NUMBER PLATE DETECTION WITHOUT HELMET

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Abstract In current situation, we come across various problems in traffic regulations in India which can be solved with different ideas. Riding motorcycle/mopeds 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. But this requires lot of manpower and time as the traffic violations frequently and the number of people using motorcycles is increasing day-by-day. What if there is a system, which would automatically look for traffic violation of not wearing helmet while riding motorcycle/moped and if so, would automatically extract the vehicles' license plate number. Recent research have successfully done this work based on CNN, R-CNN, LBP, HOG, HAAR features etc. But these works are limited with respect to efficiency, accuracy or the speed with which object detection and classification is done. 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, motorcycle/moped at first level using YOLOv2, helmet at second level using YOLOv3, License plate at the last level using YOLOv2. Then the license plate registration number is extracted using OCR (Optical Character Recognition). All these techniques are subjected to predefined conditions and constraints, especially the license plate number extraction part. Since, this work takes video as its input, the speed of execution is crucial. We have used above said methodologies to build a holistic system for both helmet detection and license plate number extraction.

Index Terms: - CNN (Convolution Neural Networks), yolo, LBP,HOG,HARR, R-CNN

I Introduction

Helmet reduces the chances of skull getting decelerated, hence sets the motion of the head to almost zero. Cushion inside the helmet absorbs the impact of collision and as time passes head comes to a halt. It also spreads the impact to a larger area, thus safeguarding the head from severe injuries. More importantly it acts as a mechanical barrier between head and object to which the rider came into contact. Injuries can be minimized if a good quality full helmet is used. Traffic rules are there to bring a sense of discipline, so that the risk of deaths and injuries can be minimized significantly. However strict adherence to these laws is absent in reality. Hence efficient and feasible techniques have to be created to overcome these problems. Manual surveillance of traffic using CCTV is an existing methodology. But here so many iterations have to be performed to attain the objective and it demands a lot of human resource. Therefore, cites with millions of population

having so many vehicles running on the roads cannot afford this inadequate manual method of helmet detection. So here we propose a methodology for full helmet detection and license plate extraction using YOLOv2, YOLOv3 and OCR. Basically helmet detection system involves following steps such as collection of dataset, moving object detection, background subtraction, and object classification using neural networks.

2 Literature survey

In this paper, the process of classification and descriptors are used to detect the vehicles and then detect the persons with 2 wheelers and detect if they are wearing the helmet or not. The processes used in this projects are:

Vehicle segmentation and classification:

- **Detection of the background-**

A reference of the road as background is considered so that the motion of the vehicle can be detected with respect to the stable object (road).

- **Segmentation of moving objects-**

Using background subtraction, the moving objects (vehicles) are differentiated with the background which gives only an image of the vehicles and the background will be eliminated.

- **Vehicle classification-**

The vehicles are classified as motorcycles or non-motorcycles and a feature vector is obtained for each generated image and passed on to random forest classifier to categorize vehicle as motorcycle or a no motorcycle.

2.2 Detection of helmet

- **Determining RI-**

This step is performed so that only the region of interest is chosen which reduces the processing time and increases processing time.

- **Extracting the features-**

A sub-window is formed in the above generated RI and the main part of the image(head in this case) is extracted and passed as input for the classifier to check if the biker has put on his helmet or not.

This project/paper does mainly deal with helmet detection. For it to be used in surveillance system, it should be able to detect the number plate of the vehicle to impose fines on the rider which lacks in this project.

- **Lokesh Allamki, Manjunath Panchakshari, Ashish Sateesha, K S Pratheek** "Helmet detection using machine learning and Automatic Number Plate recognition"[2]

This paper does the process of extracting the objects from the image using YOLO object detection and has 3 3segments in the entire process

1. **Helmet detection** - Annotated images are given to YOLOv3 model for training and the actual input for detection is given after training the model.
2. **License plate Extraction** – once the person without helmet is detected then the class with respect to person and corresponding vehicle and its number plate is detected and the number plate is cropped and saved.

3. **License plate recognition** –

The extracted number plate detected previously is passed on to OCR (Optical Character Recognition), the module outputs the string of numbers and alphabets with the accuracy percentage of the string recognized.

