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NUMBER PLATE DETECTION WITHOUT HELMET

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ABSTRACT

We currently face a number of issues with India's traffic restrictions, many of which have workable solutions. Without a helmet, it is illegal to drive a motorcycle or scooter in India, which has led to a rise in accidents and fatalities. The current system largely uses CCTV records to monitor traffic offences, requiring traffic police to zoom in on the licence plate in the event that the rider is not wearing a helmet and look into the frame where the infringement is taking place. Yet, given the high frequency of traffic offences and the rising daily usage of motorbikes, this demands a significant amount of labour and time. Currently, there are several issues with India's traffic laws that can be resolved using various solutions. Driving a motorcycle or moped without a helmet is a traffic infraction that has increased the incidence of accidents and fatalities in India. The current method largely uses CCTV recordings to monitor traffic offences. The traffic police are required to zoom in on the licence plate to determine whether the rider is wearing a helmet by looking into the frame where the infringement is occurring. Yet because there are so many traffic offences and more motorcycles on the road every day, this takes a lot of time and labour. However, these efforts have limitations in terms of effectiveness, precision, or how quickly objects may be identified and categorised. A non-helmet rider identification system is created in this research study in an effort to automate the process of identifying the traffic infraction of not wearing a helmet and obtaining the number plate number of the offending vehicle. However, these works have some limitations in terms of how quickly they can identify objects and classify them as well as their efficiency and accuracy. In this study, a system for detecting non-helmet riders is created in an effort to automate the process of identifying this traffic infraction and obtaining the number plate number of the offending vehicle.

1 INTRODUCTION

Helmets decrease the likelihood that the skull will slow down, which reduces head motion to nearly nothing. When time passes, the head comes to a stop after the helmet's cushion has absorbed the impact of the accident. Moreover, it disperses the force of the hit across a wider region, protecting the skull from serious wounds. Most significantly, it serves as a mechanical shield between the rider's head and whatever it is they come into touch with. If a full helmet of good quality is worn, injuries can be reduced. The purpose of traffic regulations is to instill a sense of discipline so that the risk of fatalities and serious injuries can be greatly reduced. Unfortunately, in practise, these laws are not strictly followed. The motion of the head is almost negligible since wearing a helmet decreases the likelihood that the skull will be slowed down. When time passes, the head comes to a stop after a contact is cushioned inside the helmet. Moreover, it disperses the force across a greater region, protecting the skull from serious injury. Most significantly, it serves as a mechanical shield between the rider's head and any nearby objects. If a high-quality complete helmet is used, injuries can be reduced. In order to drastically reduce the danger of fatalities and injuries, traffic laws are designed to instill a sense of discipline.

In practise, however, these laws are not strictly followed.

2. RELEATED WORK

2.1 Detection of Helmet on Motorcyclists

In this study, the method of classification and descriptors is utilised to first identify the vehicles, then to identify people riding two-wheelers and determine whether or not they are wearing helmets. Processes employed in this project include:

Vehicle segmentation and classification:

Detection of the background-

In order to detect the vehicle's motion in relation to the stable item, a reference of the road is taken into account as the background (road).

Segmentation of moving objects-

By separating the moving objects (vehicles) from the background using background subtraction, the background is removed, leaving only a picture of the vehicles.

Vehicle classification-

The classification of the cars as motorbikes or non-motorcycles is done by using a feature vector that is obtained for each generated image and then sent to a random forest classifier.

2.2 Detection of helmet

Determining RI-

This phase is carried out to ensure that only the region of interest is selected, which both shortens and lengthens processing time.

Extracting the features-

In the previously constructed RI, a sub-window is created, and the major portion of the image—in this example, the head—is removed and provided as input to the classifier so that it can determine if the rider is wearing a helmet or not.

The major topic of this project/paper is helmet detection. The ability to recognise the vehicle's licence plate in order to fine the rider is a requirement for it to be utilised in a surveillance system and is absent from this project.

2.3 Detecting motorcycle helmet

In this project's three sections, video data is gathered, preprocessed, and used to identify motorbike riders wearing helmets and those who are not.

1.**Dataset construction and annotation** - Random data in the form of films are gathered from Burma and preprocessed to each video of 100 frames. Using the YOLO9000 algorithm and pretrained weights, objects are detected, and the recognised vehicle and person are boxed out using predefined bounds.

2**. Helmet use detection technique** - The one stage Retina Net approach to object detection is utilised to find helmets.

