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Helmet and Triple Riding Detection on Motorcyclists using Image Processing

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ABSTRACT: Bike mishaps have been growing consistently throughout the years. Because of different social and monetary elements, this sort of vehicle is winding up progressively mainstream. Individuals pick motorbikes over other vehicles as it is significantly less expensive to run, less demanding to park and adaptable in rush hour gridlock. In India, in excess of 118 million individuals are utilizing bikes. Since utilization is high, mishap level of bikes are additionally high contrasted with different vehicles. So wearing headgear is critical to decrease the danger of injuries in the event that mishap happens. In this paper, we propose an approach for programmed identification of bicycle riders without headgear and who are triple riding utilizing surveillance videos in real-time. The proposed approach initially recognizes bicycle riders utilizing background subtraction and object segmentation. At that point we utilize object classifier HOG to classify violators. The vertical projection of binary image is utilized for counting number of riders.

KEYWORDS: HOG, Background Subtraction, Image Classification

I. INTRODUCTION

Bike is an extremely mainstream method of transportation in relatively every nation. However, there is a high risk involved due to lack of protection. To decrease the involved risk, it is highly desirable for bicycle riders to use headgear. Government have made it a punishable offense to ride a bicycle without headgear also, have embraced manual systems to catch the violators. Be that as it may, the current video observation based techniques are passive and need critical human help [1]. Automation of this procedure is exceptionally attractive for vigorous observing of these infringement and additionally it likewise altogether lessens the measure of human resource required. Also, many countries are adopting systems involving surveillance cameras at public places. So, the solution for detecting violators using the existing infrastructure is also cost-effective. However, in order to adopt such automatic solutions certain challenges need to be addressed:

1. Real-time Implementation: Processing critical measure of data in a period imperative way is a test undertaking. All things considered applications include assignments like segmentation, feature extraction, classification and tracking, in which a lot of data should be prepared in brief term to accomplish the objective of ongoing usage [1] [2].
2. Occlusion: In real life scenarios, the dynamic objects usually occlude each other due to which object of interest may only be partially visible. [3]
3. Temporal Changes in Conditions: Over time, there are numerous progressions in environmental conditions, for example, light, shadows, and so forth.
4. Quality of Video Feed: Generally, CCTV cameras catch low resolution video input. Likewise, environmental conditions such as low light, hazy climate may deteriorate it further.

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Because of such confinements as expressed in [1] tasks, for example, segmentation, classification and tracking turn out to be considerably more troublesome. Successful structure for surveillance application ought to have helpful properties, for example, real time performance, fine tuning, robust to sudden changes and predictive. Keeping these difficulties and wanted properties as a primary concern, we propose a strategy for programmed detection of bicycle riders without headgear using video feeds from existing security cameras.

II. EXISTING WORK

Automatic identification of bicycle riders without headgear falls under general class of anomaly recognition in video recordings. As clarified in [4], effective detection system framework include following errands: environmental modelling, detection, tracking and classification of moving objects. In [5], Chiverton proposed an approach which utilizes geometrical state of headgear and illumination difference at various bits of the headgear. It utilizes circle arc discovery strategy in view of the Hough transform. The major constraint of this approach is that it tries to find headgear in the full frame which is computationally costly and furthermore it might frequently confound other comparable modelled objects as headgear. Additionally, it manages the reality that headgear is applicable just if there should arise an occurrence of bicycle rider. In [6], Chen et al. proposed an effective way to deal with distinguish and track vehicles in urban rush hour gridlock. It utilizes Gaussian mixture model along with a system to refine foreground blob keeping in mind the end goal to remove foreground. It tracks a vehicle utilizing Kalman filter and refine classification utilizing dominant part voting. In [2],Duan et al.suggested a powerful approach for tracking of vehicles progressively from single camera. Keeping in mind the end goal to quicken the computation, it uses Integrated memory array processor (IMAP). Notwithstanding, it isn't a proficient arrangement because of its necessity of dedicated hardware. In [7] [8], Silva et al. proposed an approach which begins with discovery of bicycle riders. At that point it finds the head of bicycle riders by applying Hough transform and after that classifies it as head or headgear. Be that as it may, Hough transform for finding head of bicycle rider can be computationally costly. Also in [8] tests are performed on static pictures as it were. Comprehensively, there are two noteworthy constraints in the current work discussed above. Firstly, recommended approaches are either computationally extremely costly [5] [7] or passive in nature [2] [8] which are not reasonable for ongoing execution. Furthermore, the relationship between the frames is underutilized for final decisions [5] [7], as the outcomes from back to back frames can be joined to raise more reliable cautions for infringement. The proposed approach overcomes above examined constraints by giving an effective solution which is suitable for real time application.

