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Accident Prevention and Traffic Control by Otsu Method and Haar-Cascade Hand Detector

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Abstract*: *The rapid development of economy and continuous improvement of people's purchase ability in every country, purchasing the motor vehicles is increasing rapidly, so as the traffic accidents and accident death rate, which says the road traffic situation in everywhere, is worse day by day. Traffic and Accident control is a complex activity in developing countries shows in increasing number of riders and automobiles every day. The prediction and prevention of traffic accidents is an important part of the traffic safety, the purpose of prediction is to achieve the objective of reducing traffic accidents. The work proposes by using the existing video through the cameras positioned on highways, traffic signal and busy roads that can detect the incidents/events. The system can also be proposed with the ability to read and track the vehicle number helps in searching of vehicles violating the rules by finding the License plate number using Optical Recognition method which finds the alpha numeric character from the segmented image. Counting the vehicles passed through the mentioned place using Haar-cascade hand detector which helps to count the number of vehicles passed through can perform Traffic control system.

Keywords*: *Image Processing, Pattern Recognition, HAAR-Cascade, OTSU method, Traffic Control.

I. INTRODUCTION

The truth of the matter is that the number of urban residents and the number of vehicles is gradually expanding. As the urban population expands and the number of vehicles increases, the need to control roads, parks and streets is a serious problem. The current traffic executive framework does not emphasize on-site traffic conditions, which has caused the board framework to waste traffic. Moreover, in order to achieve this risk, an image preparation system is used. First, the film of the path is captured by the camera [1]. The network camera is placed in a blocked path during peak hours, which captures a picture of the street we need to control traffic. At this point, these pictures are effectively prepared to understand the traffic thickness. As indicated by the preparation information from the tangled laboratory, the controller will send a direction to the traffic LED to display a specific time on the sign to supervise the traffic [2].

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Projects in the field of PC vision confirm innovations to discover articles in image or video inheritance and select them. Although the images of the items can be changed fairly at various angles, sizes and scales, or even though they are deciphered or rotated, it is acknowledged that many of the things in the picture are seldom used. Items can be perceived without being completely unaffected by the point of view. In today's life, we need to see many problems, one of which is traffic congestion, and gradually take risks day after day. As a consequence of expansion, many problems have arisen in vehicle traffic, such as car collisions, traffic jams, etc. Traffic jams are a tricky issue. Therefore, many agents are focused on ITS (Intelligent Transportation System), for example, predicts traffic flow depending on traffic inspection at traffic intersections to identify bottlenecks [3]. This errand is still a test of the PC vision framework. Several methods for dealing with this task have been implemented for decades. There are many strategies for identifying vehicles on the street, such as motion recognition, introducing lasers and so on both sides of the street, which is monotonous, including countless [4]. The strategy uses image processing methods to check the number of vehicles on the street and measure the thickness. The number of vehicles found can be used to research or control traffic signs. This is the leader in today's best technologies that countries are trying to introduce into the transportation framework. It makes traffic in a bright way, along which you can sort traffic without the need for an individual. In preceding works, a large part of them used the coordination system by taking the basic edge and then subtracting and approaching new advantages [5]. But now in this work, we will check for keen traffic control by checking the vehicle with image processing. Vehicle identification and inclusion in determining traffic jams on the road are essential. The primary goal of identifying a car and including it in video or photo traffic is to create a technique for program identification of the vehicle and inspection on the highway. The work uses our channels to distinguish and count vehicles, take video or pictures and do some preparation, and finally give the number of cars.

II. RELATED WORK

Automatic Number Plate Recognition system is an image processing technology; the objective is to design an efficient automatic vehicle identification system by using the vehicle number plate, which implemented for various applications such as automatic toll tax collection, parking system, border crossings, traffic control, stolen cars etc. The system has color image inputs of a vehicle and the output has the registration number of that vehicle.

The system first finds the vehicle and then gets an image of vehicle from the front or back view of the vehicle. The system has four main steps image acquisition, plate localization, character segmentation and character recognition [6].

A system in 2011, to establish an accident control, that makes use of vehicular ad hoc networks coupled with systems that employ cellular technology in public transport. As there is increase in population and cities were rapidly growing, it become challenging to manage road traffic. This system ensures the possibility of real-time communication among vehicles, ambulances, hospitals, roadside units, and central servers. By using multihop optimal forwarding algorithm, the amount of time required to alert an ambulance which is there at accident zone will be lessen. To improve the aggregate spatial use of a road network, and bringing down the travel cost of operating a vehicle, an Optimal Route Planning Algorithm (ORPA) is used. This can reduce the vehicles being stuck on congested roads. The system was designed to make the ambulance easier to move and avoid traffic congestion [7].

