Smart Surveillance System for Automatic Detection of License Plate Number of Motorcyclists without Helmet

Sneha A. Ghonge[1*], Jignyasa B. Sanghavi[2]

[1*]Dept. of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India
[2]Dept. of Computer Science and Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India

Corresponding Author: snehaghonge98@gmail.com

Abstract— Since, motorcycles are affordable and a daily mode of transport there has been a rapid increase in motorcycle accidents, due to the fact that most of the motorcyclists do not wear a helmet which has made it an ever-present danger every day to travel by motorcycle. In last couple of years Government has made it a punishable offense to ride a motorcycle without helmet. The existing video surveillance based system is effective but it requires significant human assistance whose efficiency decreases with time and human biasing also comes into picture. So, automation of this process is highly desirable. In this paper, we propose an approach for automatic detection of motorcyclists without helmet using surveillance videos in real-time .The proposed approach first detects the motorcycle from the surveillance videos using background subtraction. Then it classifies between helmet and non-helmet using 1st order and 2nd order derivative edge detection algorithm and neural network. After detection if the motorcyclists are found without helmet then it will trace the vehicle number plate of the motorcyclists using (OCR) Optical Character Recognition and Neural Network and a copy of challan will be generated and will be send via SMS to the respective traffic rule violator.

Keywords — Helmet Detection, license number plate detection, Derivative edge detection Algorithm, Neural Network, (OCR) Optical Character Recognition.

I. INTRODUCTION

Two-Wheelers account for the most number of road accidents. Though careless and rash driving is the main cause of these accidents, head injuries form a single largest reason for the road accident deaths. Study shows that more than one-third who died in road accident could have survived if they would have worn a helmet, the usage of helmet can save accident deaths by 30 to 40% [1]. The rate at which preference of two wheelers in India is growing is 50 times the rate at which human population is growing. The risk of death is 2.5 times more among riders not wearing a helmet as compared to those wearing helmet. Speed is also not the main cause for motorcycle accident death study reveals that a fall from motorcycle even at slower speed can cause head injuries. Imagine a motorcycle travelling at a speed of 55km per hour, which means bike, is covering 49 feet per second. The impact of fall from the motorcycle at this speed is equal to that of a fall from fourth floor of a building [2]. Taking into account importance of wearing a helmet Government has made compulsory to wear a helmet while riding a motorcycle but many of the traffic rule violators do not obey them. Nowadays video surveillance based system has become an essential equipment to keep a track on any kind of criminal or anti law activity in modern civilization. A Law

enforcement agency has deployed large network of CCTV cameras covering all sensitive areas of cities like airport, railway station and road network. The road traffic monitoring is the most important part for detecting the traffic rule violators tracking criminals, etc. The existing video surveillance based system is effective but this system involves large number of humans who performance is not sustainable over long periods of time. Recent studies shows that human surveillance is not efficient as the duration of monitoring the video increases the errors made by humans also increases. And at some places as police Cops are manually clicking the photos of the violators not wearing the helmet in such case human biasing also comes into picture and its efficiency also decreases with large or dense traffic. So, automation of this process is on high requirement for reliable and robust monitoring of these violators. To make smart city many countries are adopting surveillance cameras at public places for 24x7 security monitoring. So, this automated solution for detecting the traffic rule violators is also cost-effective as it will use the existing video surveillance system. In this paper, we will be using background subtraction and neural network algorithm. We will extract the image from background subtraction and on that particular image we will apply derivative edge detection

and neural network algorithm for detecting the presence or absence of helmet and (OCR) Optical Character Recognition and neural network for tracing the license number plate as compared to traditional methods which uses handcrafted features SIFT (Scale Invariant Feature Transform), HOG (Histogram of Oriented Gradient), SVM (Support Vector Machine), LBP (Local Binary Pattern) for detection. Neural network has gain much more attention in complicated tasks such as image classification and has not been explored till date for such classification. The paper is organized as follows, Section I contains the introduction of the current scenario of the motorcycle accidents on public roads and the techniques or solution to overcome it. Section II contains the Literature Review on helmet detection and license plate detection methodology. In Section III the proposed system is described in detail. Section IV contains the Research Methodology of our project. Last section includes conclusion of this project.

