TRACKING LICENSE PLATE NUMBER AND CLASSIFICATION OF NON-HELMET RIDERS USING NEURAL NETWORKS

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Abstract

The current scenario in India's traffic rules presents a number of challenges, each of which may be addressed with a novel approach. More and more people are being killed or seriously injured in traffic accidents in India because motorcyclists are breaking the law by not wearing helmets. The current system relies heavily on CCTV records to keep tabs on traffic offences, forcing cops to manually examine individual frames and, if the rider isn't wearing a helmet, zoom in on their license plate. Since traffic offenses are common and the number of persons riding motorbikes is growing every day, doing so takes a significant investment of time and energy. Suppose there was a way for a computer to detect whether or not a motorcyclist was wearing a helmet, and if so, to get the vehicle's registration information. CNN, R-CNN, LBP, HoG, HaaR features, etc. have all been used effectively in recent studies to do this and related tasks. However, the speed and accuracy of object identification and categorization are severely constrained by these works. In an effort to automate the process of finding instances of the traffic infraction of not wearing a helmet and retrieving the license plate number of cars, this study develops a Non-Helmet Rider detection system. The core idea is a three-tiered system of Object Detection based on Deep Learning. Person, motorcycle/moped, helmet, and license plate are all recognized utilizing YOLOv2's increasing levels of sophistication. The next step is for OCR (Optical Character Recognition) to decipher the license plate and pull the corresponding number. Every One Of These Methods are limited by rules and regulations set in advance, especially The section when you get the plate number. Due to the nature of the input data (video), the processing time is critical. We've utilized the aforementioned techniques to create a unified platform for scanning for helmets and extracting license plate numbers.

INTRODUCTION ;

The annual death toll from traffic accidents is estimated at 1.35 million, with an additional 50 million individuals suffering some kind of injury.

The 2018 World Health Organization Road Safety Report was just published. It's hard to believe that walkers, bikers, and motorcyclists all shoulder this responsibility unequally. According to the findings of this analysis, a concerted effort must be made to save lives. When it comes to fatalities caused by automobile accidents, India is, unfortunately, first in the world. Analysis conducted by specialists has shown that rapid urbanization and the refusal to use safety equipment while driving are contributing factors in this pattern. India joined the Brasilia Declaration on Road Safety in 2015, promising to cut the number of people killed in traffic accidents in half by 2020. Before reducing road collision mortality in India, policymakers must first recognize the challenges that exist there. The rider of a two-wheeled vehicle is often ejected from the vehicle when an accident occurs as a result of the vehicle's quick deceleration. In the event of a head impact, the head's motion will cease but the brain's mass will cause it to continue moving until the item penetrates the skull's interior. This kind of brain trauma may sometimes be deadly. A helmet is a lifesaver in such a situation. Because a helmet lessens the likelihood that the skull will be decelerated, it effectively stops the head from moving. The impact of the collision is absorbed by the helmet's cushion, and the head gradually stops moving. It cushions the blow by dispersing the force across a broader region, protecting the skull from harm. More significantly, it prevents the rider's head from coming into direct contact with whatever surface they hit. If a high-quality complete helmet is used, head trauma may be kept to a minimum. Discipline fostered by following traffic regulations helps keep people safe on the road and reduces the likelihood of tragedy. However, in practice, there is no observance of these regulations. Therefore, practical and effective methods need to be developed to address these issues. The use of CCTV for manual traffic monitoring is a tried and true strategy. However, in this case, a large number of iterations are required to reach the goal. Cities with millions of residents and thousands upon thousands of cars on the road simply cannot afford the ineffectiveness of this manual approach of helmet identification. To that end, we provide a system that employs YOLOv2, YOLOv3, and optical character recognition (OCR) to identify and extract entire helmets and license plates.

If the rider isn't wearing a helmet, data collecting, moving object identification, background removal, object categorization using neural networks, and license plate number extraction are the basic stages of a helmet detection system. KNN classifier was used by Rattapoom Waranusast et al. [2] to extract and categorize moving objects.