III.PROPOSED WORK

In this section we present the proposed approach for real-time detection of bike-riders without helmet. To start with we identify a motorbike-rider in the input video frame, then we find the head of the bike rider and after that distinguish whether the rider is utilizing a protective headgear or not. Next, we apply background subtraction on gray-scale frames, with an aim to distinguish moving objects from static objects. Next, we exhibit steps associated with background subtraction. At first, the background subtraction method in [9] is used to isolate the objects in movement, for example, bike, people, auto-rikshaw, cars from static objects like trees, streets and buildings. Nonetheless, there are some difficulties when dealing with data from single fixed camera. Morphological operations like eroding, dilate, opening and closing are used to remove the noise from the binarized image frames. Next stage includes recognition of bike riders in the frame. This step uses the objects, potential bicycle riders returned by background modelling step and group them as bicycle rider versus others, depending on their visual aspects. This stage includes two stages: Feature extraction and Classification. Feature Extraction is carried out using Histogram of Oriented Gradients (HOG) method [10]. HOG descriptors are demonstrated to be extremely effective in object recognition. These descriptors catch neighborhood shapes through gradients. The component vectors effectively represent the activity and contains discriminative data, which additionally gives hope for great grouping precision. After feature extraction, subsequent stage is to classify them as bicycle riders versus other vehicles. In this manner, this requires a binary classifier. Any binary classifier can be used here, be that as it may we pick SVM because of its power in classification or performance even when prepared from less number of feature vectors. Once the bicycle riders are identified the following stage is to

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identify whether that bicycle rider is wearing headgear or not and furthermore regardless of whether there are in excess of 2 individuals riding that motorbike. Detection of headgear is like discovery of bicycle riders, where the protective headgear are characterized based on its features and fed to the binary classifier. In parallel with the headgear detection program, we additionally run the rider counter program which employs the projection operations and reduce operations to check the number of riders on the bike. The final result is written to the log file for future handling.

