iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50375

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Helmet Detection on Two-Wheeler Riders using Machine Learning

Ms. Mayuri Raut[1], Ms. Divya Shende[3], Mr. Pranay Meshram[4], Ms. Bhagyashri Nimgade[5], Prof. Anuja Ghasad[6]
[1, 2, 3, 4]*Department of Computer Science and Engineering, J D College of Engineering An Autonomous Institute, Nagpur, Maharashtra, India*
[5]*Guide, Assistant Professor, CSE Dept. JDCOEM, Nagpur*

Abstract: In daily life, the role of a helmet is vital for motorists. The human brain is an important organ, which is protected by the skull. So the head is to be protected by a helmet in case of an accident. From our literature survey we found that in india, the majority of motorists do not wear a helmet. This negligence causes fatal injuries. We want to minimize this risk. Our project uses ML and OPENCV tools for Helmet Detection. In this project we use a camera module to detect the face of the person. The preprocessed input is fed to the Machine Learning model. This model processes it and transports which 'outputs' the real-time status of the helmet. ***Keywords:- MachineLearning, OpenCV, Helmet Detection***

I. INTRODUCTION

Intelligent tracking has become more prevalent in our daily lives in recent years. Object detection is a hotspot for computer vision and offers several possibilities. In the initial stages of research, object detection systems mostly used classical features to extract image features, coupled with cascade-of-rejectors to speed up calculation speed and obtain pedestrian recognition. The region selection methods using sliding windows lack specific calculation, the feature extraction techniques have poor generalization capacity and low robustness for complex image data, and traditional object detection algorithms have numerous drawbacks. As an outcome, their running time is too high to solve practical problems.

A. Object Movement Detection

Finding a helmet is the first step in the identifying process moving automobiles. The example begins by collecting a first video frame in which the background is split from the moving objects, as opposed to processing the entire video at once.

Processing just the first few frames makes it easier to complete the necessary procedures to process the video. For the foreground detector to establish the Gaussian mixture model, a specific number of video frames are required .

The technique of foreground separation is rarely flawless and frequently contains unwanted noise. The bounding boxes of each connected component that relate to a moving vehicle are then discovered.

B. Categorization of Vehicles

The extracted moving vehicle from the previous section must now be classified. To categorize vehicles, we have used a variety of machine learning techniques, from traditional machine learning algorithms to cutting-edge deep neural networks, to determine which strategy performs best when there is little available data. A vehicle can be categorized as either a two-wheeler or a four-wheeler. Due to our need to identify helmets, we are only interested in the two-wheelers in Figure 1. Only when a two-wheeler is found does the system move on. If not, the cycle continues as it discards this vehicle and looks for others.

C. Detection of Helmets

We determine whether the rider is wearing a helmet using the same method used to determine the type of vehicle. The reduced versions of the two-wheeler photos that concentrate on the rider's head region were utilized to train a helmet detector. By employing this method, we were still able to maintain the class balance, meaning that there were an equal number of photos in which the rider was wearing a helmet as there were without one. To choose the best machine learning classifier for this task, we used a variety of them. Without a helmet or seatbelt, the driver of the vehicle is involved in a high-speed collision. It can result in death and is extremely dangerous. A seat belt and helmet can lessen the impact's shock and even save a life. The goal of this research project is to create a smart seat belt and helmet detection system for dune buggies in order to prevent or lessen driver tiredness during accidents without a seatbelt and helmet, the driver will not be able to start the car.

Motorcycles are an obvious choice for a handy method of transportation, and they significantly increase the number of fatalities and injuries in traffic accidents. Despite government driving laws, many people still choose not to wear helmets.