II.   LITERATURE REVIEW

Wen et al. [3] suggested circle arc detection method based on Hough transform. They applied it detect the presence of helmet on the surveillance system of Automatic Teller Machine. But the drawback of this work was it has used only the geometric features to detect the presence of helmet. Geometric features are not enough to detect the presence of helmet; many times the head can be mistaken with the helmet.

In Chiu et al. [4] it has used computer vision based system which aims to detect and segment motorcycles partly occluded by another vehicle. Helmet detection system was used in which presence of helmet simplifies that there is a motorcycle. In this paper to detect the helmet edges were computed of the possible helmet region.

Chiverton et al. [5] described and tested a system for automatic classification of motorcycles with and without helmet. It has used (SVM) Support Vector Machine which is trained of (HOG) Histogram of Oriented Gradients which is derived from the head region of the static images and individual image frame from video data. By this method the accuracy rate was high but the number of testing images taken were very less.

Silva et al. [6] proposed a system for detection of helmet which first starts with moving object segmentation using descriptors and then detection of helmet tracing the (ROI) Region of interest which is the head region then classifies between helmet and non- helmet .But the drawback was that it uses circle Hough transform to classify between helmet and non - helmet which also leads to misclassification between head and helmet as both has round shape and it is computationally expensive.

Dahiya et al. [7] proposed a system for detection of bike riders without helmet using surveillance videos in real time it has used hand crafted features (HOG) Histogram of Oriented Gradients , (SIFT) Scale invariant feature transform (LBP)

Local binary pattern. By this method the detection accuracy was 93.80% but the processing time required was very slow 11.58 ms per frame.

Doughmala et al.[8]   presents half and full helmet wearing detection by Haar like features like nose, ear, mouth, left eye, right eye and circular Hough transform to detect helmet presence. But in this paper it has worked on fixed resolution images.

Karwal et al.[9] proposed a system for detection of vehicle number plate in which it has used normalized cross correlation for template matching with an aim of addressing the problem of scaling and recognition of characters under different positions but the drawback of this work was it has used fixed template matching.

Sulaiman et al.[10] process in combination of image processing and (OCR) Optical Character Recognition to detect vehicle number plate under different background but it has worked on static i.e. non - moving images in Malaysia.

Lahiri et al [11] proposed a system in which it has used image processing techniques such as edge enhancement, un-sharp masking for detecting correctly the edges in an image and (OCR) Optical character recognition to detect the components in an image .But it was not able to detect some misaligned and different size of characters in image.

 Yun-Chung et al [12] used Fuzzy system with (OCR) Optical character recognition but the drawback was it fail to detect the boundaries of vehicle number plate due to failure occurred in locating the module and it also fails to differentiate between numbers '1' and '7'.

Cika et al [13] used (RBF) Neural Network to recognize characters especially for Saudi Arabian vehicle plate but the limitation was it was sensitive to brightness of light.

III.   PROPOSED SYSTEM

The objective of this paper is to develop a system which will detect whether the person is wearing helmet or not and if not then capture vehicle number plate and convert it into text for automatic challan . The techniques used are 1st and 2nd order derivative edge detection with neural network for helmet detection and (OCR) Optical Character Recognition with neural network for license number plate detection .The following are the steps which will be followed during processing