This paper does not deal with the ability to detect the difference between motorcycle and a no motorcycle and this project cannot be implemented for input as videos since the input given through OCR is images only.

2.3 Detecting motorcycle helmet

There are 3 divisions in this project in which the data is collected in the form of videos, preprocessed and used in detecting the riders of motorcycle with and without helmets.

1. Dataset creation and annotation - Random data in the form of videos is collected from Myanmar and is preprocessed to each video of 100 frames each and object detection is done through YOLO9000 algorithm with pre trained weights and the recognized vehicle with person is bounded using boxes.

2. Helmet use detection algorithm - For object detection, the single stage approach of Retina Net is used to detect the helmets. ResNet50 as backbone initialized with pre-trained weights from Image Net. The models were implemented using python keras library with tensor flow as backend

3. Results - The helmet use detection results of the algorithm on the test set, using the optimal model developed on the validation set (where it obtained 72.8% weighted map)

The limitation for this project is that in many instances there will be 2 persons travelling in the motor-cycle and this model does not recognize is the pillion is wearing the helmet or not. This can detect only one person with a helmet or not and the accuracy is low for a CNN network.

2.4 A Hybrid Approach for Helmet Detection

In this model various previous methods related to automatic helmet detection has been taken into consideration and the new model has been given. This is a technique of automatic helmet detection, where the input is of either the video which has been recorded or it might be a video through a web camera. This method includes 4 different steps in it.

1. Image procurement - This is the very first step of any vision system, where cameras are used to capture images of riders on road.

2. Preliminary processing technique - This step is mainly focused on elimination of background noise, enhancement of contrast and image linearization.

3. Vehicle classification - This step is mainly focused on vehicle classification based on two main parameters

I.e. aspect ratio and size of the particular vehicle and then the vehicle are classified.

4. Helmet detection - This step includes extraction of head part from the classified image and providing it to ROI where the matching of ROI and trained features happen to determine whether helmet is there or no.

This model gives an idea of the number of people who violate the traffic rules. It is also cost effective as we use open source technology like OpenCV , etc. for development purpose. Further this model can be used to detect people talking on phone while driving and to identify people driving at a high speed.

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

This model tells us that since the motorcycles are affordable, people use it for daily transportation. Due to this increased use the occurrence of accidents are high. Major of the accidents include head injury, which is due to helmet violation by the motorcycle users. As many cities have surveillance system for safety purpose, we can use it for detecting non helmet riders which would be a cost effective approach. This approach uses a machine learning technique, CNN (Convolution Neural Network) for getting good images in spite of various problems like illumination, climate changes, etc. There are four different steps included in the process of this model:

1. **Background modeling and object detection**: This step is basically used for applying adaptive background subtraction to get the images properly and of same quality no matter what ever the conditions might be whether its day time, night or rainy, etc. To separate various factors not needed we use Gaussian mixture model.
2. **Object detection using Convolution neural network:** This technique is basically a type of feed forward neural network using back propagation network. The idea of using this technique was due to the ability to extract interdependent data from the images. This technique involves various levels for detecting the object, where in each level we get the data and in final level the entire image is finally formed.
3. **Recognizing motorcycle from moving objects:** We use bounding boxes technique for the identification of the motorcycle from other objects. These boxes are evaluated by providing them as an input to the CNN model, which in reference to the various data in test model gets to know motorcycle and other.
4. **Recognizing motorcyclists with helmet**: To identify motorcyclists we apply cropping for the top one fourth of the image, cause that's the position where the head of the motorcyclists would always be. Then we find the doing subtraction of the binary image of the same. Then CNN

3 Implementation Study

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. But this requires lot of manpower and time as the traffic violations frequently and the number of people using motorcycles is increasing day-by-day. What if there is a system, which would automatically look for traffic violation of not wearing helmet while riding motorcycle/moped and if so, would automatically extract the vehicles' license plate number. Recent research have successfully done this work based on CNN,

R-CNN, LBP, HoG, HaaR features,etc. But these works are limited with respect to efficiency, accuracy or the speed with which object detection and classification is done

3.1proposed methodology

In this project we are detecting whether two wheeler rider wearing helmet or not, if he is not wearing helmet then we are extracting number plate of that two wheeler. To extract number plate we have YOLO CNN model with some train and test images and if you want to add some other images then send those images to us so we can include those images in YOLO model with annotation to extract number plate of those new images.