II. LITERATURE REVIEW

1) In the paper "A Robust Method for Helmet Detection of Motorcyclists using Deep Learning," by Xuan Huan et al. (2018), the authors proposed a deep learning-based approach for detecting helmets on two-wheeler riders. The approach utilized a Faster R-CNN architecture with ResNet-101 as the backbone network. The authors achieved an accuracy of 94.71% on their dataset, which contained 745 images of two-wheeler riders.
2) In the paper "Helmet Detection and Recognition for Motorcyclists using Convolutional Neural Networks," by H.J. Liu et al. (2019), the authors proposed a system that can detect and recognize helmets worn by two-wheeler riders using deep convolutional neural networks. The proposed approach used a combination of region proposal network and convolutional neural networks. The authors achieved an accuracy of 97.8% on their dataset, which contained 1,200 images of two-wheeler riders.
3) In the paper "Helmet Detection and Classification for Two Wheeler Riders using CNN," by Abhishek Chaudhary et al. (2020), the authors proposed a system for helmet detection and classification for two-wheeler riders using convolutional neural networks. The proposed approach utilized a combination of histogram of oriented gradients and convolutional neural networks. The authors achieved an accuracy of 98.67% on their dataset, which contained 500 images of two-wheeler riders.
4) In the paper "Helmet Detection and Recognition using Deep Learning for Two-Wheeler Riders," by S. Deekshitha et al. (2021), the authors proposed a deep learning-based approach for detecting and recognizing helmets on two-wheeler riders. The proposed approach used a combination of Faster R-CNN and ResNet-101 architectures. The authors achieved an accuracy of 98.67% on their dataset, which contained 500 images of two-wheeler riders.

A. Challenges During the Project

1) *Limited Dataset:* One of the main challenges is obtaining a large and diverse dataset of images of two-wheeler riders with and without helmets. This can be time-consuming and costly, and the quality and diversity of the dataset can affect the accuracy and robustness of the system.
2) *Variability in Lighting Conditions and Camera Angles:* Another challenge is the variability in lighting conditions and camera angles, which can affect the visibility and quality of the images. The system should be able to handle different lighting conditions and camera angles to ensure accurate helmet detection.
3) *Object Occlusion:* Sometimes, the helmet can be partially or fully occluded by other objects such as the rider's hand or hair, or other objects in the background. This can make it difficult for the system to detect the helmet accurately.
4) *Real-time Processing:* In many cases, the system needs to be able to process images in real-time, as two-wheelers are typically in motion. This requires efficient and optimized algorithms for real-time processing and detection.

III. PROPOSED PLAN OF WORK

A. Project Scope

The capability of the two-wheeled helmet review system using machine learning depends on the specific needs and goals of the project. However, some general considerations for the work include:

1) *Data Collection:* Gather different and qualitative data on the appearance of both tires with and without metal caps at various lighting and camera angles.
2) *Data Preprocessing:* Preprocessing of datasets, including image resizing, normalization and enlargement, to improve the quality and variety of data.
3) *Model Selection and Learning:* Select appropriate learning models, such as neural networks, and train them on the data to identify and recognize helmets in two-wheelers.
4) *Performance Evaluation:* Evaluate the performance of the system using appropriate metrics such as accuracy, precision, recall and F1 score and improve the model as needed.
5) *Real-time Monitoring:* The system is implemented on the embedded system or in real time using cloud solutions to provide real-time monitoring of the two-wheeled bicycle.

6) *Commissioning and Maintenance:* Provide regular maintenance and updates of machines in the field, including performance monitoring and making necessary adjustments.

The reality of a project will depend on factors such as the project's objectives, timelines, budgets and available resources. For the project to be successful and complete, it is important that it is clearly defined at the beginning of the project.

IV. METHODOLOGY USED

.