- Pre-processing on video.
- Background removal.
- Segmentation of two-wheelers.
- Detection of helmet.
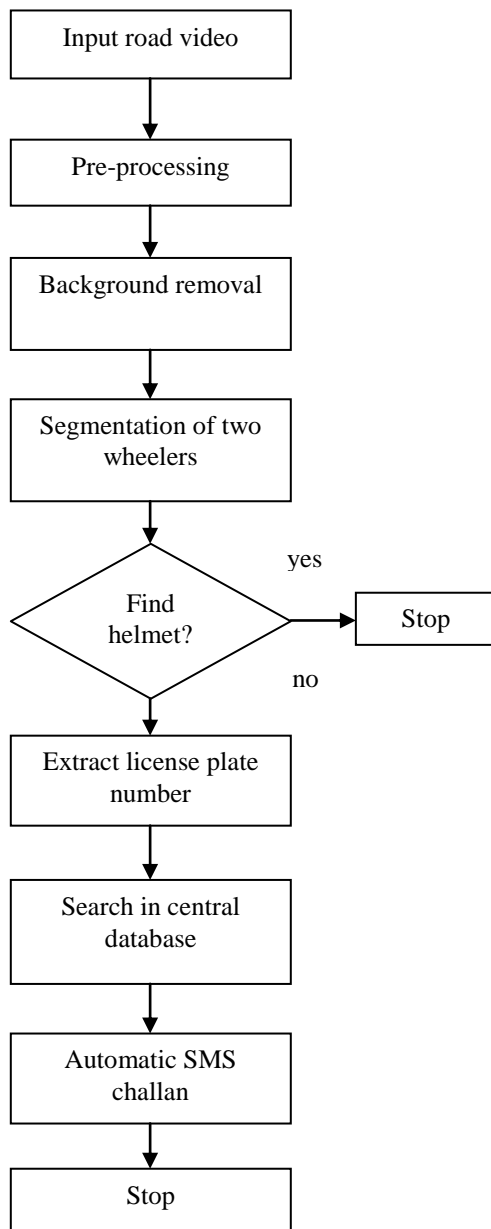- If helmet not detected then number plate recognition.

found without helmet then trace the license number plate of the motorcycle. The steps involved are as follows:

A. INPUT ROAD VIDEO

Videos of the road are taken of specific duration, then obtained video is broken into frames of a fixed intervals. The output will be the sequence of input video frames. On each frame we will do pre-processing such as image enhancement, improving the contrast level of the image, removing the noise and applying Gaussian filter. Then this filtered video frame is fed to background subtraction.

B. BACKGROUND REMOVAL

As motorcycle is the main requirement of our system computation overhead of the entire video will be a hectic task. So in order to increase the detection rate we do background subtraction to separate the objects in motion to that of static objects. Objects in motion such as motorcycle, human, cars from static objects such as trees, roads and buildings are extracted. This can be done by the Gaussian model.

C. SEGMENTATION OF TWO WHEELERS

The output from background subtraction consists of objects in motion such as motorcycle, human, cars, etc. But we are only interested in motorcycle so we segment the motorcycle from the objects in motion using object segmentation which will differentiate between motorcycle and non- motorcycle. Using feature extraction methods such as (HOG) Histogram of oriented gradients, (SIFT) Scale invariant feature extraction, (LBP) Local binary pattern and first and second order derivative edge detection algorithm.

D. DETECTION OF MOTORCYCLISTS WITHOUT HELMET

After the detection of two wheelers we will detect the motorcyclists without helmet using feature extraction algorithms (HOG) Histogram of oriented gradients , (SIFT) Scale invariant feature extraction, (LBP) Local binary pattern and first and second order derivative edge detection algorithm with Neural Network.

E. EXTRACT LICENSE NUMBER PLATE

If the motorcyclists are found without helmet we will extract the license number plate of the motorcycle using (OCR) Optical character recognition as a template matching with Neural Network.

V. CONCLUSION

Taking into account the techniques studied in literature review and to overcome the drawbacks in the technique we

Figure1: Proposed System Working.

IV. RESEARCH METHODOLOGY

In this section we propose an approach for automatic detection of motorcyclists without helmet in surveillance videos. And in case if the motorcyclists are not wearing the helmet then we will trace the license number plate of the vehicle .The process involves three phrases. In the first phrase we will detect the motorcycle in the surveillance videos. In the second phrase we will locate the head of the motorcyclists to detect whether the motorcyclists is wearing a helmet or not. In the third phrase if the motorcyclists is

propose a real-time vision-based motorcycle monitoring system to detect and track motorcycles in a sequence of images using 1st and 2nd order derivative edge detection algorithm with neural network for detecting presence or absence of helmet and (OCR) Optical Character Recognition with Neural Network for license number plate detection. The proposed approach is design with an aim to catch the traffic rule violators not wearing the helmet and report the vehicle number plate of the violators and generate the automatic challan.

REFERENCES

[1] Maya Sharma , "use your head - use a helmet", Team NDTV article , Dec 12 , 2016.

[2] Anisha Bhatia ,"Wearing helmets - A choice between life and death", Team NDTV article , Dec 9 , 2016.