IV. ARCHITECTURE

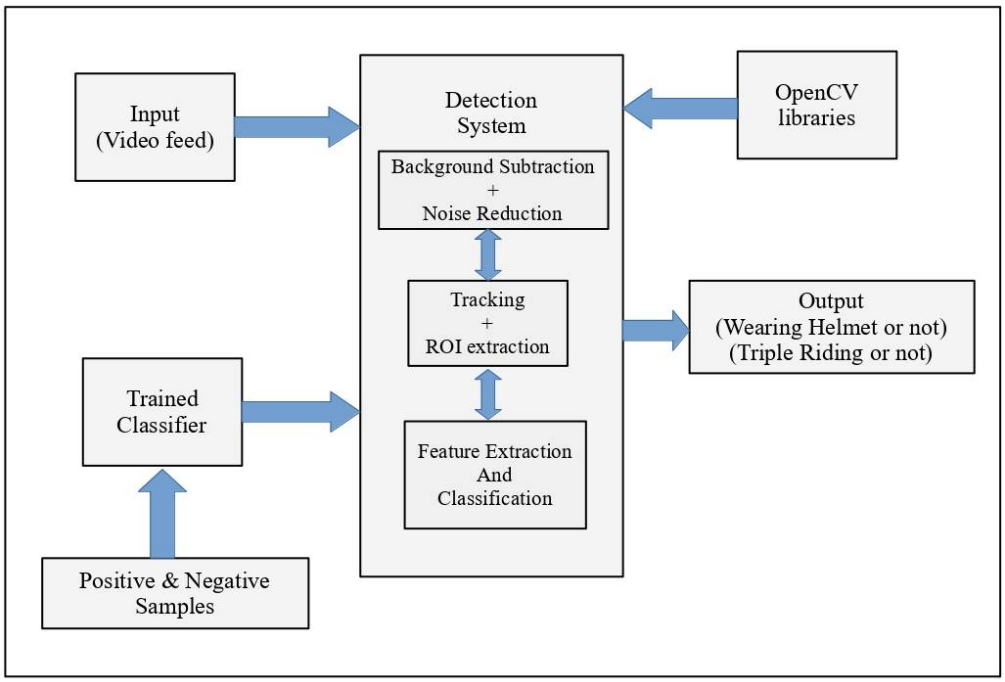

Fig.1. Proposed System Architecture

"Fig. 1" gives an overview of the architecture of our proposed system. In this system the detection system is the central program that performs all the operations. The video feed to the system is from the security camera. The video feed goes through a number of steps as follows:

1) Background Subtraction and Noise reduction: Background subtraction is carried out in order to detect a moving object in a static background model. The resulting is a binary image which contains salt and pepper noises. Further image smoothening and morphological operations are used to remove or reduce the noise.
2) Tracking and ROI extraction: Once the moving objects are detected, they should be tracked so that their identity is preserved in subsequent frames. Tracking is done based on the centroid position of the moving object. We can also determine the direction of the moving object using tracking information. Next the ROI (Region of Interest) is extracted which only the portion is having the moving object from the frame.
3) Feature Extraction and Classification: Feature Extraction involves extracting unique features of the provided samples images. A training data set consists of positive and negative image samples. The classifier is trained such that it detects objects similar to provided positive samples and rejects objects similar to negative samples.

The OpenCV Libraries are used along with the detection system which contains the predefined functions and data members used for processing images such as background subtraction, morphological operations, feature extraction and

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classification. The output of the detection system is whether the detected motorcyclist is wearing helmet or not and whether there are more than 2 people riding on the motorcycle (triple rider detection). The output is written to the log file.

"Fig.1" and "Fig.2" show examples of negative and positive samples used for SVM training using HOG feature descriptor.

Fig.2. Negative Samples for SVM Training

Fig.3. Positive Samples for SVM Training

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V. SIMULATION RESULTS

In the simulation, we tested our project with various traffic videos from multiple places with a total length of 4 hr 18 mins . It includes 258 motorbikes, 411 other vehicles (excluding occluded vehicles). The results are tabulated below.

Object of Interest	Actual Count	Detected Correctly
Motorcycle	258	249
Other Vehicles	411	389
Single Riders	87	85
Two Riders	123	115
Three Riders	48	40
Riders wearing Helmets	176	153
Riders not wearing Helmets	82	68

Table.1. Comparison of actual counts with detected counts.

Efficiency of Vehicle Classification: 95.3 %
Efficiency of Rider Count : 93.0 %
Efficiency of Helmet Detection : 85.6 %
Overall Efficiency : 75.8 %

VI. CONCLUSION AND FUTURE WORK

In this paper, we have proposed a framework for real-time detection of traffic rule violators who ride motorbikes without using headgear. A computer vision system, that is divided into modules such as moving objects segmentation, moving objects classification and helmet use detection will assist the traffic the authorities to take action against rule violators. Proposed framework will also assist the traffic police for such violators in odd environmental conditions viz hot sun, etc. Also the framework automatically adapts to new scenarios if required, with slight tuning. This framework can be extended to detect and report number plates of violators by combining this system with automatic license plate recognition system by synchronizing multiple view cameras. Also advanced tracking algorithms can be used to handle occlusion. Night vision cameras can be utilized to use the detection system in the absence of daylight.

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