Initialized using pre-trained weights from Image Net and using ResNet50 as the backbone. Tensor flow served as the backend while the models were implemented using the Python keras package.

3. Results - Results of the algorithm's helmet use detection on the test set, utilising the best model created on the validation set (where it acquired a weighted map of 72.8%).

The project's weakness is that there will frequently be two people riding in the motorcycle, and this model does not detect if the pillion is wearing a helmet or not. This has a low level of precision for a CNN network and can only tell whether one person is wearing a helmet or not.

2.4 A Hybrid Approach for Helmet Detection

The new model has been presented in this model, which also takes into account a number of earlier techniques for automatic helmet recognition. This automatic helmet detection method uses recorded video or webcam video as its input, and it can identify helmets from the video. There are 4 different steps in this procedure.

1. **Image acquisition** – The initial phase in any vision system involves using cameras to take pictures of bikers on the road.

2. **Initial processing method** - In this stage, background noise is mostly removed, contrast is improved, and the image is linearized.

3. **Classification of the vehicle** - This process largely focuses on classifying the vehicle based on two primary factors, namely the aspect ratio and size of the specific vehicle.

4. **Helmet detection** - In this stage, the head portion from the categorised image is extracted and given to the ROI, where the matching of the ROI and trained features takes place to identify whether or not a helmet is present.

This model provides a rough estimate of the number of persons that break traffic laws. Also, it is affordable because we use open source software for development, such as OpenCV. This model can also be used to identify persons driving fast and to spot people using a phone while they're driving.

- **C. Vishnu**, **Dinesh Singh**, **C. Krishna Mohan and Siobhan Babu** "Detection of Motorcyclists without Helmet in Videos using Convolutional Neural Network"[5]

According to this paradigm, individuals utilise motorcycles for daily mobility since they are reasonably priced. Accidents happen frequently as a result of this increased use. The majority of incidents result in head injuries, which are brought on by motorbike riders who don't wear helmets. As many cities have surveillance systems for safety purposes, we can utilise them to identify riders who are not wearing helmets, which would be a more economical strategy. This method use CNN (Convolution Neural Network), a machine learning methodology, to obtain high-quality photographs despite a variety of issues like lighting, environmental changes, etc. The method of this model involves four major steps:

1. **Background modelling and object detection:** This process primarily applies adaptive background subtraction to obtain the photos correctly and with the same quality regardless of the lighting situation, such as day, night, or rainy weather. We utilise a Gaussian mixture model to separate different components that are unnecessary.
2. **Convolution neural network-based object detection:** This method is essentially a feed-forward neural network with a back-propagation network. The capacity to extract interdependent data from the photos was the inspiration for the technique. This method uses several layers to detect the item; at each level, we gather data, and at the last level, the whole image is created.
3. **Distinguishing a motorcycle from moving items:** We distinguish a motorcycle from other objects by using the bounding box technique. These boxes are assessed by giving them to the CNN model as input, which, in relation to the various data in the test model, learns about motorbike and other things.
4. **Identifying motorcycle riders wearing helmets**: To recognise motorcycle riders, we crop the image so that the top one-fourth of the frame contains only the riders' heads. The binary representation of the same is then subtracted. Next, CNN

3 Implementation Study

Yolo v2 and OCR Method Modules for Detecting Non-Helmet Cyclists and Extracting Number Plate Number

1 Upload Picture

2 Find Person & Bike

The selected frame is fed into the "Motorbike" and "Person" object recognition classes in the YOLOv2 model. The output is an image that has the necessary class detection, along with confidence in the detection thanks to the bounding box and probability value.

Only the identified objects are extracted using the functions provided by the Image AI package, stored as individual photos, and given sequential image numbers and class names. It will be saved as motorcycle-1, motorcycle-2, etc., for instance. if the extracted object is a motorbike or if the extracted image contains a person, such as person-1, person-2, etc. The information from these extracted photos is saved in a dictionary and can be utilised for additional processing in the future.

3. Find a helmet(Detection)

The human photos are sent as input to the helmet detection algorithm once the person-motorcycle pair has been identified. Several erroneous detections were noticed when the helmet detection model was being tested. As a result, the person's image was cropped to only include the top quarter of the frame. This guarantees the elimination of false detection cases and prevents situations where the rider is holding the helmet in their hand or leaving it on the motorcycle while they are riding rather than donning it, which could result in incorrect results.