[3] C.Y.Wen, S.H.Chiu, J.J.Liaw, and C.P. Lu, *"The safety helmet detection for ATM's surveillance system via the modified hough transform"* in IEEE 37th Annual International Carnahan Conference on Security Technology , 2003 , pp- 364-369.

[4] C.C. Chiu, M.Y. Ku, and H. -T. Chen, *"Motorcycle detection and tracking system with occlusion segmentation,"* in Proceeding of International Workshop on Image Analysis for Multimedia Interactive Services , Santorini , Greece, 6-8 June 2007, pp. 32-32.

[5] J. Chiverton , *"Helmet presence classification with motorcycle detection and tracking,"* IET Intelligence Transport Systems (ITS) , Volume 6 , no. 3 , pp. 259-269, 2012.

[6] R. V. Silva , T. Aires , and V. Rodrigo , *" Helmet Detection on Motorcyclists using image descriptors and classifiers"*, in Proceeding of Graphics , Patterns an Images (SIBGRAPI) , Rio de Janeiro ,Brazil , 27-30 August 2014 , pp. 141-148.

[7] K. Dahiya, D. Singh and C.K .Mohan, "*Automatic detection of bike riders without helmet using surveillance videos in real - time",* in Proceeding of International Joint Conference Neural Networks (IJCNN), Vancouver, Canada , 24-2 July 2016,pp.3046-3051.

[8] Pathasu Doughmala, Katanyoo Klubsuwan, "*Half and Full Helmet Detection in Thailand using Haar Like Feature and Circle Hough Transform on Image Processing*" in Proceeding of IEEE International Conference on Computer and Information Technology, Thailand, Bangkok , pg. 611-614,2016.

[9] Hanit Karwal , Akshay Girdhar , "*Vehicle Number Plate Detection System for Indian Vehicles",* in Proceeding of IEEE International Conference on Computational Intelligence and Communication Technology pg. 8-12,2015.

[10] Norizam Sulaiman , *"Development of Automatic Vehicle Plate Detection System "* in Proceeding of IEEE 3rd International Conference on System Engineering and Technology , 17-20 Aug .2013.

[11] Sahil Shaikh , Bornika Lahiri, Gopi Bhatt, Nirav Raja, "*A novel approach for Automatic Number Plate Recognition",* in Proceeding of International Conference on Intelligent Systems and Signal Processing (ISSP), pg. 375-380, 2013.

[12] C. Shyang-Lih, C.Li-shen, C.Yun-Chung, C. Sei- Wan. "Automatic License Plate Recognition," IEEE Transaction on Intelligent Transportation Systems, vol. 5, no.1, pp. 42-53, 2004.

[13] P. Cika, *"Vehicle license plate detection and recognition using symbol analysis,"* Proceedings of the 34th International Conference on Telecommunications and Signal processing," 2011, pp. 589- 592.

[14] Arkadiusz Pawlik, *"High performance automatic number plate recognition in video streams",* Image Processing Theory, Tools and Applications, 2012.

[15] Rahim Panahi, *"Accurate Detection and Recognition of Dirty Vehicle Plate Numbers for High- Speed Applications"*, IEEE transactions on intelligent transportation systems, vol. 18, no. 4,pg. 767-779, April 2017.

[16] D. Singh , C. Vishnu , and C.K Mohan , *"Visual Big data analytics for traffic monitoring in smart city ,"* in proc. IEEE Conf . Machine Learning and Application (ICMLA) , Anaheim , California , 18-20 December 2016.

Authors Profile

Sneha   A. Ghonge has done Bachelor of Engineering   in   Electronics   and Telecommunication from Rashtrasant Tukodoji Maharaj Nagpur University , India in 2015 and Currently Pursuing P.G in Computer Science and Engineering from Ramdeobaba College of Engineering and Management , Nagpur , India and Research Paper work   focuses on Image Processing.

Jignyasa Sanghavi is Assistant Professor at Shri Ramdeobaba College of Engineering and Management, Nagpur, India. She received B.E. degree and M.Tech degree in Computer Science and Engineering from Rashtrasant Tukodoji Maharaj Nagpur University. She has teaching experience of 7 years in Computer Science and Engineering department. Her research interest includes Image Processing, Parallel Computing, Databases and Algorithms. She has published 7 research papers in various conferences, workshops and International Journals.