Another method proposes a framework for achieving Object detection and tracking tasks in a non-overlapping multiple camera network. This system uses a new object detection algorithm using Mean Shift (MS) segmentation. The work which uses occluded objects which were separated with the help of depth information derived from stereo vision. A novel Bayesian Kalman filter was used to detect objects with simplified Gaussian mixture. A nontraining-based object recognition algorithm is employed to support object tracking over non-overlapping network [8].

III. PROPOSED METHODOLOGY

A. Number Plate Recognition - Optical Character Recognition

Optical Character Recognition on images helps to read license plate from closed circuit cameras or road rule enforcement cameras. They are used for various tasks, including electronic toll collection on pay per use roads, restricted car identification access control schemes such as for pay parking lots or for secured office compounds, monitoring traffic activity such as red-light adherence in an intersection and for direct marketing. Automatic Number Plate Recognition (ANPR) tends to be region specific, owing to plate variation from place to place [9].

Current work proposes use of an adaptive thresholding scheme, specifically, Otsu's method. To speed up processing and ease coding, a morphological closing, obtained using MATLAB's inbuilt functions dilation and erosion with a horizontal structuring element of width greater than that expected between characters, could be used to implement top hat filtering as the replacement of smearing algorithm. Further enhancement of the license plate would search for coarse texture regions using range filtering. Suitable binary measurements would then be used to retrieve the correct character objects. The character segmentation works for both the license plate extraction and optical character recognition module. It will segment the characters on region where each character can be analyzed through optical character recognition module which individually helps to recognize the words.

Optical character recognition takes as input the segmented characters from the image processing block and yields characters in form a machine editable string. This output string is then used to obtain the required data from a suitable database. The template matching approach proposed in the previous work would be adopted here. While the template matching is limited by its suitability to recognition of simple single-font, not-rotated, and fixed-size characters and requires properly built templates, it is easy to implement and yields reasonable accuracy in spite of its reduced complexity. However, a neural network classifier would be implemented to investigate the comparative difference in cognitive accuracy.

Pre-processing

Pre-processing is the first step where the minimum filter is applied to the image to enhance the dark values in the image by increasing the area. The pre-processing work which mainly used to make the characters and the plate edges bold, and also to remove the effects of the light diagonal strips that appear in the characters and edges of the License plates. The process increases the saturation of the image and the separation between the colors, and then the image is converted to gray scale by taking the luminance component.

RGB to Gray Scale Conversion

Next, the key idea is to convert an RGB image pixel which a triplet value corresponding to red, blue and green color component of an image into a single value by calculating a weighted sum of all three-color component in a specified spatial location.

Image Binarization

Binarization of an image gives further accuracy in character recognition. The global binarization methods used single threshold value for whole image and the local binarization method where the threshold value calculated locally pixel by pixel or region by region. This method uses a single threshold value for the whole image to perform segmentation.

Background Subtraction

The unwanted or noise of the segmented image should be eradicated using background subtraction where the images with unwanted segmented portions increases the complexity of the image segmentation process. It separates foreground from background as a function of a thresholding value of pixel intensities. Consequently, if foreground objects present in them both low and high intensity values, and background middle ones, it is difficult to find a threshold value capable to separate background from the foreground. Hence background subtraction helps to improve the segmentation procedure. Sample Image after Binarization

Optical Character Recognition

The feature in this system is the chain code of the contour of the image after dividing it into four tracks then into four sectors.

The Feed Forward Neural network trained with back propagation with sigmoid activation function with 4×4×8=128 input neurons corresponds to the Arabic alpha-numeric set of characters except zero.

Every character with the chain of features and with the class of maximum value will be predicted as a class of the character. If the error exceeds a predefined value then the character is considered a false one and rejected.

