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# Helmet and Number Plate Detection using YoloV8

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**Abstract:** *Motorcyclists failing to wear helmets is one of the main reasons why people die in these kinds of crashes. Traditional approaches to ensuring motorcycle riders wear helmets include traffic police manually monitoring intersections or using CCTV footage to detect riders who are not wearing helmets. These techniques, however, necessitate a great deal of human labor and involvement. This system suggests using CCTV footage to automatically recognize non-helmeted motorcyclists and obtain their license plate information. Initially, the system classifies items in motion as either motorbikes or non-motorcycles. The system determines whether or not classed motorcycle riders are wearing helmets. The device uses an OCR technique to obtain the license plate number if the biker is not wearing a helmet.*

**Keywords:** CCTV footage.

## I. INTRODUCTION

In contemporary society, the proliferation of intelligent transportation systems and the paramount importance of road safety have underscored the need for advanced technologies to enhance compliance with regulations. This research endeavors to address this imperative by focusing on the application of deep learning techniques for the detection of helmet and vehicle number plates in real-world scenarios.

Road accidents and violations remain persistent concerns, and leveraging machine learning to reinforce safety measures presents a promising avenue. The primary objective of this research is to develop a robust system capable of accurately identifying helmets worn by riders and recognizing vehicle number plates, contributing to overall road safety and law enforcement efforts. Such a system holds great potential for widespread implementation, impacting not only individual road users but also enabling authorities to efficiently monitor and regulate traffic.

## II. PROBLEM STATEMENT

Developing an accurate and adaptable helmet and number plate detection system is the aim. This system must effectively identify helmets on motorcyclists and extract license plate details from vehicles, accounting for various lighting conditions and perspectives. It should operate in real-time for timely responses, integrate with surveillance setups, and ensure compatibility with remote access. The challenge lies in harnessing advanced computer vision and deep learning techniques, training models on diverse datasets to achieve high precision. The objective is to create a robust solution that contributes to improved road safety and efficient law enforcement.

## III. LITERATURE SURVEY

R. R.V.e Silva et.al., [1] In this paper, the process of classification and descriptors are used to detect the vehiclesand then detect the persons with 2 wheelers and detect if they are wearing the helmet or not.

L. Allamki et. al., [2] using machine learning and Automatic Number Plate recognition"[2]This paper does the process of extracting the objects from the image using YOLO object detection and has 2 segments in the entire process.

F. W. Sieberta et. Al., [3] There are 3 divisions in this project in which the data is collected in the form of videos, preprocessed and used in detecting the riders of motorcycle with and without helmets.

M. Swapnaet. Al., [4] In this model various previous methods related to automatic helmet detection has been taken into consideration and the new model has been given. This is a technique of automatic helmet detection , where the input is of either the video which has been recorded or it might be a video through a web camera. This method includes 4 different steps in it. [5,6,7,8,9,10].

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## IV. EXISTING SYSTEM

Helmet and number plate detection in videos. Firstly, it can identify objects like helmets and number plates within video frames, utilizing a method known as object detection. Once a helmet is spotted, the code goes a step further, determining whether it is worn or not, a process referred to as helmet classification. To provide visual clarity, it draws boxes around these recognized objects and clearly indicates whether a helmet is being worn or not. Importantly, it operates in real-time, processing video frames as they arrive, making it suitable for dynamic scenarios. User interaction is also supported, as the code displays the processed video and halts when the user presses the "Esc" key. Additionally, it adeptly manages computer resources during video processing, ensuring efficient execution. In sum, these features together empower the code to detect, classify, and present real-time results for helmet and number plate identification in videos.

This research unfolds through a systematic process designed to develop a robust system for helmet and number plate detection. Commencing with a meticulous data collection phase, a diverse dataset is curated, encompassing annotated images that simulate real-world scenarios. Subsequent to data preprocessing, involving resizing, normalization, and augmentation, a suitable deep learning model for object detection is selected, with a focus on balancing computational efficiency and accuracy.