To implement above technique we are following or implemented below modules

1) First image will be upload to the application and the using YOLOV2 we will check whether image contains person with motor bike or not, if YOLO model detect both person and motor bike then we will proceed to step 2.
2) In this module we will use YOLOV3 model to detect whether object wear helmet or not, if he wear helmet then application will stop hear itself. If rider not wear helmet then application proceed to step 3.
3) In this module we will extract number plate data using python tesseract OCR API. OCR will take input image and then extract vehicle number from it.

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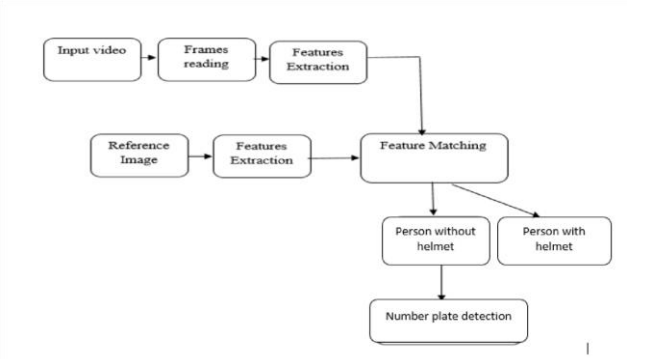

Fig 1: - proposed model

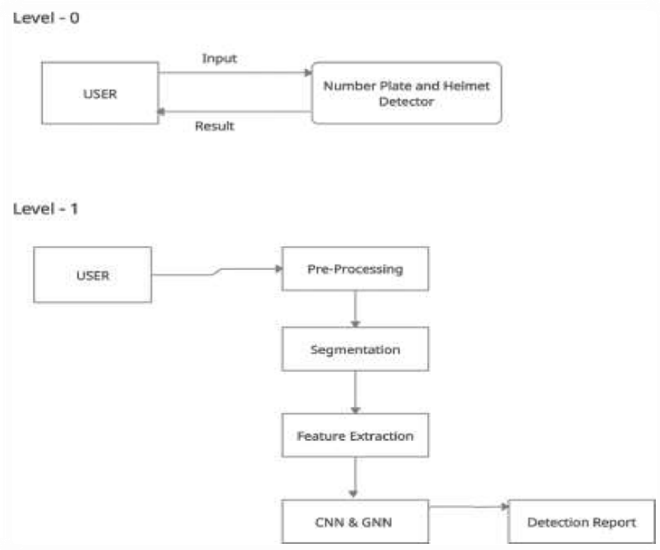

Fig 2: - flow diagram of the proposed model

3.2 Methodology

- **Modules of Detection of Non-Helmet Riders and Extraction of License Plate Number using Yolo v2 and OCR Method**

- Upload Image
- Detect Motor Bike & Person

The frame chosen is given as input to YOLOv2 object detection model, where the classes to be detected are „Motorbike", „Person". At the output, image with required class detection along with confidence of

detection through bounding box and probability value is obtained.

With the help of functions given by Image AI library, only the detected objects are extracted and stored as separate images and named with class name and image number in order. For example, it will be saved as motorcycle-1, motorcycle-2, etc.… if extracted object is motorcycle or person-1, person-2, etc.… if extracted image is of person. The details of these extracted images which is stored in a dictionary which can be later used for further processing.

3. Detect Helmet

Once the person-motorcycle pair is obtained, the person images is given as input to helmet detection model. While testing the helmet detection model, some false detections were observed. So, the person image was cropped to get only top one-fourth portion of image. This ensures that false detection cases are eliminated as well as avoid cases leading to wrong results when the rider is holding helmet in hand while riding or keeping it on motorcycle while riding instead of wearing.