B. Counting the Number of Vehicles

This work is to decide the execution of picture handling methods in grouping and including moving vehicles in video floods of traffic scenes recorded by stationary cameras. The discovery and following methodology is as per the following. The moving vehicles are first separated from the traffic scene by applying the supportive foundation subtraction strategy. After the foundation subtraction, utilizing edge and middle channels, confined picture masses are distinguished as individual vehicles. When the masses are recognized, including and order of vehicles in a chose area are done. The fundamental outcomes demonstrate that the created framework can proficiently and dependably track vehicles when unhampered perspective on the traffic scene can be acquired. For ideal camera alignment, a precision superior to anything 80% in checking vehicles was watched. The present framework performs better with video information in which the vehicles are moving far from the camera contrasted with the video information in which the vehicles are moving towards the camera. The outcomes got through the created framework demonstrate that with further enhancements the framework can be utilized continuously to check and group vehicles on occupied traffic courses [10].

The vehicle counter is part into two class objects, one named Vehicle which is utilized to characterize every vehicle object, and the other vehicle counter which figures out which 'vehicles' are substantial before checking them (or not). Vehicle is generally straightforward and offers data about each identified article, for example, a followed position in each casing, what number of edges it has showed up in (and what number of it has not been seen for on the off chance that we incidentally free track of it), regardless of whether we have tallied the vehicle yet and what bearing we trust the vehicle to go in. We can likewise get the last position and the situation before that so as to compute a couple of qualities inside the vehicle counter calculation.

Vehicle counter is progressively mind boggling and fills a few needs. We can utilize it to decide the vector development of each followed vehicle from edge to outline, giving a pointer of what developments are valid and which are false matches. We do this to ensure we're not inaccurately coordinating vehicles and along these lines getting the most precise check conceivable. For this situation, we just expect vehicles going from the highest point of the picture to the base right hand corner, or the switch. This implies we just have a specific scope of suitable vector developments dependent on the edge that the vehicle has moved. The picture on the left demonstrates the normal vector developments (featured in red) and the picture on the left demonstrates an outline of separation moved versus the edge - those classed as passable developments are featured by the sliding window.

On the off chance that a vehicle object fulfills the above criteria, we at that point need to check what course it is moving in before then passing it to the counter. We would then be able to utilize this data to decide if the vehicle ought to be tallied and after that whether the tally applies to one side hand paths (up course) or right-hand paths (down heading). When fulfilled, we update the counter and print it to the yield outline. In the event that a vehicle has not been seen for some time, we expel it from the rundown of followed questions as it is no longer of intrigue.

This framework catches the motions from web-cam which is associated with miniaturized scale controller through USB have and the picture is prepared by methods for picture handling system. Here we are utilizing Open CV library to distinguish a frontal hand as a picture utilizing its Haar-Cascade hand Detector, this will build the human PC communication. In the event that any motion is perceived by the camera, a rectangular box will show up on screen.

The framework is partitioned into three essential stages, a foundation subtraction framework that recognizes striking districts in the picture, a division module that is in charge of dividing singular autos and the following and tallying module that keeps up a direction for every vehicle. The foundation subtraction framework is presently executed by displaying the shading circulation at every pixel as a unimodal Gaussian and after that estimating the Mahalanobis separate between the present shading vector and this foundation model.

Increasingly refined methodologies utilizing multi-modular Gaussians to all the more likely model shadows were researched yet these progressively costly models did not seem to offer huge upgrades in execution or shadow dismissal and in this manner, we are right now utilizing the less complex model. The foundation model is refreshed after some time by picking irregular examples from the last couple of pictures.

Pre-Seeding the Background

The video is very short, as it takes a piece of the video to proceed the background work. The last edge of the video considered here is totally without vehicles, and accordingly we can utilize it as the underlying foundation picture.

Recognizing data can use to refine the vehicle type and furthermore to address blunders which are caused because of impediments. Subsequent to enlisting the static vehicles the foundation picture is subtracted from the video edges to get the frontal area dynamic vehicles.

Framing up the Foreground Mask

Morphological changes which helps to improve the closer view cover. Investigating the veils, handled casings and the document of log values produced with sifting, and have moderated the issue of various pieces of one vehicle being distinguished as independent items.

Tracking Vehicles between Frames

To track the vehicles the log file should be considered by collecting all the centroid coordinates for each vehicle.

This will allow us to plot and inspect the path each vehicle traces across the image. Fig. 1. shows the general procedure for tracking vehicles between frames.

