IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

HELMET DETECTION AND NUMBER PLATE RECOGNITION USING MACHINE LEARNING

[1]Swapnil Nanasaheb Deshmukh, [2]Vinod Balshiram Pande, [3]Vaibhav Sudam Udhane, [4]Chaitanya Ashok Waghire, [5]Prof. S. R. Bhujbal

[1]Student, [2]Student, [3]Student, [4]Student, [5]Head Of Department

BE (Department Of Computer Engineering)

P K Technical Campus, Pune, India

Abstract: Bikers who do not wear helmets pose a major threat to themselves. A UN Motorcycle study done in 2021 showed that around fifteen thousand deaths of bike riders could be avoided annually in India with safety measures. It also mentions that wearing helmets improves the chances of surviving accidents by 42 % and helps riders to avoid injuries by 69 %. Due to large vehicular traffic, manual monitoring of vehicles has become a problem. This can be automated using Deep Learning, which is the purpose of our work. Motorcycles have always been the primary mode of transportation in developing countries. Motorcycle accidents have increased in recent years. One of the main reasons for fatalities in accidents is that a motorcyclist does not wear a protective helmet. The most common way to ensure that motorcyclists wear a helmet is by traffic police to manually monitor motorcyclists at road junctions or through CCTV footage and to penalize those without a helmet. But it requires human intervention and effort. So this system Proposes an automated system for detecting motorcyclists who do not wear a helmet and retrieving their motorcycle number plates from CCTV video footage First, the system classifies moving objects as motorcycling or non motorcycling. In the case of a classified motorcyclist, the head portion is located and classified as a helmet or non-helmet. Finally, for the motorcyclist identified without a helmet, the number plate of the motorcycle is detected and the characters on it are extracted by using the OCR algorithm.

Index Terms **- Helmet Detection, Machine Learning, Opencv, Image Selection ,Extraction Ocr.**

I. INTRODUCTION

In almost all countries, motorcycle is a popular means of transport. However, due to less protection high risk is involved in two wheelers. Motorcycle riders need to take extra steps to safeguard their bodies in addition to wearing helmets, which try to lower the risk of major head and brain injuries by absorbing the force of a force or collision to the head when compared to those who don't wear helmets, riders and passengers who do so significantly boost their chances of surviving an accident. Every motorcyclist is required by law to wear a helmet when operating a motorcycle. However, a lot of bikers disregard and operate their vehicle without any form of defence. The policeman made an effort to manually regulate the situation, but it was insufficient given the actual situation. Despite the recent requirement for helmets, many people continue to operate motor vehicles without them. Since helmets are the primary piece of safety gear used in developing nations, the number of fatalities has increased every year. It is highly desirable for two-wheeler riders to use helmet to reduce the risk. Most of the deaths in the last few years in accidents are due to head injury. It is a punishable offense to ride a bike without helmet and many manual strategies have been adopted to catch the violators due because of its importance. Still a large number of two wheeler riders do not follow the rule. Automation of this process is the need of the hour is real time and accurate monitoring of these violations as well as it also significantly reduces the amount of human intervention. In numerous countries systems which involve surveillance cameras have been installed at public places, Therefore, using

the existing infrastructure the solution for detecting traffic rule violators is cost-effective. In the field of Road safety Automation, not much exists in order to ensure that traffic rules are not being violated. Violations such as speeding and crossing a Stop signal can be detected by automated systems and have already been implemented on roads. But when it comes to not wearing helmets, there has been no automated process implemented to detect and indicate this violation. A large amount of people casually don't wear helmets while riding assuming its safe and chances that they will get caught are very less.

1) Scope Project

Motorcycle accidents have been rapidly growing throughout the years in many countries. The helmet is the main safety equipment of motorcyclists, however many drivers do not use it. The main goal of helmet is to protect the drivers head in case of accident. In case of accident, if the motorcyclist does not use can be fatal .and it is not possible for traffic police force to watch every motorcycle and detects the persons who are wearing helmet or not .so there was need to make the automates system that's automatically monitor motorcycles and detects the persons wearing helmet or not and also detect number plate to penalize those persons without a helmet.