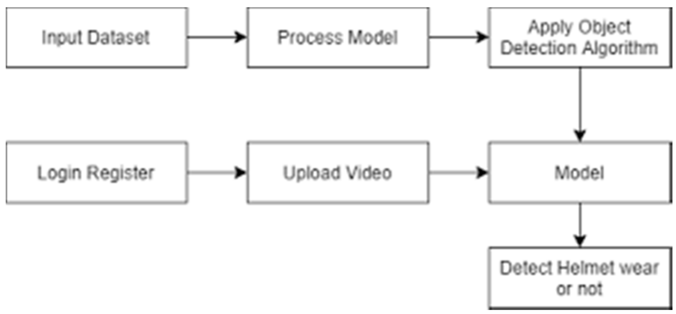


Fig: -work flow

1) *Data Collection and Preprocessing:* Collecting a diverse and high-quality dataset of images of two-wheeler riders with and without helmets, under various lighting conditions and camera angles. The dataset should be annotated with bounding boxes around the helmets. The dataset can be preprocessed by resizing the images and normalizing the pixel values.
2) *Model Selection:* YOLOv7 is a state-of-the-art object detection model that can be used for helmet detection. YOLOv7 is an extension of YOLOv5 and uses a novel architecture with a dynamic head that adapts to the different object sizes and aspect ratios.
3) *Training the Model:* Training the YOLOv7 model on the annotated dataset using a GPU-enabled machine. The model can be trained using transfer learning, where the weights of a pre-trained model are used to initialize the YOLOv7 model. The training can be performed using techniques such as stochastic gradient descent with warm-up and cosine annealing learning rate schedules.
4) *Model Evaluation:* Evaluating the performance of the trained YOLOv7 model on a separate validation dataset, using appropriate metrics such as mean average precision (mAP) and intersection over union (IoU).
5) *Fine-tuning and Optimization:* Fine-tuning the YOLOv7 model on the validation dataset to improve the performance. The model can be optimized by adjusting the hyperparameters such as the learning rate, batch size, and anchor boxes.
6) *Deployment:* Deploying the trained and optimized YOLOv7 model on a suitable platform for real-time helmet detection on two-wheeler riders. The deployment platform can be an embedded system or a cloud-based solution, depending on the specific requirements and constraints.

V. CONCLUSIONS

It may be concluded that brandom forest performs significantly better than all the other algorithms. In image recognition, a deep neural network is predicted to outperform a random forest, but this is not the case due to a lack of data. As previously said, deep learning algorithms perform best when there is an abundance of training data .By carefully examining the system's shortcomings, future improvements can be made. There are a few negatives. First off, the technique is ineffective when there are several automobiles present. That element has been purposefully omitted because our main goal was to compare how well various machine learning algorithms performed in this situation rather than to optimize the system for helmet detection. However, the system must be able to distinguish several vehicles and properly complete all tasks as it does in the case of a single vehicle for it to be useful.

VI. RESULTS

The results of two-wheeled helmet protection machine learning depend on many factors, such as the size and variety of data, the quality of the description, the choice of model machine learning and algorithms, and specific implementation and optimization concepts. Therefore, it is difficult to give details without knowing the specifics of a particular project. But in general, a well-designed and well-designed helmet can provide high accuracy and efficiency in controlling helmets of two-wheeled vehicles.

Many studies in Literature have been useful for helmet detection using machine learning. It is based on the use of the YOLOv7 algorithm to identify the helmet on two tires with 89% accuracy.

Another real-time analysis using a 75% CNN-based helmet detection model reported an accuracy of 88.7% and a recall of 90.27%. These results demonstrate the potential of machine learning-based methods to detect helmets in two-wheeled vehicles.

REFERENCES

[1] The safety helmet identification for ATM's surveillance system using the modified Hough transform was described in "Che-Yen Wen, Shih-Hsuan Chiu, Jiun-Jian Liaw, ChuawPin Lu, 18 May 2004."