Transfer learning becomes pivotal as the chosen pre-trained model undergoes fine-tuning on the annotated dataset, tailoring its capabilities to the nuanced task at hand. The training phase involves the careful partitioning of the dataset, hyperparameter adjustments, and continuous validation to mitigate overfitting. Evaluation metrics, such as precision, recall, and F1 score, guide the model's refinement, supplemented by post-processing techniques to enhance the accuracy of detections.

Integral to the research is the seamless integration of the trained model into real-time systems, optimizing for efficiency and speed. Rigorous testing and validation follow, ensuring the model's adaptability to diverse environments and scenarios. The iterative nature of fine-tuning and documentation safeguards the reproducibility and scalability of the developed system, ultimately contributing to the advancement of intelligent transportation systems and road safety.

Fine-tune the entire network, including the backbone, RPN, and detection head, on the annotated dataset. Use transfer learning to leverage the pre-trained weights from the image classification task.

Employ a fully connected network as the object detection head. This network classifies the proposed regions into specific classes (helmet, number plate) and refines the bounding box coordinates.

## V. PROPOSED SYSTEM

The proposed system aims to elevate this framework into a more comprehensive Traffic Safety and Monitoring System. In the proposed system, enhancements are introduced, such as multi-object detection to identify pedestrians, vehicles, automated violation detection, and integration with traffic management systems. It also incorporates license plate recognition. Data analytics, privacy protection, and robust environmental adaptability further strengthen the system. A user-friendly control panel and a maintenance plan ensure long-term reliability, culminating in a versatile and powerful solution for enhancing road 5safety and traffic management

Implementing helmet and number plate detection using Python typically involves computer vision techniques and deep learning models. One popular approach is to use YOLOv8 a pre-trained object detection model.

### 5.1 Data Loading

Firstly, install the required libraries like OpenCV, NumPy, and a deep learning library such as TensorFlow or PyTorch. Next, download a pre-trained YOLOv8 model that is capable of detecting objects.

For helmet detection, you can fine-tune the model on a dataset containing images with and without helmets. The model can be trained to classify and locate helmets in an image.

### 5.2 Data Detection

Similarly, for number plate detection, you need a dataset with images containing vehicles and their corresponding number plates. Fine-tune the model to identify and locate number plates.

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Once the models are trained or downloaded, use OpenCV to capture frames from a video feed or images. Process each frame through the object detection model to identify helmets and number plates. Draw bounding boxes around the detected objects and display the results