2) User classes and characteristics

Identify the various user classes that you anticipate will use this product. User classes may be differentiated based on frequency of use, subset of product functions used, technical expertise. security or privilege levels, educational level, or experience. Describe the pertinent characteristics of each user class. Certain requirements may pertain only to certain user classes. Distinguish the most important user classes for this product from those who are less important to satisfy.

3) Assumptions and Dependencies

Helmet Recognition Assumptions:

Assumption 1: Helmets are worn by individuals in specific contexts, such as during bike riding, motorcycle riding, construction work, or in sports like cycling or skateboarding.

Assumption 2: Helmet recognition systems rely on visual cues to identify the presence or absence of a helmet on a person's head. These cues can include the shape, colour, and location of the helmet.

Assumption 3: The system may assume that helmets are typically worn on the head and that the head is visible in the image or video frame.

Helmet Recognition Dependencies:

Image/Video Input: Helmet recognition systems depend on a continuous stream of images or videos as input. This input can be from cameras, CCTV systems, or other visual sensors. Computer Vision Algorithms: The core of helmet recognition systems relies on computer vision algorithms, including object detection, image segmentation, and deep learning models to identify and classify helmets. Data Annotation: Training a helmet recognition model requires annotated data where helmets are labelled. Manual or automated data annotation is a critical dependency. Hardware: The system may rely on specific hardware, such as cameras and processing units, to capture and process images or videos. Environmental Conditions: The effectiveness of helmet recognition can be influenced by environmental factors like lighting conditions, weather, and the presence of obstructions. License Plate Recognition (LPR)

II. METHODOLOGY

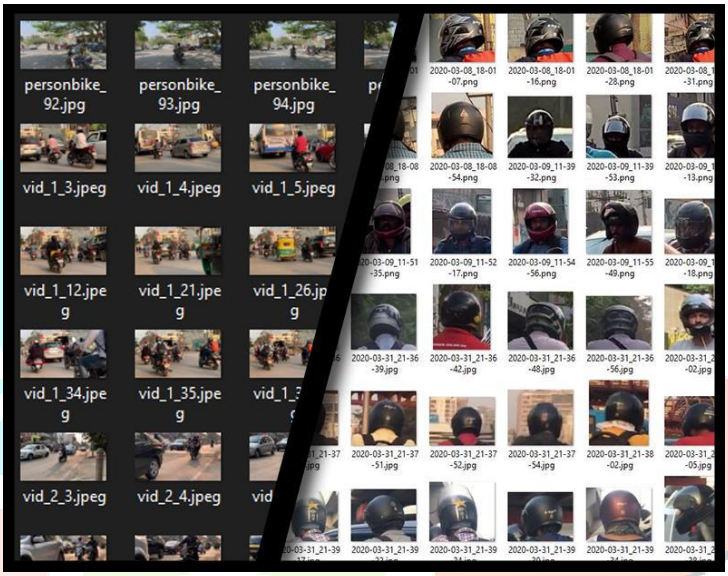
The main phases of this work consist of Dataset Creation, in which images were gathered and annotated for training purpose, followed by training the YOLOv3 model and the binary classifier on this custom dataset, and finally implementing these newly trained weights with the models in a Python code that utilises readily available libraries to perform the detection and classification tasks, and stores the results. These phases are explained in detail in the coming subsections. The methodology discusses the stages of development which are explained in section A. The architecture of the stages of proposed system development and the flow diagram are discussed in section B. Software design and development of automated system have been discussed in section C. the fig.1 shows the complete methodology of the system.

1. Stages of Development

The system has been developed in four stages. The first stage involved data(images) collection and classification into positive and negative images. The second stage involved machine training using OpenCV library and generation of HAAR [18] cascades. The third stage involved the text extraction from the number plate using OCR [16]. The fourth stage involved the challan generation using the number plate text extracted from the OCR. The last and the final stage involved development of a user-friendly software from which the users can pay the fine sitting anywhere in the world.

1.1 Stage 1:Data (Images) Collection

The sample images collection was the most difficult task in this project. The sample images of two wheeler riders with and without helmet with proper visibility of two wheeler's registration number plate. After image collection the images has to be classified in two types, The Positive- which comprises of the images which are to be detected by the system in the real time and The Negative- which are to be ignored by the system in real time environment.



