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AUTOMATIC NUMBER PLATE AND MOTORCYCLISTS WITHOUT HELMET DETECTION USING IMAGE PROCESSING

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***Abstract:** Motorcycles have always been the primary mode of transport in developing countries. In recent years, there has been a rise in motorcycle accidents. One of the major reasons for fatalities in accidents is the motorcyclist not wearing a protective helmet. The most prevalent method for ensuring that motorcyclists wear helmet is traffic police manually monitoring motorcyclists at road junctions or through CCTV footage and penalizing those without helmet. But it requires human intervention and efforts. This paper proposes an automated system for detecting motorcyclists not wearing helmet and retrieving their motorcycle number plates from CCTV footage video. The proposed system first does background subtraction from video to get moving objects. Then, moving objects are classified as motorcyclist or nonmotorcyclist. For classified motorcyclist, head portion is located and it is classified as helmet or non-helmet. Finally, for identified motorcyclist without helmet, number plate of motorcycle is detected and the characters on it are extracted. The proposed system uses Convolutional Neural Networks trained using transfer learning on top of pre-trained model for classification which has helped in achieving greater accuracy. Experimental results on traffic videos show an accuracy of 98.72% on detection of motorcyclists without helmet.*
***Keywords:** Convolutional neural network (CNN), license plate recognition (LPR), non-helmet motorbike riders detection, Optical Character Recognition, vehicle tracking.*

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 motorcycle riders to use helmet. Government have made it a punishable offense to ride a motorcycle without helmet and 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. Automation of this procedure is exceptionally attractive for vigorous observing of these infringements 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 proposed infrastructure is also costeffective.

II. RELATED WORK

Various literatures discussed method for plate detection. As most of the methods discussed in these literatures (in references) use more than one approach, it is not possible to do category wise discussion. Different number plate segmentation algorithms are discussed below. In [5], for faster detection of region of interest (ROI) a technique called sliding concentric window (SCW) is developed. It is a two-step method contains two concentric windows moving from upper left corner of the image. Then statistical measurements in both windows were calculated based on the segmentation rule which says that if the ratio of the mean or median in the two windows exceeds a threshold, which is set by the, then the central pixel of the windows is considered to belong to an ROI. The two windows stop sliding after the whole image is scanned. The threshold value can be decided based on trial and error basis. The connected component analysis is also used to have overall success rate of 96%. The experiment was carried out on Pentium IV at 3.0 GHz with 512-MB RAM and took 111ms of processing time for number plate segmentation. Another SCW based system is presented in [8] for locating Korean number plate. After applying SCW on vehicle image authors used HSI color model for color verification and then tilt was corrected by using least square fitting with perpendicular offsets (LSFPO). The distance between camera and vehicle varies from 3 to 7 meters. A cascade framework was used in [16] for developing fast algorithm for real time vehicle number plate detection. In this framework a compact frame detection module is used to segment number plate. This module contains three steps: First - Generation of Plate Region Candidates which is used to reject non plate regions by using gradient features. Second Extraction of complex plate regions which contains three steps to identify plate region and reject non plate regions. Third – plate verification is used to make sure that no non plate regions are extracted in preceding steps. The experiment was carried out on 3-GHz Intel Pentium 4 personal computer. In [15] a feature salient method is used to extract vehicle number plate by using salient features like shape, texture and color. The authors used Hough transform (HT) to detect vertical and horizontal lines from rectangular vehicle number plate and then processed it by converting red, green, blue (RGB) to hue-intensity-saturation (HIS). Finally, the number plate is segmented. This algorithm is executed on Pentium-IV 2.26-GHz PC with 1 GB RAM using MATLAB.

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 helmet or not. Most

of the existing systems for this problem statement use classifiers built on handcrafted features on the images/frames in video. Coming up with really good handcrafted features is a difficult task. This is why, deep Convolutional Neural Networks (CNNs) have become popular in recent years for the job of image classification. CNNs learn rich feature representations from a broad range of images which often outperform handcrafted features and lead to more accurate and efficient image classification. Thus, implementation of the system for this problem statement is done using CNN classifiers. One CNN classifier is used to classify between motorcyclist and nonmotorcyclist and another CNN classifier is used to classify between helmet and non-helmet. Building a CNN classifier from scratch requires a huge amount of data and powerful hardware resources. Also, despite having both of these, the built CNN model might not perform really well due to problems in its architecture. So, transfer learning is used on top of one of the most popular CNN models, VGG-16, that is pretrained on the ImageNet dataset. This has facilitated in obtaining high accuracy in classification. Also, the system recognizes the number plates of motorcycles when the motorcycle has not worn helmet.

Number plate detection (localization) for target motorcycle: Number plates have high contrast between foreground and background that is designed for humans so that they can read easily. This is a blessing for computer vision problem

Input motorcyclist image is first converted to grayscale. Then, it is thresholder. After this, the binary image obtained is inverted. Now, the contours are found out. Minimum area rectangles are generated around the contours. At this point, not only the number plate is detected, but there might be few other parts of motorcycle detected too. These are filtered out based on their orientation, height, width, aspect ratio. After this step, many of the candidates get filtered out (in most cases, all except the number plate get filtered). The remaining candidates are de-skewed, thresholder, eroded and contours are generated for each. Rectangles are then obtained for the contours. Image of number plate has numbers and letters on it which are separated by white colored area. Therefore, more rectangles get produced for a number plate image than other images. Thus, the image with number plate is successfully identified.

Thus, the steps can be generalized as follows:

- We read the input video frame or image by open source computer vision.
- On each frame we will do pre-processing such as image enhancement, improving the contrast level of image. Then this filtered frame is fed to background subtraction.
- Motorcycle detection and classification have done through using TensorFlow object detection and it discards Nonmotorcyclists.
- After detection of motorcyclists in input, we identify the head of the bike rider and classify whether the bike rider is utilizing a protective helmet or not. This can be classified using Convolutional Neural Network classifier.
- If the motorcyclists are found without helmet we will extract the number plate of the motorcycle using optical character recognition.
- Sending suitable notification to the motorcyclist via email associated with the registered number plate.

IV. IMPLEMENTATION RESULTS

We have used python as a programming language which is a robust programming language which has its main focus on rapid application development. We have three different python files each with different functionality i.e. hel.py for rider without helmet detection, openalpr.py to retrieve license plate number and db.py to update it to database and to retrieve email id. On running the initial module hel.py results in individual frames from the video which are stored in separate folder if and only if the rider is not wearing protective helmet. At the same time, motorbike riders without helmet are displayed with a rectangle surrounded to them. On running openalpr.py it extracts the license plate number of the vehicle and it is being printed for our reference meanwhile it is updated in database under the violations table. The module db.py deals with updating the license plate number to database as above as well as sending mail to the associated rider by retrieving mail id from vehicle's table. Thus, after detecting the license plate number and sending mail to corresponding rider, the output would be:

V. CONCLUSION AND FUTURE WORK

It is quite clear that ALPR is difficult system because of different number of phases and presently it is not possible to achieve 100% overall accuracy as each phase is dependent on previous phase. Certain factors like different illumination conditions, vehicle shadow and non-uniform size of license plate characters, different font and background color affect the performance of ANPR. Some systems work in these restricted conditions only and might not produce good amount of accuracy in adverse conditions. Some of the systems are developed and used for specific country. It is evident that very few of the ALPR are developed for India. So, there is a wide scope to develop such system for the country like India.

ALPR can be further exploited for traffic control, vehicle speed control and vehicle location tracking. It can be manually and cost effective for any country for low resolution images some improvement algorithms like super resolution of images should be focused. Most of the ALPR focus on processing one vehicle number plate but in real-time there can be more than one vehicle number plates while

the images are being captured. In 5. multiple vehicle number plate images are considered for ALPR while in most of other systems offline images of vehicle, taken from online database are given as input to ALPR so the exact results may deviate from the results.

This paper provides comprehensive study of recent development and future trends in ALPR, which can be helpful to the researchers who are involved in such developments.

REFERENCES

[1] You-Shyang Chen and Ching-Hsue Cheng, "A Delphi-based rough sets fusion model for extracting payment rules of vehicle license tax in the government sector," Expert Systems with Applications, vol. 37, no. 3, pp. 2161-2174, 2010.
[2] Anton Satria Prabuwono and Ariff Idris, "A Study of Car Park Control System Using Optical Character Recognition ," in International Conference on Computer and Electrical Engineering, 2008, pp. 866-870.
[3] A Albiol, L Sanchis, and J.M Mossi, "Detection of Parked Vehicles Using Spatiotemporal Maps," IEEE Transactions on Intelligent Transportation Systems, vol. 12, no. 4, pp. 1277-1291, 2011.
[4] Christos Nikolaos E. Anagnostopoulos, Ioannis E. Anagnostopoulos, Ioannis D. Psoroulas, Vassili Loumos, and Eleftherios Kayafas, License Plate Recognition From Still Images and Video Sequences: A Survey, vol. 9, no. 3, pp. 377-391, 2008.
[5] Christos Nikolaos E. Anagnostopoulos, Ioannis E. Anagnostopoulos, Vassili Loumos, and Eleftherios Kayafas, "A License Plate Recognition Algorithm for Intelligent Transportation System Applications," pp. 377-392, 2006.
[6] H. Erdinc Kocer and K. Kursat Cevik, "Artificial neural netwokrs based vehicle license plate recognition," Procedia Computer Science, vol. 3, pp. 1033-1037, 2011.
[7] A Roy and D.P Ghoshal, "Number Plate Recognition for use in different countries using an improved segmenation," in 2nd National Conference on Emerging Trends and Applications in Computer Science (NCETACS), 2011, pp. 1-5.
[8] Kaushik Deb, Ibrahim Kahn, Anik Saha, and Kang-Hyun Jo, "An Efficeint Method of Vehicle License Plate Recognition Based on Sliding Concentric Windows and Artificial Neural Network," Procedia Technology, vol. 4, pp. 812-819, 2012.
[9] Lucjan Janowski et al., "Quality assessment for a visual and automatic license plate recognition," Multimedia Tools and Applications Springer US, pp. 1-18, 2012.
[10] Yifan Zhu, Han Huang, Zhenyu Xu, Yiyu He, and Shiqiu Liu, "Chinese-style Plate Recognition Based on Artificial Neural Network. and Statistics," Procedia Engineering, vol. 15, pp. 3556-3561, 2011.
[11] Fikriye Öztürk and Figen Özen, "A New License Plate Recognition System Based on Probabilistic Neural Networks," Procedia Technology, vol. 1, pp. 124-128, 2012.
[12] Jian Liang, D Dementhon, and D Doermann, "Geometric Rectification of Camera- Captured Document Images," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 9, no. 3, pp. 591-605, 2008.
[13] Xin Fan and Guoliang Fan, "Graphical Models for Joint Segmentation and Recognition of License Plate Characters," IEEE Signal Processing Letters, vol. 16, no. 1, pp. 10-13, 2009.
[14] Lihong Zheng, Xiangjian He, Bijan Samali, and Laurence T. Yang, "An algorithm for accuracy enhancement of license recognition," Journal of Computer and System Sciences, 2012.
[15] Zhen-Xue Chen, Cheng-Yun Liu, Fa-Liang Chang, and Guo-You Wang, "Automatic License-Plate Location and Recognition Based on Feature Saliance," IEEE Transactions on Vehicular Technology, vol. 58, no. 7, pp. 3781-3785, 2009.
[16] Shen-Zheng Wang and Hsi-Jian Lee, "A cascade framework for real-time statistical plate recognition system," IEEE Trans. Inf. Forensics security, vol. 2, no.2, pp. 267-282, 2007.