1. List the position of identifier, most recent at the front.
2. Last-seen counter with the number of frames will be the last seen vehicle.
3. Count the vehicle and mark it by a flag. If not marked, then the class vehicle counter will store a list of currently tracked vehicles, and track of the total count on every frame.
4. Update the list of bounding boxes and the positions of the identified vehicles in the state of the vehicle counter.
5. To update the currently tracked vehicle
   a. If vehicle is matched, then update the vehicle position and reset the last-seen counter. Remove the match from the list.
   b. Else, increase the last-seen counter for the current vehicle.
6. Create new vehicles for any remaining matches - If the vehicle has not been counted, update the total count and mark the vehicle as counted.
7. Remove vehicles that are no longer visible – if the last-seen counter exceeds the threshold value, remove the vehicle.

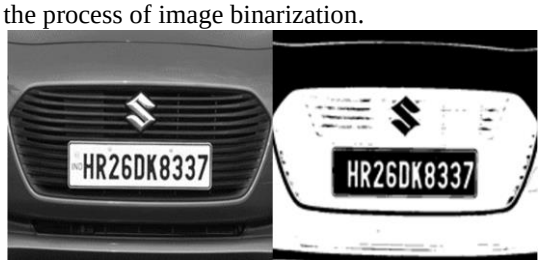
Fig. 1 General Procedure for Tracking Vehicles between Frames

IV. EXPERIMENTAL EVALUATION

Experimental evaluation of the proposed approach has been performed on UIUC Image Database for Car Detection. The database consists of 1050 training images with 550 car and 500 non-car images, 170 single-scale test images containing 200 cars at roughly the same scale as in the training images, 108 multi-scale test images containing 139 cars at various scales [11]. The images are in gray-scale in pgm format.

Fig. 2 to fig. 8 show the sample results of experimental evaluation on an image taken from the UIUC Image Database for Car Detection Dataset. The license plate recognition through OCR consists of the following procedure: The preprocessing work is the initial step leads to segment images precisely. In the proposed methodology as pre-processing work, initially the surveillance image is converted from RGB scale into gray scale image as shown in Fig. 2 (a).

As segmentation method, the gray scale converted image should be segmented using morphological operations for to binarize the image. The gray scale pixels will get convert into black and white segmented image which aids for future background subtraction method. Fig. 2 (b) shows the image after the process of image binarization.



(a) (b)

Fig. 2 Sample Image after Scale Conversion and Binarization

Background subtraction is the method where the unwanted noise in the binary image should be removed. Here the unwanted portion other than the license plate will be eliminated using threshold based elimination, only the license plate will be considered for optical character recognition method. Fig. 3 shows the image after the process of background subtraction.

Fig. 3 Sample Image after Background Subtraction

Optical character recognition is the technique which trained using feed forward backpropogation neural network to identify alpha-numeric set of characters from background seperated binary image. In this proposed methodology the license plate character is identifed using OCR through predefined features and character values in FFBN. Fig. 4 shows the result of optical character recognition from an image.

Fig. 4 Sample Result of Optical Character Recognition

Counting the number of vehicles is the next phase in the proposed work. Preseeding the background subtractor should be done before declaring the foreground mask in the surveillance image. The surveillance environment without vehicles should be captured for preseeding work and this image should be trained that is further used for detection and monitoring the traffic. Fig. 5 shows the surveillance image without vehicles for preseeding work.

Creating the foreground mask will helps to identify the morphological chances in the surveillance image. After preseeding through non vehicle image, the foreground should be masked for identifying the vehicle in the surveillance video. The Morphological process segmentation in the vehicle running image should be carried out to define the foreground mask.

Fig. 6 shows the image of Foreground mask for identifying the vehicles in the surveillance videos and Fig. 7 shows the sample input of the vehicles in the surveillance images.

Fig. 5 Sample image after pre-Seeding the background subtractor

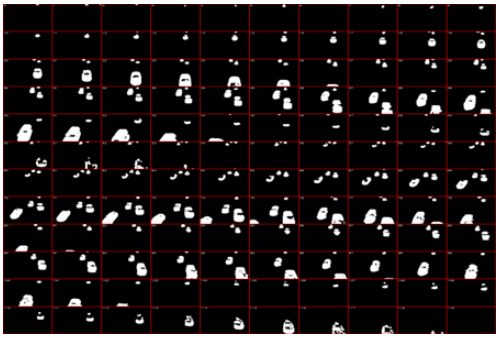


Fig. 6 Sample Image after Cleaning the Foreground Mask

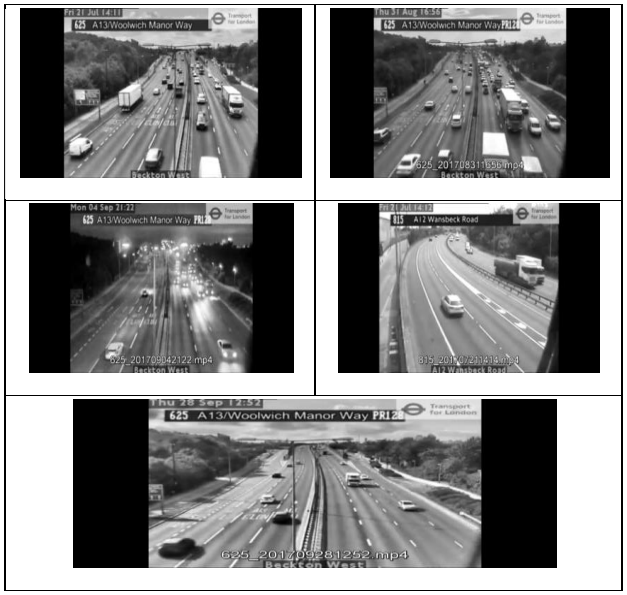


Fig. 7. Sample Input of the Application for detecting vehicles

Fig. 8 shows that the proposed methodology has a marking line in the surveillance video that whenever the vehicle crosses the threshold line the vehicle will be counted using the Haar-cascade hand detector. The count of the vehicle get increases and updated as the vehicle get crosses the line, the proposed method widely helps to control the traffic in various places. Sample output of the application of the proposed approach for detecting vehicles is shown in Fig. 8.

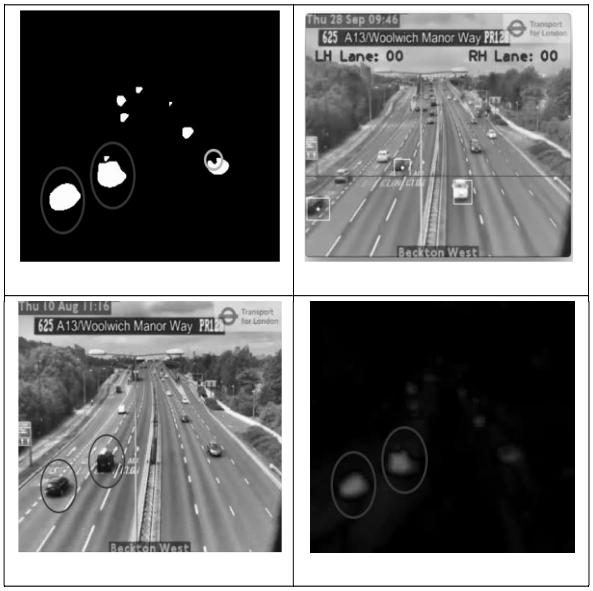


Fig 8. Sample output of the application of the proposed approach for detecting vehicles

V. CHALLENGES AND IMPROVEMENTS

The calculation utilized functions admirably in circumstances where traffic is free-streaming, inside sunshine hours. It likewise works generally well in most climate conditions in spite of the fact that foundation evacuation demonstrates troublesome in high breezes as a moving camera implies the foundation additionally changes rapidly. In any case, precision drops when vehicles are either near one another or have huge shadows (shaping one extensive article), dull vehicles don't constantly meet the location criteria, and night scenes are hard to determine as fog light shafts can make huge territories that meet limit criteria. Location criteria are likewise generally novel for every camera thus it might require investment to refine these qualities to be positive about the yield checks.

Huge numbers of these issues could be settled by exploring elective location techniques that don't depend so vigorously on identifying pixels over edge esteem. Keeping that in mind, identifying vehicles utilizing HAAR falls would possibly resolve these issues or if nothing else gives an increasingly exact and steady strategy for including vehicles in different conditions and without agonizing a lot over beginning identification esteems. All things considered, this would make the requirement for good preparing information and conceivably information for every camera thus would include be more asset substantial at first.