4. Exit

4 **PROPOSED WORK AND ALOGRITHAM**

In this project, we check to see if the rider of a two-wheeler is wearing a helmet. If not, we extract the licence plate of that

two-wheeler. If you want to add more photographs, send them to us so we can add them to the YOLO model with annotation to extract the number plate of those new images. We already have a YOLO CNN model with some train and test images for this purpose.

The following modules are being used to implement the aforementioned technique.

1) The first image will be uploaded to the application, and using the YOLOV2 algorithm, we will determine whether or not it contains a person and a motorcycle. If the YOLO model detects both, we will move on to step 2.

2) In this module, the YOLOV3 model will be used to determine if an object is wearing a helmet or not; if so, the application will halt itself. If the rider does not wear a helmet, move on to step 3 of the application.

3) Using the Python Tesseract OCR API, we will extract data about licence plate numbers in this module. OCR will use the provided image to retrieve the car number.

5 METHODOLOGIES

Helmets decrease the likelihood that the skull will slow down, which reduces head motion to nearly nothing. When time passes, the head comes to a stop after the helmet's cushion has absorbed the impact of the accident. Moreover, it disperses the force of the hit across a wider region, protecting the skull from serious wounds. Most significantly, it serves as a mechanical shield between the rider's head and whatever it is they come into touch with. If a full helmet of good quality is worn, injuries can be reduced. The purpose of traffic regulations is to instill a sense of discipline so that the risk of fatalities and serious injuries can be greatly reduced. Unfortunately, in practise, these laws are not strictly followed.

To solve these issues, effective and workable methods must be developed. Existing practises include employing CCTV to manually monitor traffic. Yet in this case, performing so many iterations is necessary to achieve the goal, and this requires a lot of human resources. Thus, cities with millions of residents and a large number of moving cars cannot afford to use this subpar manual approach of helmet identification. Thus, combining YOLOv2, YOLOv3, and OCR, we now offer a methodology for full helmet detection and licence plate extraction. The basic components of a helmet detection system are dataset collecting, moving object identification, background subtraction, and object categorization using neural networks.

- Linear Regression
- Decision Tree Regressor
- Random Forest Regressor

Linear Regression:

Linear regression is one of the easiest and most popular Machine Learning algorithms. It is a statistical method that is used for predictive analysis. Linear regression makes predictions for continuous/real or numeric variables such as sales, salary, age, product price, etc. Linear regression algorithm shows a linear relationship between a dependent (y) and one or more independent (y) variables, hence called as linear regression. Since linear regression shows the linear relationship, which means it finds how the value of the dependent variable is changing according to the value of the independent variable. The linear regression model provides a sloped straight line representing the relationship between the variables.

Decision Tree Regression:

Non-linear regression in Machine Learning can be done with the help of decision tree regression. The main function of the decision tree regression algorithm is to split the dataset into smaller sets. The subsets of the dataset are created to plot the value of any data point that connects to the problem statement. The splitting of the data set by this algorithm results in a decision tree that has decision and leaf nodes. ML experts prefer this model in cases where there is not enough change in the data set. One should know that even a slight change in the data can cause a major change in the structure of the subsequent decision tree. One should also not prune the decision tree regressors too much as there will not be enough end

nodes left to make the prediction. To have multiple end nodes (regression output values), one should not prune the decision tree regressors excessively. This trains a model in structure of a tree to predict data in the future to produce meaningful continuous output.

Random Forest Regression Algorithm:

Random forest is also a widely-used algorithm for non-linear regression in Machine Learning. Unlike decision tree regression (single tree), a random forest uses multiple decision trees for predicting the output. Random data points are selected from the given dataset (say k data points are selected), and a decision tree is built with them via this algorithm. Several decision trees are then modelled that predict the value of any new data point. Since there are multiple decision trees, multiple output values will be predicted via a random forest algorithm. You must find the average of all the predicted values for a new data point to compute the final output. This happens due to the large number of decision trees mapped under this algorithm, as it requires more computational power. It's a bagging technique not a boosting technique trees run parallel. i.e no interaction between these tree while building trees.

Classification Algorithms:

Classification is an algorithm that finds functions that help divide the dataset into classes based on various parameters. a computer program gets taught on the training dataset and categorizes the data into various categories depending on what it learned.

- Logistic Regression
- Decision Tree Classifier
- Random Forest Classifier
- KNN - K Nearest Neighbour

Logistic Regression:

Logistic regression comes under the Supervised Learning technique. It is used for predicting the categorical dependent variable using a given set of independent variables. Logistic regression predicts the output of a categorical dependent variable. Therefore, the outcome must be a categorical or discrete value. It can be either Yes or No, 0 or 1, true or False, etc. but instead of giving the exact value as 0 and 1, it gives the probabilistic values which lie between 0 and 1. In Logistic regression, instead of fitting a regression line, we fit an "S" shaped logistic function, which predicts two maximum values (0 or 1). Logistic Regression can be used to classify the observations using different types of data and can easily determine the most effective variables used for the classification.

Decision Tree Classification Algorithm:

Decision Tree is a Supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome. In a Decision tree, there are two nodes, which are the Decision Node and Leaf Node. Decision nodes are used to make any decision and have multiple branches, whereas Leaf nodes are the output of those decisions and do not contain any further branches. It is a graphical representation for getting all the possible solutions to a problem/decision based on given conditions. It is called a decision tree because, like a tree, it starts with the root node, which expands on further branches and constructs a tree-like structure. In order to build a tree, we use the CART algorithm, which stands for Classification and Regression Tree algorithm. It can be used for both Regression and Classification.

Random Forest Algorithm:

Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. Random Forest is a classifier that contains several decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset. It can be used for both Classification and Regression problems in ML. It is based on the concept of ensemble learning, which is a process of combining multiple classifiers to solve a complex problem and to improve the performance of the model. It predicts output with high accuracy, even for the large dataset it runs efficiently. It can also maintain accuracy when a large proportion of data is missing.

K-Nearest Neighbour (KNN) Algorithm:

K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique. K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories. K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm. K-NN algorithm can be used for Regression as well as for Classification but mostly it is used for the Classification problems. KNN algorithm at the training phase just stores the dataset and when it gets new data, then it classifies that data into a category that is much like the new data.

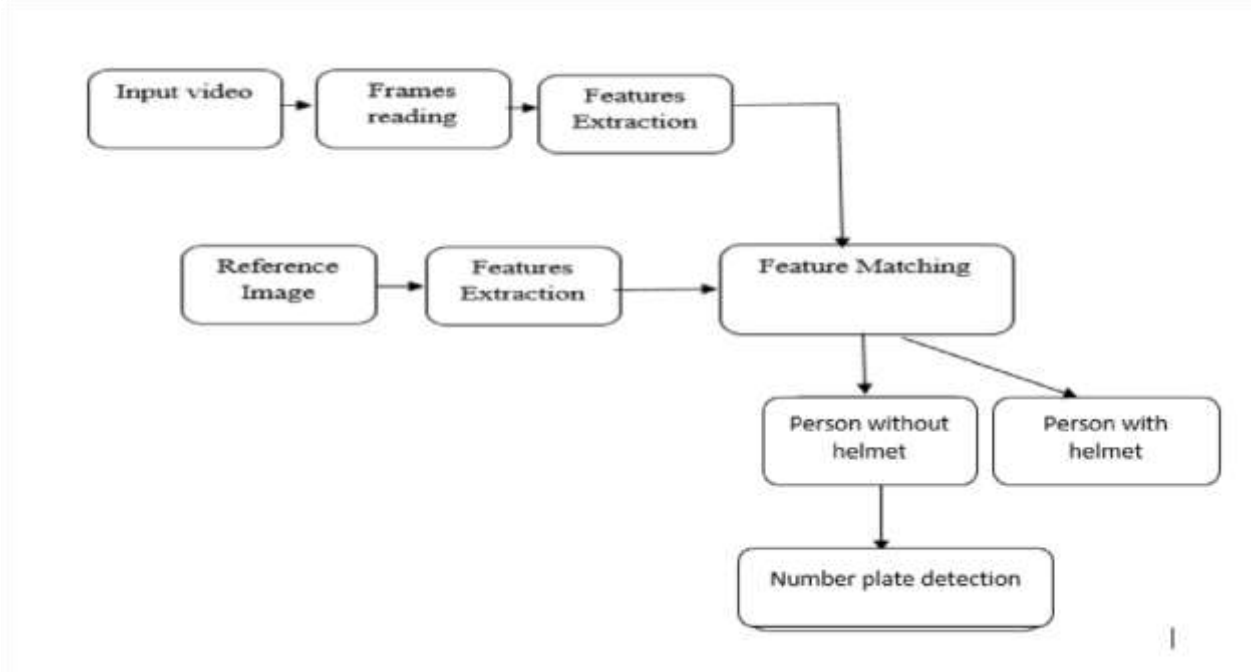

Fig. 1: propose Architecture

6 **RESULTS AND DISCUSSION**

SCREENSHOTS

Fig-6.1 Double-click the "run.bat" file after setting the directory to launch the project and display the screen below.