1.2 Stage 2: Machine Training and HAAR generation

After the sample collection now, machine needed to be trained using those images and as the output of it's learning the OpenCV library produces a HAAR [18] file which could be used by any scripting language among Java, Python and CPP and used for making decision in the real time environment.

1.3 Stage 3: Text extraction from registration number plate

Now when the system has decided that the rider is not wearing helmet and also detected the registration number plate region then comes the role of OCR. This step will extract the actual registration number of the two-wheeler for which the challan has to be generated.

1.4 Stage 4: Challan generation

This is the final step our system where the challan would be generated against the registration number provided by the OCR. Any of the scripting languages like Java, python and CPP can connect to the state's road transport authority's database and generate the challan.

1.5 Stage 5: User Interface for fine payment

We have designed web and mobile interfaces for the fine payment. The users can save a lot of time as the web and mobile app provides the facility of paying fine anytime and sitting anywhere in the world.

III. Architecture design of the system

The smart system was designed using openCV and OCR libraries. The fig.2 shows the architecture of the system. The machine was trained to differentiate between two- wheelers and other vehicles running on the road, then the machine was trained to decide whether the rider is wearing the helmet or not using openCV library. OpenCV is a strong image processing tool which can differentiate between different objects after being trained using sample images. On detecting the rider without helmet, the registration plate of the two-wheeler is processed using OCR. The OCR is a library used for extracting text from the images.

The Raspberry pi takes input from the CCTV cameras for obtaining live video of road traffic. Raspberry pi runs a python or a java script which uses the HAAR cascade file generated using openCV and decides whether the two wheeler rider is wearing the helmet or not and if the rider is found without helmet then the rider is penalized. The process of challan generation is initiated by the raspberry pi itself after detecting text after text attraction from the image of the registration number plate.

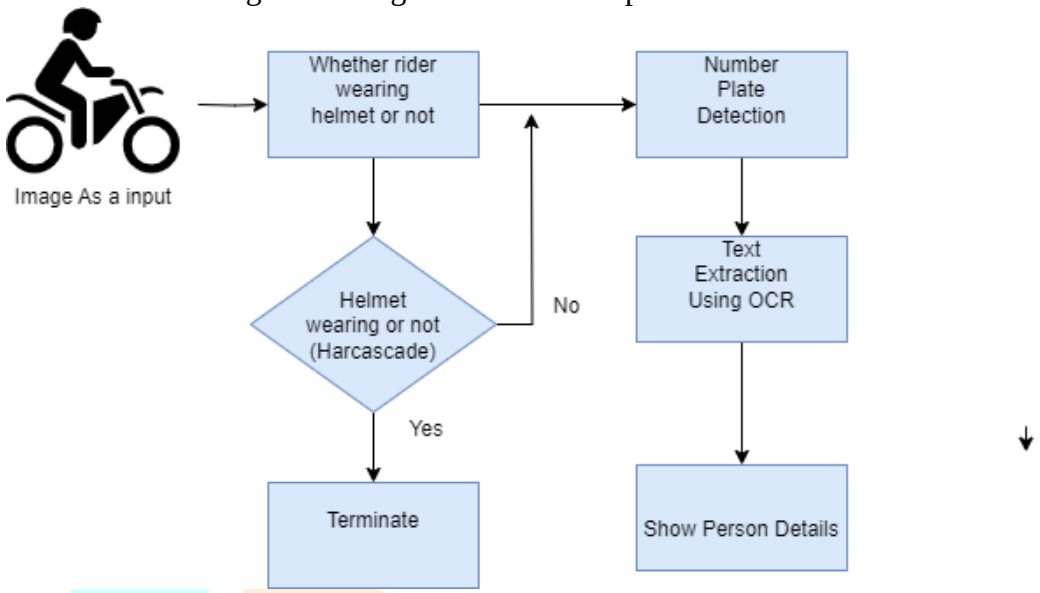


Fig 2: System Architecture

IV. CONCLUSION

A working prototype of the system that can detect bikers who are violating traffic rules by not wearing helmets and endangering their own safety by doing so, has been made. A system like this can actively help in reducing the number of people not following traffic rules. The algorithms and methods involved in each step of this work, such as YOLOv3, Res Net classifier, etc. were chosen after researching thoroughly on a lot of alternatives. We implemented methods that provide balance between speed and accuracy, while also giving reliable information. This system, once implemented with high quality equipment, can give even better accuracies than the current prototype. In the near future,
further research can be carried out to make the system work with different camera angles, and detect unsafe helmet designs that are not approved by the Police. The current dataset is of small size and is just enough to implement a working prototype model. The dataset can be expanded to make the model robust, allowing it to handle multiple camera angles and different lighting conditions.

1) People wearing different kinds of helmet which are not safe and hence should be considered as violation of traffic rule.
2) Rider wearing different kinds of caps which should also be considered as violation.
3) People wearing turbans should also be considered as special case.

V. LITERATURE SURVEY

1.Paper Name: Automated Helmet Detection for Multiple Motorcycle Riders using CNN
Author: Madhuchhanda Dasgupta, Oishila Bandyopadhyay, Sanjay Chatterji, Computer Science Engineering IIIT Kalyani West Bengal, India
Description : Automated detection of traffic rule violators is an essential component of any smart traffic system. In a country like India with high density of population in all big cities, motorcycle is one of the main modes of transport. It is observed that most of the motorcyclists avoid the use of helmet within the city or even in highways. Use of helmet can reduce the risk of head and severe brain injury of the motorcyclists in most of the motorcycle accident cases. Today violation of most of the traffic and safety rules are detected by analysing the traffic videos captured by surveillance camera. This paper proposes a framework for detection of single or multiple riders travel on a motorcycle without wearing helmets. In the proposed approach, at first stage, motorcycle riders are detected using YOLOv3 model which is an incremental version of YOLO model, the state-of-the-art method for object detection. In the second stage, a Convolutional Neural Network (CNN) based architecture has been
proposed for helmet detection of motorcycle riders. The proposed model is evaluated on traffic videos and the obtained results are promising in comparison with other CNN based approaches.

2.Paper Name: Helmet and Number Plate detection of Motorcyclists using Deep Learning and Advanced Machine Vision Techniques
Author: Fahad A Khan, Nitin Nagori, Dr. Ameya Naik, Department of Electronics Telecommunication K.J.Somaiya college of Engineering Mumbai, India
Description : In today's world, the increasing use of Motorcycles has prompted increment in road accidents and injuries. Helmet not used by the motorcycle rider is one of the major cause. Currently, one procedure is to physically check use of helmet at the
pavement junction or through the CCTV footage video, which requires human intervention to detect motorcyclists without helmet. The proposed framework presents a computerization machine structure to distinguish the motorcycle rider with or without
helmet from images. The system extracts objects class based on feature extracted.

3.Paper Name: Helmet Detection Using ML IoT
Author: Dikshant Manocha, Ankita Purkayastha, Yatin Chachra, Namit Rastogi, Varun Goel Department of Electronics and Communication Engineering Jaypsee Institute of Information Technology Noida, India
Description :This paper is about detecting two-wheeler riders without helmet with the help of machine learning and provide them with a user interface to pay challans. The proposed approach first captures the real time image of road traffic and then
differentiates the two wheelers from other vehicles in the road. It then processes to check whether the rider and pillion rider are wearing helmet or not using OpenCV. If any one of the riders and pillion rider found not wearing the helmet, their vehicle
number plate is processed using optical character recognition (OCR).

4.Paper Name: Convolutional Neural Network-based Automatic Extraction and Fine Generation
Author: Y Mohana Roopa, Sri Harshini Popuri, Gottam Gowtam sai Sankar, Tejesh Chandra Kuppili, Computer Science and Engineering Institute of Aeronautical Engineering, Hyderabad, India
Description: Numerous reasons lead to dangerous accidents. Lack of helmet is one of the major reasons for death during accidents. People are negligent regarding helmet usage. This needs to be controlled by proper surveillance. The present traffic
control system is mostly based on human power. A police officer cannot manage the whole traffic and look out for rule-breakers. It would be a very tough job and will need a lot of human power to cover all the areas. This can be solved through
our new automated system where two-wheelers with no helmets will be recognized through yolov2 and the respective frames are taken from the video from which the number plate of the particular vehicle is extracted and the fine for disregarding traffic
rules.

VI. Acknowledgment

I would like to take this opportunity to thank my internal guide Prof. S.R.Bhujbal for giving me all the help and guidance I needed. I am really grateful to them for their kind support. Their valuable suggestions were very helpful.