Here, several properties extracted from the segmented head area are used to determine whether or not the head is protected by a helmet. Adaptive background subtraction is used to spot items in motion [13]. The technique for modeling backgrounds in ViBe may also be used to detect moving objects [15, 19]. Moving objects may be segregated with the help of a clever edge detection method [21]. A approach for feature extraction was presented by Romuere Silva et al. [3], [17] employing a combination of the LBP based hybrid descriptor, the HOG descriptor, and the Hough transform descriptor. When it comes to feature extraction, Xinhua Jiang et al. [8] combined grey level co-occurrence matrix with LBP. It is possible to use the YOLOv2 and COCO dataset to identify and categorize various objects [16, 20]. Motorcycles, motorcyclists, pedestrians, and laborers all fall within the scope of this sentence. Motorcycles may be identified by the use of color differences between helmets and tires [6]. Authors Kunal Dahiya et al. [9] used object segmentation and backdrop removal to identify the cyclist. Others have limited their CNN searches to motorcyclists [13, 24]. A helmet is a necessary safety precaution on building sites. HOG may be utilized for this purpose [7]. As a preventative measure in the event of an accident, fall detection may make use of background reduction and optical character recognition [10]. S. A. Shabbeer, S. A. Shabbeer, S. Two-wheeler accident detection utilizing a microcontroller and accelerometer was presented in [12]. Because pedestrians are so often the unseen victims of traffic collisions, protecting them is paramount. SVM-based pedestrian classification utilizing histogram of oriented gradient features (HOG) was suggested by Jie Li et al. [15]. The last process is helmet recognition. It is possible to identify helmets using color-based and circular Hough transforms [7], [5], [10], and HOG descriptors [22]. One alternative possibility is color feature recognition [15]. The helmet was detected using color feature discrimination and color space transformation, techniques developed by Kang Li et al. [19]. To improve helmet detection, we apply a GLCM statistical feature set and a Back-Propagation artificial neural network. [8]. For the purpose of identifying helmetless motorcyclists, Romuere Silva et al. [4] used a multi-layer perception classifier. Haar-like characteristics were used by Pathasu Doungmala et al. [11] to distinguish between people wearing full and no helmets, while the circular hough transform was used to distinguish between those wearing half and no helmets. The PCA method [14] is utilized to further refine the accuracy of helmet recognition. OCR, MobileNets, and Inception-v3, Open ALPR[20], [18], [16] are only some of the technologies that have been utilized to identify license plates and extract the characters.

I. METHODOLOGY The many stages of processing are detailed below.

In the beginning, frames are extracted from the video file at regular intervals, as shown in Figure 1(a) and Figure 1(b). All of the gathered photos go into a specific folder. They have names like frame_7_50, frame_7_100, etc., that reflect the frame number. Where the numbers 50, 100, etc. denote the frame number, and the seventh video file was entered. It is evident from the data that many of the frames are unnecessary. Therefore, the final frame or the last second frame is selected for processing depending on the motion of the vehicle with regard to the camera.For two different scenarios, the complete process may be broken down into five stages:

Example 1: Helmeted motorcyclist or mopedist Second scenario: when the motorcyclist or mopedist is not protecting his or her head. Collection of Frames

Collection of Frames

Fig. 1 (a): Frames collected at regular intervals (Case 1)

Fig. 1 (b): Frames collected at regular intervals (Case

DETECTION OF BICYCLES AND PEOPLE

In order to identify the desired classes, the selected frame is fed into the YOLOv2 object detection modelMotorcycle and Human both fit the bill. As can be seen in Fig. 2 (a) and Fig. 2 (b), the final result is an image with the necessary class detection as well as an indication of the accuracy of that detection in the form of a bounding box and a probability value.

Fig. 2 (a): Frame with 'person' and 'motorcycle' classesdetected (Case 1)

Fig. 2 (b): Frame with 'person' and 'motorcycle' classesdetected (Case 2)

Fig. 3 (b): Extracted motorcycle and person images(Case 2)

With the help of functions given by Image AI library, only the detected objects are extracted as shown in Fig. 3 (a) and Fig. 3 (b) and stored as separate images and named with class nameand 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 isof person. The details of these extracted images which is stored in a dictionary which can be later used for further processing.

I. HELMET DETECTION

Fig. 4: Cropped images (Case 1 and Case 2)

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, as shown in Fig. 4. 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 whileriding instead of wearing.

Fig. 5: Helmet detection

After applying cropped image to helmet detection model, output is as shown in Fig. 5. The bounding box around helmet along with the detection probability is displayed as shown in Fig. 5. As the rider wearing helmet in Case 1, no further processing is necessary. Since in Case 2, rider is not wearing helmet, no bounding box is created.

II. LICENCE PLATE DETECTION

If the helmet is found, there is no need for this step. However, if the helmet is not found, then the motorcycle image is given as input to license plate detection model. For training purpose, 832 images were collected as dataset whichwere images of bike, mopeds with their license plate. Then using labeling tool, the license plate in those images were annotated, i.e., a bounding box is created around license plate in those images so that the model could learn. The information regarding the bounding box is stored in .xml file with the name being same as image name. Then the annotated imagesare used to build the trained model for detecting license plates.

Fig. 6: License plate detection

Using the trained model, the bounding box is created across license plate in given input image. The corresponding information includes top-left, bottom right co-ordinates of bounding box, class name, confidence of detection in a .json file. Then to extract the license plate image only, the bounding-box co-ordinates stored in .json file are used and extracted images are stored. Sometimes, as shown in Fig. 6, for a single motorcycle image, more than one bounding box were detected. In that case, a threshold of 0.5 is set for confidence of detection. While reading details of bounding box in the .json file, the one with confidence greater than thethreshold is chosen.

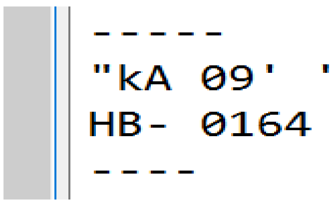

Fig. 7: License plate extraction and rotationFig. 8: License plate image after increasing brightness and rescaling

Sl. No	Detection model	Number Plates Detection	Threshold value
1	YOLO v2(Without Helmet)	Yes	0.5
2	YOLO v2(With Helmet)	No	0..87

Fig. 9: Output after applying OCR

For more precise results using optical character recognition (OCR), the retrieved license plate picture must undergo pre-processing beforehand. This is why the picture was flipped. Figure 7 shows the final license plate picture after extraction and rotation. Since the camera will be in the same relative location for each shot, the only time trial and error is required is to determine by how much an extracted license plate picture must be rotated. It was calculated to be 6 degrees Celsius in this instance. To improve OCR's string detection accuracy, the rotating picture was rescaled. The width and height of the resized picture were set by selecting a scaling ratio, defined as the ratio of the resized image to the original. Let the original image's width and height, w and h, respectively, be w and h, and the resized image's width and height, w' and h'. Take r to be a ratio. The resulting picture size after scaling is calculated by:w` = w * r ……………………….. (1)

h` = h * r………………………… (2)

where r, the ratio, is not a constant but rather varies with each frame that is extracted. In this instance, it was determined to be in the range of 1.44 to 1.47.The image's brightness is then raised so that the contrast between the black plate numbers and the white backdrop is more pronounced. The image's Hue, Saturation, and Value (h,s,v) values were retrieved. It is well knowledge that a color's v(Value) indicates how light or dark it is. If the "v" value for a given pixel is higher than the predetermined maximum, 255 will be used instead. If the pixel's "v" value is less than the minimum, a fixed amount was applied to it. The selected constant value in this example is 30, and the maximum possible value is 225 (255 minus 30).

price = 30 / 255 - price

Fig. 1.Example of a figure caption. (*figure caption*)

RESULT AND DISCUSSION Table 1. Details of Threshold value with model

In this article, we go through the results for two different scenarios. It's true that they are, In the first scenario, the rider of a motorbike or moped is protected by a helmet, as seen in fig. 5.

Scenario 2: License plate detection on a motorbike or moped while the rider is not wearing a helmet.

CONCULUTION A video file is used as input to train a Non-Helmet Rider Detection system. The motorbike's license plate number is retrieved and shown if the rider in the camera clip is not wearing a helmet while operating the motorcycle. The YOLO architecture is used to identify objects like motorcycles, people, helmets, and registration plates. If the cyclist isn't protecting their head with a helmet, OCR is utilized to read their license. Both the figures and the original frame are taken out of the picture and used to different uses. The project successfully completed all of its goals.

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