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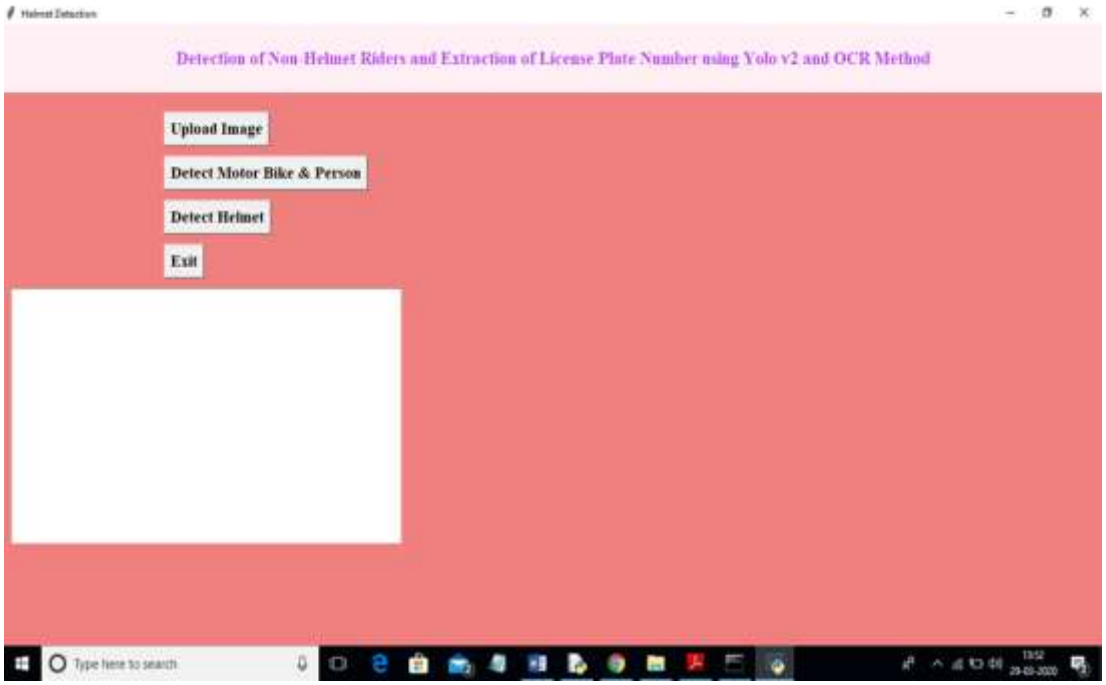
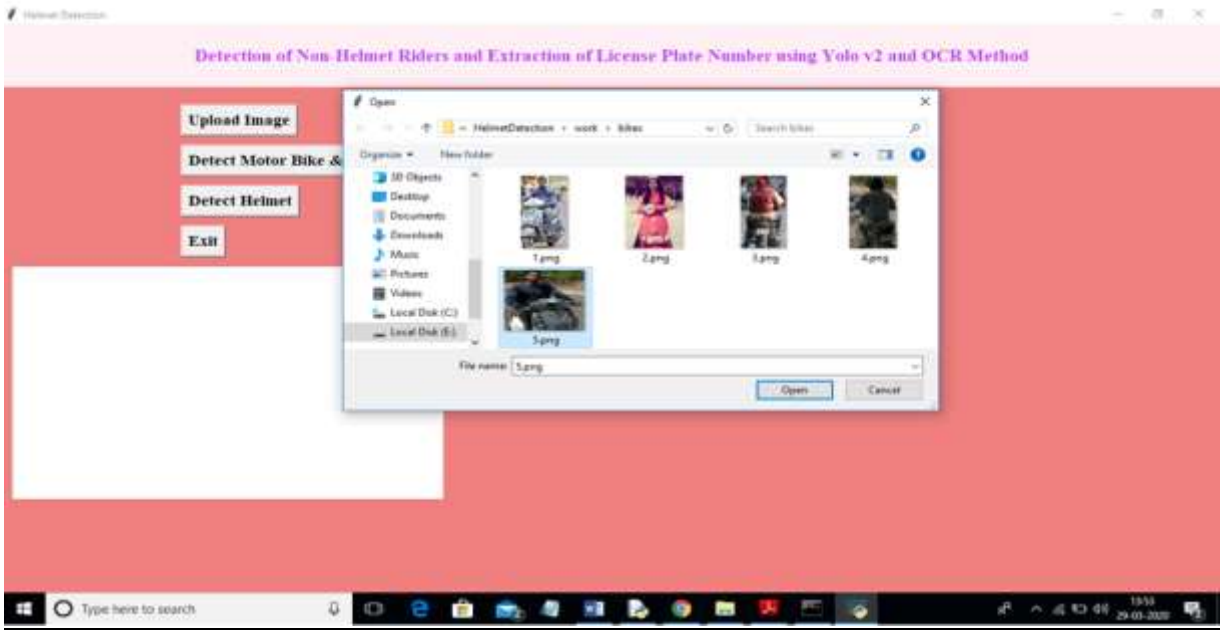