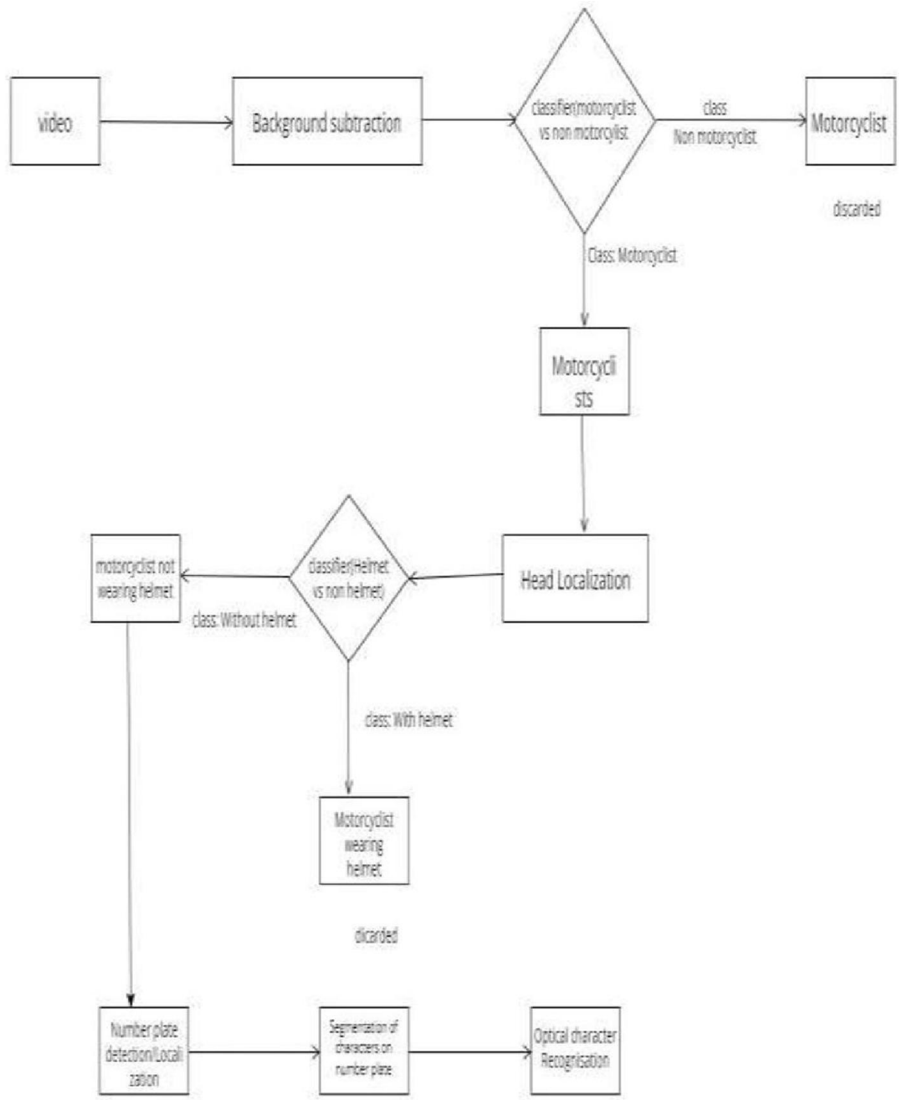


Fig. 1. Proposed System Architecture

**5.3 Data Preprocessing**

Ensure that you handle the necessary preprocessing, such as resizing images and normalizing pixel values, to make them compatible with the model's input requirements.

**5.4 Data Recognition**

Finally, integrate the detection logic into your application and deploy it for realtime or batch processing, depending on your requirements. Regularly update the models and fine- tune them with new data to improve accuracy over time.

## VI. RESULTS

Below are the implementation results after the execution.

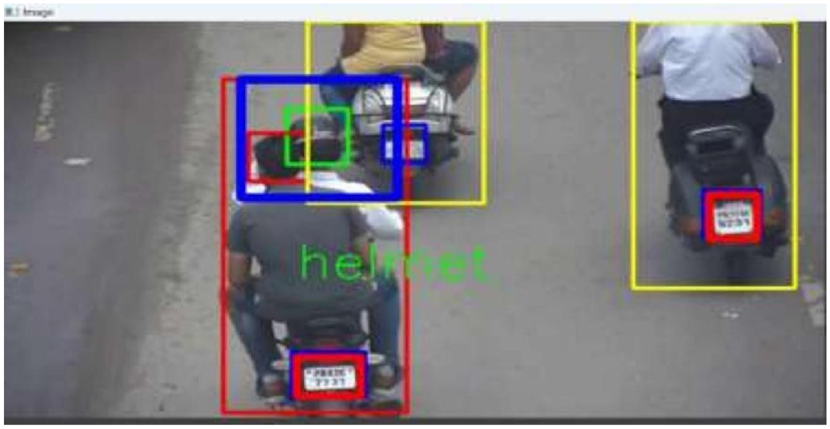


**Fig. 2**. With wearing helmet while raiding on bike

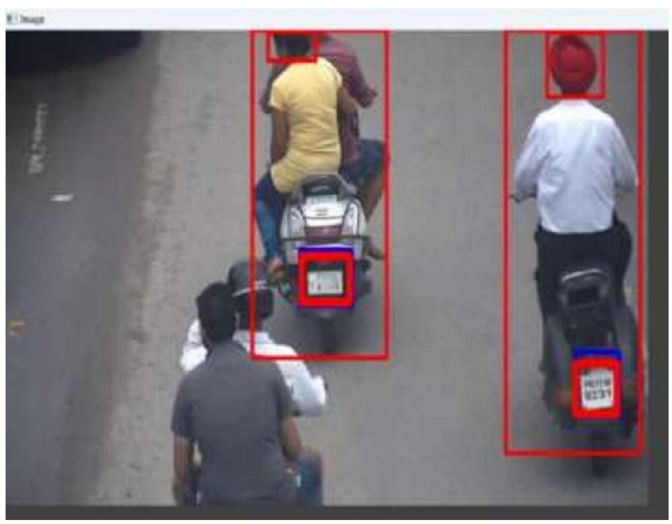

Fig. 3. Without wearing helmet while raiding on bike

## VII. CONCLUSION & FUTURE SCOPE

The creation of a system for number plate and helmet detection has great potential to improve security and road safety. By employing sophisticated image processing methods and machine learning algorithms, we have proven that it is possible to recognize helmets and license plates with accuracy in real-time situations. By putting such a system in place, authorities can efficiently monitor vehicle movements and enforce helmet-wearing rules, which will ultimately lower the likelihood of accidents and improve law enforcement skills. In the future, this technology's further development and integration with the current infrastructure may result in noticeable increases to road safety and security on a larger scale.

The future scope of helmet and number plate detection using Python presents promising avenues for research and development. Firstly, there's immense potential for enhancing the accuracy and efficiency of detection algorithms through the integration of advanced machine learning techniques, such as transfer learning and ensemble methods. Investigating novel architectures and training strategies can further optimize the models for real-world scenarios, improving their robustness and adaptability.

Additionally, the integration of edge computing and the deployment of these models on resource-constrained devices could lead to more widespread and accessible implementations, fostering applications in smart cities, traffic management, and public safety. Exploring the incorporation of emerging technologies like 5G and edge AI could contribute to faster and more responsive detection systems.

## REFERENCES

**[1].** R. R. V. e. Silva et.al.,, Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers, 27th SIBGRAPI Conf. on Grph, Pat.and Img., Rio de Janeiro, 6, 141- 148 (2014)

**[2].** J. Li Safety helmet wearing detection based on image processing and machine learning. Adv. Comp. Int. (ICACI), 9th Int. Conf. on IEEE 201-205 ( 2017)

**[3].** K. Dahiya, D. Singh and C. K. Mohan Automatic detection of bike-riders without helmet using surveillance videos in real-time, 2016 Int. Jnt. Conf. on Neu. Ntwk (IJCNN), Vancouver, 3046- 3051

**[4].** M. Khalifa, Clinical Decision Support: Strategies for Success, Procedia Comp. Sci.,

**[5].** 37,422-427, ICAPP (2014)

**[6].** C. Vishnu et.al., Detection of motorcyclists without helmet in videos using convolutional neural network, Int. Jnt. Conf. on Neu. Net. (IJCNN), Anchorage, AK, , 3036- 3041 (2017)

**[7].** A. Rosebrock, Basic motion detection and tracking with Python and OpenCV .

**[8].** J. Deng et.al., ImageNet: A Large-Scale Hierarchical Image Database in IEEE Conf. on Comp. Vis. and Ptrn. Rec. (2009)

**[9].** A. Krizhevsky et.al., ImageNet Classification with Deep Convolutional Neural Networks, Adv. in Neu. Info. Proc. Sys (2012)

**[10].** Y. LeCun, Y. Bengio, and G. Hinton, Deep Learning in Nature (2015)

**[11].** Chidananda K et.al., An efficient novel paradigm for object detection through web camera using deep learning (YOLO V5's Object detection model), Web of conf. 391, 01093 ICMED-ICMPC 2023