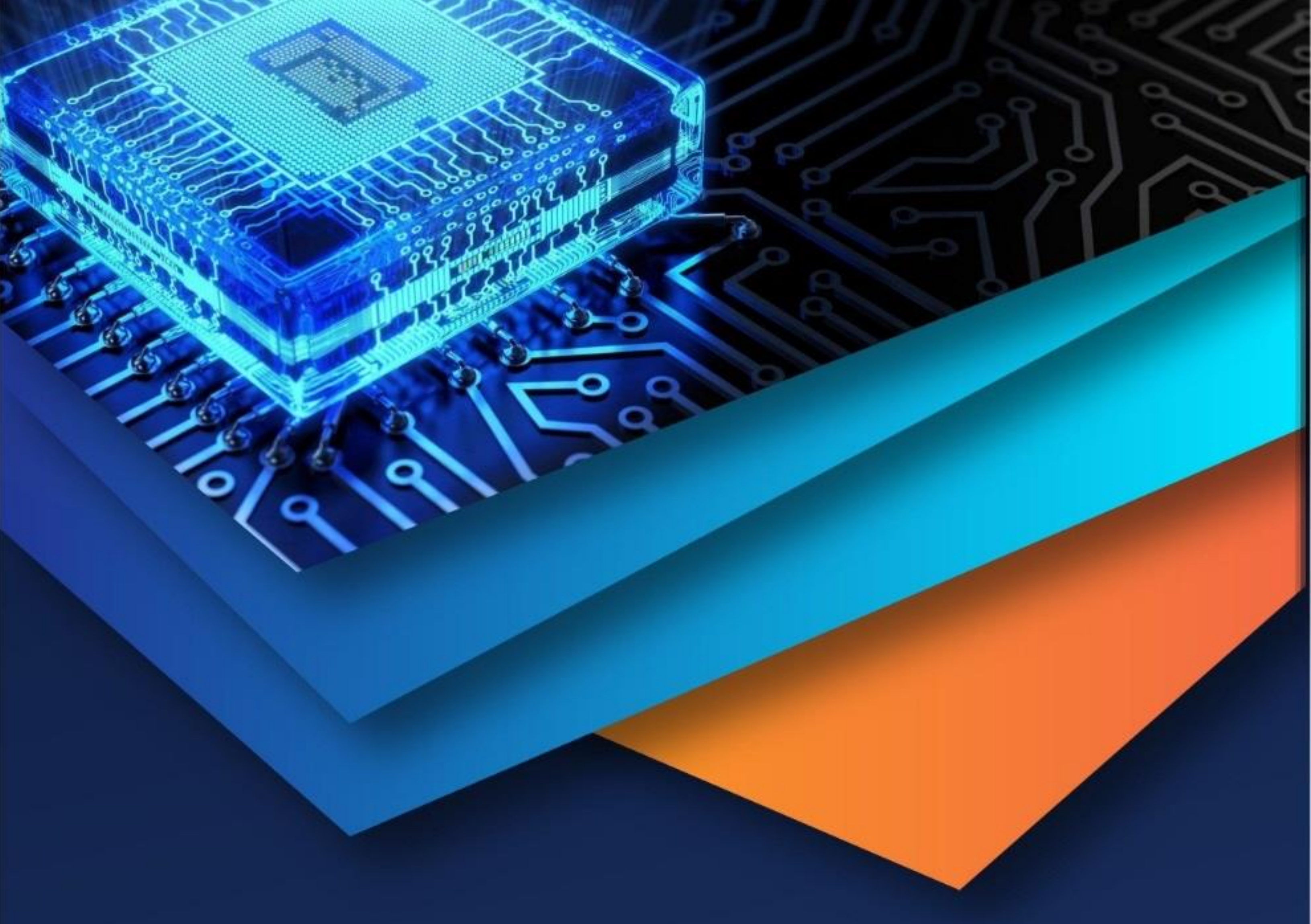
[2] International Journal of Trend in Research and Development, 3 2016, G. S. Gopika, R. Monisha, and S. Karthik

[3] IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), vol. 2015, S. A. Babu, S. Ayyalusamy, R. R. Singh, S. Dharmarajan, James, Jason, and M. Anas.

[4] Safeguarding of Motorcyclists via Helmet Recognition, by G. Sasikala, K. Padol, and A. A. S. Dhanasekaran, vol. 2015.

[5] Text Extraction for Sri Lankan Number Plates, by J. M. N. D. B. Jayasekara and W. G. C. W., vol. 2015. [Online]. Available:\shttps://in.mathworks.com/help/\svision/ref/vision.foregrounddetector-system-object.html

[6] L. Breiman, Machine Learning, vol. 5, 2001, p. [Online].



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY