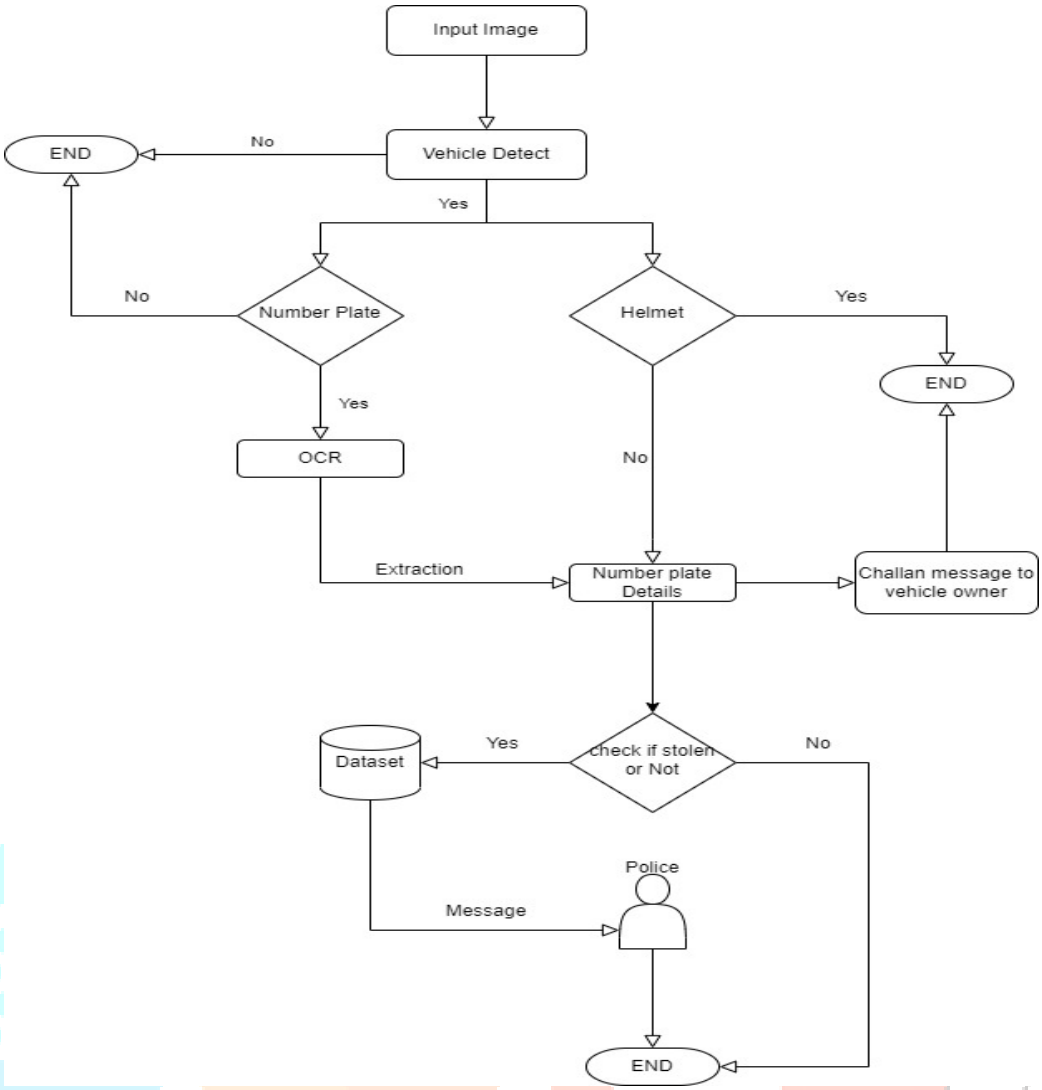

Fig.1.System Architecture

IV. ALGORITHMS

1.CNN:
A Convolutional Neural Network is a Deep Learning algorithm takes an image as input, assign importance i.e. learnable weights and biases to various aspects or objects in the image, and is able to differentiate one from the other. The pre-processing required in this algorithm is much lower as compared to other classification algorithms. There are many other types of neural networks in deep learning which are available for detection but for identifying and recognizing objects CNN algorithm is the network architecture of choice. This makes them highly suitable for computer vision tasks and for applications where object recognition is very important such as self-driving cars and facial recognition.

2.OCR:
OCR stands for Optical Character Recognition. It is a widespread technology to recognize text inside images, such as scanned documents and photos. OCR technology is used to convert virtually any kind of image containing written text (typed, handwritten, or printed) into machine-readable text data.

3.YOLO:
YOLO is an abbreviation for the term 'You Only Look Once'. This is an algorithm that detects and recognizes various objects in a picture (in real-time). Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images. YOLO algorithm employs convolutional neural networks (CNN) to detect objects in realtime. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects. This means that prediction in the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and bounding boxes simultaneously. The YOLO algorithm consists of various variants. Some of the common ones include tiny YOLO and YOLOv4.

V. REQUIREMENTS

1) Software:
Language: Python
IDE: Jupiter notebook.
Tools: Machine Learning, CNN, Tensorflow, Yolo, OpenCV.
OCR: EasyOCR
Web Framework: Django
Database: MySQL

2) Hardware:
Processor: Intel i3/i5
RAM: 4GB or more
512 GB HDD

VI. CONCLUSION

In this paper we have described a framework for automatic detection of motorcycle riders without helmet from CCTV images and automatic retrieval of vehicle license number plate for such motorcyclists. The use of Convolutional Neural Networks (CNN) and transfer learning will help in achieving good accuracy for detection of motorcyclists not wearing helmets. But, only detection of such motorcyclists is not sufficient for taking action against them. So, the system will also recognize the number plates of their motorcycles and store them. The stored number plates can be then used by Transport Office to get information about the motorcyclists from their database of licensed vehicles. Concerned motor cyclists

can then be penalized. Also we have learnt detection of stolen vehicle and challan generation.

VII. FUTURE WORK

We used Jupiter notebook to implement the program and we successfully implemented the program. Our project was successfully tested in python. We also made study of applications and future scope of the project. Our project can be linked with the traffic cameras and with some modifications it can be used to detect helmets in the real time system. Furthermore we can merge the algorithm of automated license plate detection and stolen vehicle for those who don't wear helmets.

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