I am also grateful to Prof. S.R.Bhujbal Head of Computer Engineering Department, P K Technical Campus for her indispensable support, suggestions.

VII. REFERENCES

[1] K. Dahiya, D. Singh, and C. K. Mohan, "Automatic detection of bike riders without helmet using surveillance videos in real-time," in Proc.Int. Joint Conf. Neural Networks (IJCNN), Vancouver, Canada, 24–29July 2016, pp. 3046–3051

[2] 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

[3] Vishnu, Dinesh Singh, C. Krishna Mohan, Sobhan Babu, 2017, 'Detection of motorcyclists without helmet in videos using convolutional neural network', 2017 International Joint Conference on Neural Networks (IJCNN)

[4] Quadri, Tofiq & Patel, Mayank. (2015). "Face Detection and Counting Algorithms Evaluation using OpenCV and JJIL".

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

[6] J. Chiverton, "Helmet presence classification with motorcycle detection and tracking," IET Intelligent Transport Systems (ITS), vol. 6, no. 3, pp. 259–269, 2012.

[7] T. Lin, P. Goyal, R. Girshick, K. He, and P. Doll´ar, "Focal loss for dense object detection," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 42, no. 2, pp. 318–327, 2020.

[8] N. Boonsirisumpun, W. Puarungroj, and P. Wairotchanaphuttha, "Automatic detector for bikers with no helmet using deep learning," in 2018 22nd International Computer Science and Engineering Conference (ICSEC), 2018, pp. 1–4.

[9] J. Redmon and A. Farhadi, "Yolov3: An incremental improvement," CoRR, vol. abs/1804.02767, 2018. [Online]. Available: http://arxiv.org/abs/1804.02767

[10] Rohith, S. A. Nair, P. S. Nair, S. Alphonsa, and N. P. John, "An efficient helmet detection for mvd using deep learning," in 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), 2019, pp. 282–286.

[11] M. Dasgupta, O. Bandyopadhyay, and S. Chatterji, "Automated helmet detection for multiple motorcycle riders using cnn," in 2019 IEEE Conference on Information and Communication Technology, 2019, pp. 1–4.

[12] R. Huang, J. Pedoeem, and C. Chen, "Yolo-lite: A real-time object detection algorithm optimized for non-gpu computers," 2018 IEEE International Conference on Big Data (Big Data), Dec 2018. [Online]. Available: http://dx.doi.org/10.1109/BigData.2018.8621865

[13] T.-Y. Lin, M. Maire, S. Belongie, L. Bourdev, R. Girshick, J. Hays, P. Perona, D. Ramanan, C. L. Zitnick, and P. Doll´ar, "Microsoft coco: Common objects in context," 2014.

[14] J. Cartucho, R. Ventura, and M. Veloso, "Robust object recognition through symbiotic deep learning in mobile robots," in 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018, pp. 2336–2341.

[15] News Mobile, 'Chill your head while riding bike with AC helmet', 25- Dec-2017. [Online]. Available: http://newsmobile.in/articles/2017/12/25/chill-headriding- bike-achelmet/. [Accessed: 30-Nov- 2019]

[16] The Times of India, 'Helmet must for pillion riders in Karnataka from Jan 12', 08-Jan-2016. [Online]. Available: https://timesofindia.indiatimes.com/city/bengaluru/Helmetmust- forpillion-riders-in-Karnataka-from-Jan 12/articleshow/50499061.cms. [Accessed: 30- Nov- 2019]

[17] G. Sasikala, K. Padol, A. A. Katekar and S. Dhanasekaran, "Safeguarding of motorcyclists through helmet recognition," 2015 International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Chennai, 2015, pp. 609-612.

[18] N. Boonsirisumpun, W. Puarungroj and P. Wairotchanaphuttha, "Automatic Detector for Bikers with no Helmet using Deep Learning," 2018 22nd International Computer Science and Engineering Conference (ICSEC), Chiang Mai,Thailand, 2018, pp. 1- 4.

[19] L. Chen, W. Chang, J. Su and Y. Chen, "i-Helmet: An intelligent motorcycle helmet for rear big truck/bus intimation and collision avoidance," 2018 IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV,2018, pp. 1-2