4 Results and Evolution Metrics

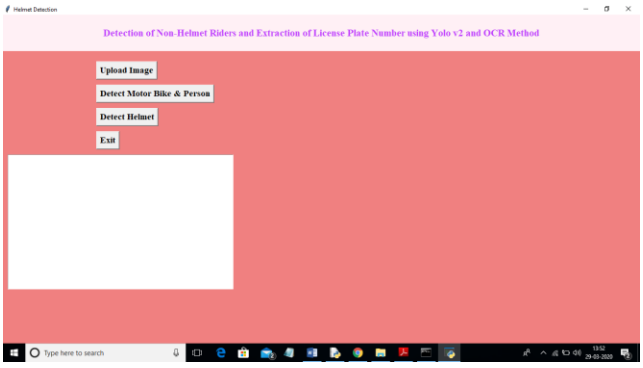

Fig 3: main page

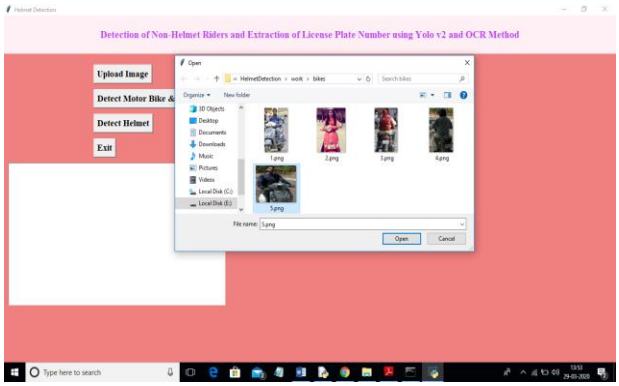

Fig 4:- In above screen click on 'Upload Image' button and upload image

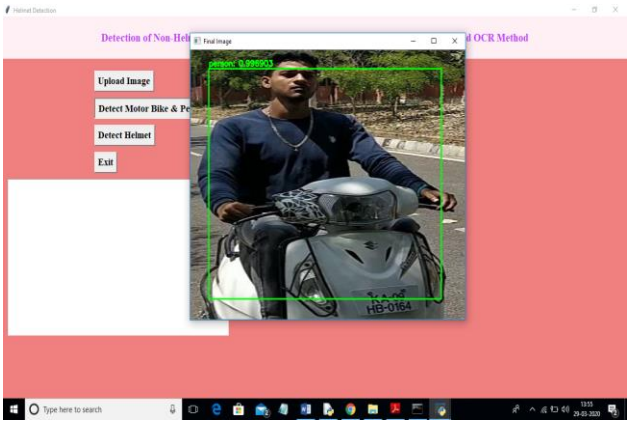

Fig 5: In above screen I selected one image as '5.png' and click on 'Open' button to load image. Now click on 'Detect Motor Bike & Person' button to detect whether image contains person with motor bike or not

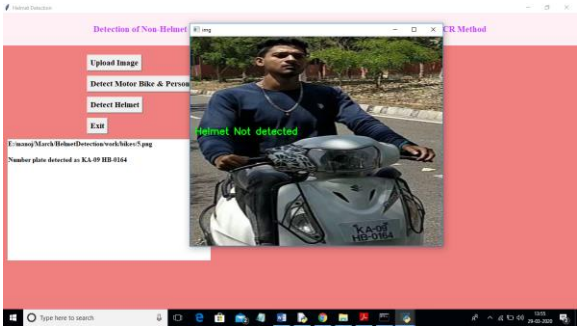

Fig 6:- In above screen Yolo detected image contains person and bike and now click on 'Detect Helmet' button to detect whether he is wearing helmet or not

5 Conclusion

A Non-Helmet Rider Detection system is developed where a video file is taken as input. If the motorcycle rider in the video footage is not wearing helmet while riding the motorcycle, then the license plate number of that motorcycle is extracted and displayed. Object detection principle with YOLO architecture is used for motorcycle, person, helmet and license plate detection. OCR is used for license plate number extraction if rider is not wearing helmet. Not only the characters are extracted, but also the frame from which it is also extracted so that it can be used for other purposes. All the objectives of the project is achieved satisfactorily.

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