Insert Image

Fig-6.2 To upload an image, select the "Upload Image" button in the previous screen.



Picture Loading

Fig-6.3 I choose the image labelled "5.png" in the screen above, then I clicked the "Open" button to load the image. To determine whether an image contains a person and a motorbike, click the 'Detect Motor Bike & Human' button now.

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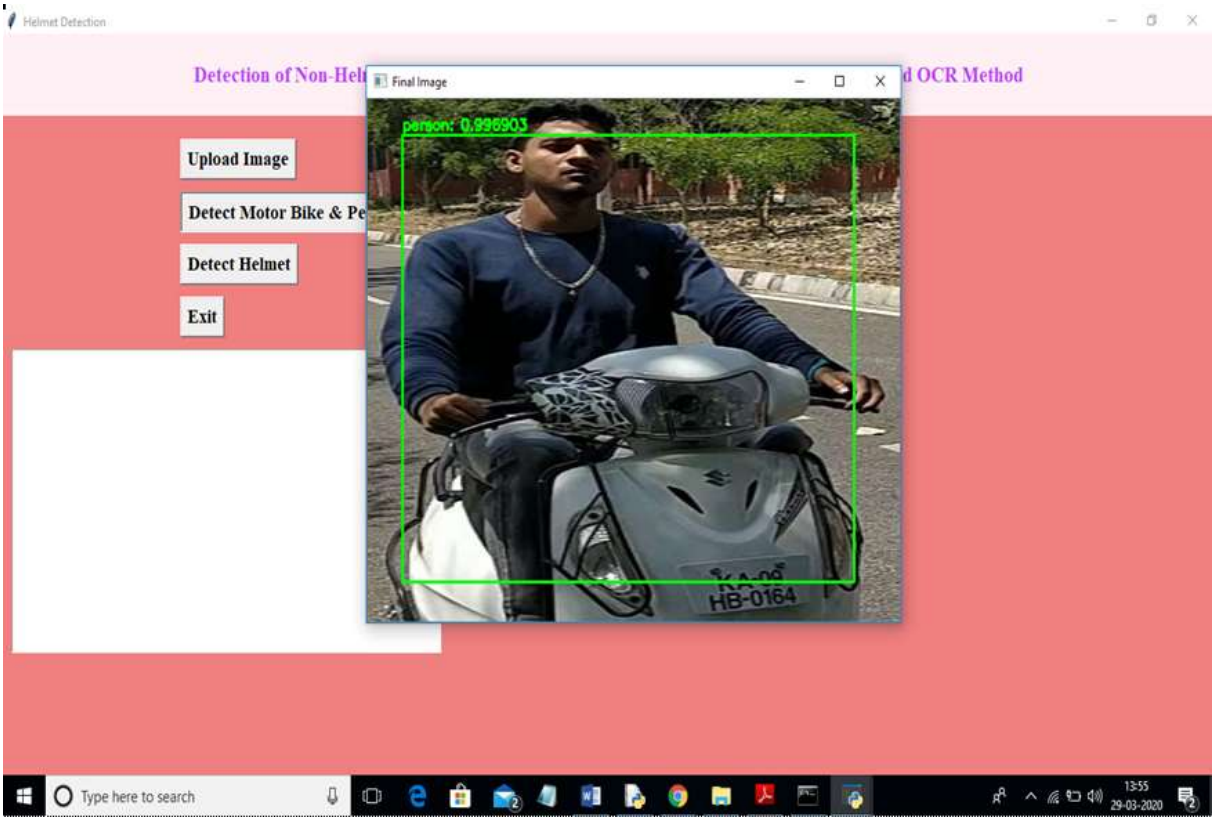
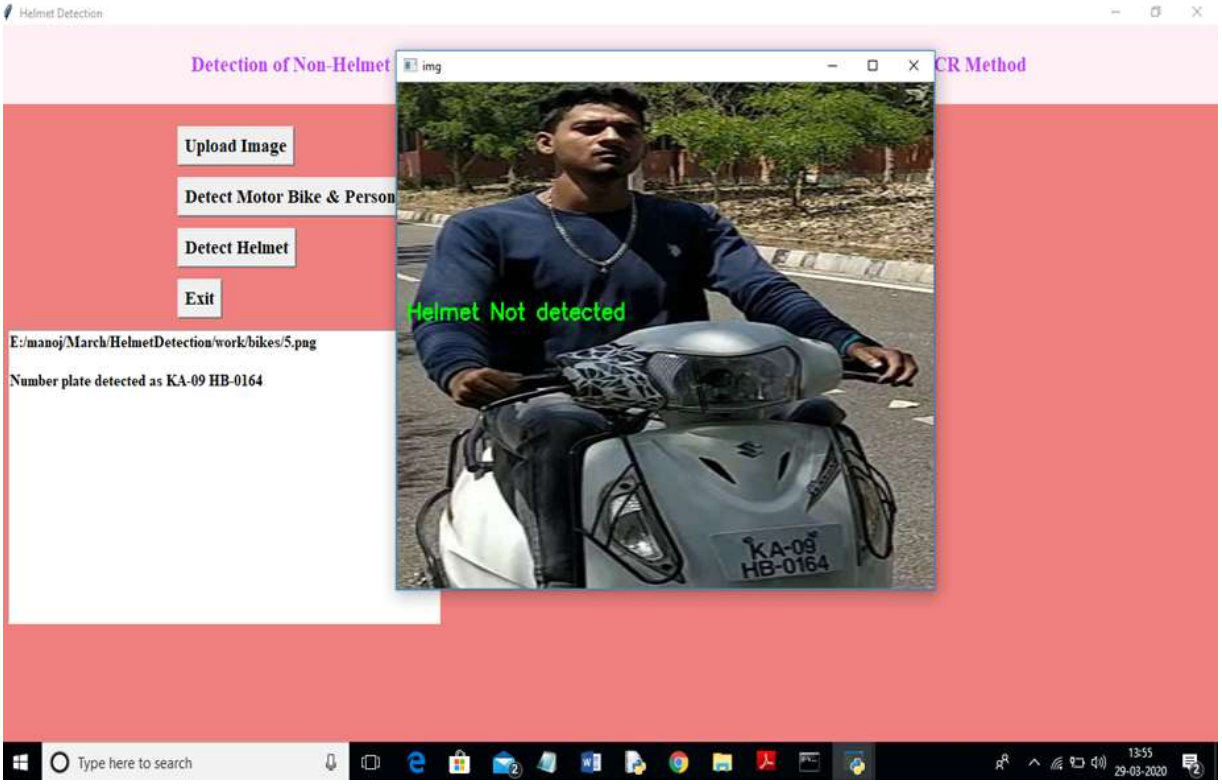


Helmet Not Found

Fig-6.4 Yolo identified the person and bike in the image above, and you can now click the "Detect Helmet" button to determine whether or not he is wearing a helmet.



7. CONCLUSION AND FUTURE WORK

A video file is used as the input for a system being built to detect non-helmeted riders. The motorcycle's number plate number is retrieved and shown if the rider in the video clip is not wearing a helmet while operating the machine. Motorcycle, person, helmet, and licence plate detection all use the object detection principle with the YOLO architecture. In cases where the rider is not wearing a helmet, OCR is utilised to extract the number plate number. In order to be used for various purposes, not only the characters but also the frame from which they are retrieved are extracted. The project's goals have all been properly met.

Our technology may be used to detect helmets in real time by connecting to traffic cameras and making certain adjustments to it. Additionally, we can combine the algorithm for automatic licence plate recognition to create a system that produces challahs for people who don't wear helmets.

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