VI. CONCLUSIONS AND FUTURE WORK

The work might be extended to identify the bike riders who are riding without helmets in order to prevent the accidents. A real-time vision-based helmet warning monitoring system can be proceeded with this methodology to save the two-wheelers. The system can further work as a moving object detection method for helmet detection that resolves full and half helmet problems using helmet detection and segmentation method. The helmet detection system might the visual face / nose / mouth / left eye / right eye detection using Haar like feature and circle Hough transform to identify classes of full and half helmet [11]. The system will overcome various issues raised by the complexity of full and half helmet detection problems. Experimental results should be obtained with complex road and helmet style images revealed as that the proposed system could use further to successfully segment and detect the non-helmet persons in motorcycles will be the subject of future work [12].

By actualizing the intelligent transport system in the vehicle by utilizing web of things will improve the street wellbeing and give safe and solace to the vehicle client. The speed breaker discovery module causes the clients to drive the vehicle in experimental mode and anticipates the vehicle harms and human lives. At that point the general population ID while crossing the street additionally maintains a strategic distance from the street mishaps and lingerie the client to hinder the vehicle in those zones. In this manner, the programmed speed break location framework, individuals ID while crossing the street and the insinuation of soak bends in the street utilizing web of things will improve the street security and counteract the human live being superfluously executed. In this paper, we can additionally have stretched out with some programmed transport framework to give street security and all the quicker outcomes the follow up on the earth changes and furthermore to safe watchman the human lives.

REFERENCES

1. B. Duan, W. Liu, P. Fu, C. Yang, X. Wen, and H. Yuan, "Real-time onroad vehicle and motorcycle detection using a single camera," in Procs. of the IEEE Int. Conf. on Industrial Technology (ICIT), 10-13 Feb 2009, pp. 1–6. [3] C.-C.
2. Paul J. Ossenbruggen, Jyothi Pendharkar, and John Ivan, "Roadway safety in rural and small urbanized areas," Accident Analysis and Prevention, vol. 33, no. 4, pp. 485 – 498, 2001.
3. Ibrahim M. Abdalla, Robert Raeside, Derek Barker, and David R.D. McGuigan, "An investigation into the relationships between area social characteristics and road accident casualties," Accident Analysis and Prevention, vol. 29, no. 5, pp. 583 – 593, 1997.
4. Karl Kim, Lawrence Nitz, James Richardson, and Lei Li, "Personal and behavioral predictors of automobile crash and injury severity," Accident Analysis and Prevention, vol. 27, no. 4, pp. 469 – 481, 1995.
5. Lorenzo Mussone, Andrea Ferrari, and Marcello Oneta, "An analysis of urban collisions using an artificial intelligence model," Accident Analysis and Prevention, vol. 31, no. 6, pp. 705 – 718, 1999.
6. D. Ioannou, W. Huda, and A. F. Laine, "Circle recognition through a 2d hough transform and radius histogramming," Image and vision computing, vol. 17, no. 1, pp. 15–26, 1999.
7. F. Pedregosa, G. Varoquaux, A. Gramfort, V. Michel, B. Thirion, O. Grisel, M. Blondel, P. Prettenhofer, R. Weiss, V. Dubourg, J. Vanderplas, A. Passos, D. Cournapeau, M. Brucher, M. Perrot, and E. Duchesnay, "Scikit-learn: Machine learning in Python," Journal of Machine Learning Research, vol. 12, pp. 2825–2830, 2011.
8. Chiu, M.-Y. Ku, and H.-T. Chen, "Motorcycle detection and tracking system with occlusion segmentation," in Int. Workshop on Image Analysis for Multimedia Interactive Services, Santorini, June 2007, pp. 32–32.
9. A. Adam, E. Rivlin, I. Shimshoni, and D. Reinitz, "Robust real-time unusual event detection using multiple fixed-location monitors," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 30, no. 3, pp. 555–560, March 2008.
10. W. Hu, T. Tan, L. Wang, and S. Maybank, "A survey on visual surveillance of object motion and behaviors," IEEE Transactions on Systems, Man, and Cybernetics, Part C: Applications and Reviews, vol. 34, no. 3, pp. 334–352, Aug 2004.
11. R. Waranusast, N. Bundon, V. Timtong, C. Tangnoi, and P. Pattanathaburt, "Machine vision techniques for motorcycle safety helmet detection," in Int. Conf. of Image and Vision Computing New Zealand (IVCNZ), Nov 2013, pp. 35–40.
12. J. Chiverton, "Helmet presence classification with motorcycle detection and tracking," Intelligent Transport Systems (IET), vol. 6, no. 3, pp. 259–269, September 2012.

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