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Automatic Helmet Monitoring System using Deep Learning

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ABSTRACT: Safety and compliance are the uppermost and fundamental concerns in the modern transport subsystems. As a result, the project is essentially designed to come up with an advanced solution by combining YOLOv8 for precise identification of objects and, on the other hand, EasyOCR for reading characters. The key goals are to detect helmets, those without helmets, and identify number plates of the respective motor vehicle. With YOLOv8, we start training the model to identify not only helmets but the lack of helmets, which is necessary for compliance monitoring based on the law. Further, YOLOv8 is also designed to determine the Regions of Interest. Regarding vehicles, the model focuses mainly on license plates which are key objects. After finding the appropriate areas, EasyOCR is designed for applying optical character recognition, helping to obtain vehicle numbers of any type in the most organized, quick way. Therefore, combining YOLOv8 at the stage of object detection and EasyOCR for the recognition of characters creates a novel but, at the same time susceptible system for a vehicle control company.

KEYWORDS: Helmet, Deep Learning, Object Detection, Character Recognition, ROI

I. INTRODUCTION

Advancements in deep learning technology have changed many fields in recent years, such as object detection and laptop vision. One crucial area of software where such developments continue to have enormous potential is in the improvement of road safety through automated tracking systems. Revolutionary solutions that might reduce hazards and ensure adherence to safety regulations are desperately needed given the growing problem of traffic-related injuries and fatalities. Our challenge focuses on using Deep Learning techniques to enhance an Automated Helmet Monitoring machine in response to this need. Installing cutting-edge deep learning algorithms to discover motorcycle riders' helmet-wearing habits is the main objective of our task. We use the power of YOLOv8, a relatively green object detection set of rules renowned for its quickness and accuracy, to do this. Our system uses YOLOv8 to detect cyclists in real-time who are wearing helmets and who are not, allowing for timely intervention to enforce safety procedures.

In addition, our project handles registration code detection, one more crucial aspect of roadway safety, in addition to helmet monitoring. YOLOv8 is used to find license plates on automobiles once more. After identification, we merge EasyOCR, a robust optical character recognition (OCR) library, to accurately read the license plate characters. This makes it possible for license plate data to be automatically retrieved, enabling a variety of services like vehicle identification, tracking, and law enforcement.

We may go into further detail about our project's technique in the areas that follow. Section II provides an overview of relevant literature. The suggested computer vision-based automatic helmet-wearing or non-helmet-wearing detection algorithm is presented in Section III. The dataset, experimental setup, and performance on the dataset are covered in Section IV. Section V listed the conclusions and next steps in order of importance.

II. RELATED WORK

The Numerous researchers have proposed various approaches to automatic helmet detection in real-time environments. Cheverton[1] developed a system using background subtraction techniques and super vector machine (SVM) to distinguish between bikers wearing and not wearing helmets. However, the system has two major drawbacks: it analyzes the entire frame for helmet detection, which raises computational costs, and it misclassifies the number of heads not

wearing helmets. Dahiya et al. [2] created a system using HOG, SIFT, LBP, and SVM machine learning algorithms to identify bikers not wearing helmets. The system provided an accuracy of 93.80%. Boonsirisumpun et al.[3] used a convolutional neural network (CNN) method to identify bikers not wearing helmets, using 493 photos from cameras. The highest accuracy was provided by MobileNet at 85.19%. Sridhar et al.[4] used YOLOv2 to determine if the subject is wearing a helmet. Adam et al.[5] and Waranusat et al.[6] used background subtraction and k-NN classifiers to identify motorcycle helmets using real-time surveillance footage. The results of the Faster R- CNN model training on a self-generated dataset in Lahore, Pakistan, show a 97.26% accuracy in identifying motorcycle helmets. A deep convolutional neural network (CNN)-based approach was developed to identify motorcycle riders who violate the law. However, the proposed approach has drawbacks, such as low precision and a restricted dataset. The suggested method outperforms current algorithms in terms of accuracy and was created using a large dataset, specifically in low-resolution video, occlusion, scale variations, lighting, profile, frontal views, and different versions of an item.

III. METHODOLOGY

A methodology is proposed for for automatically detecting helmet violations in roadside surveillance videos. The suggested technique uses the Yolov8 deep learning model to detect helmet violations in traffic videos and take appropriate action against violators. The suggested system executes various operations in sequence. First, it recognizes motorcycle riders and divides them into two categories: "With Helmet" and "Without Helmet." Second, it identifies riders' license plates and uses EasyOCR to extract the text. The figure below depicts the proposed technique's block diagram.

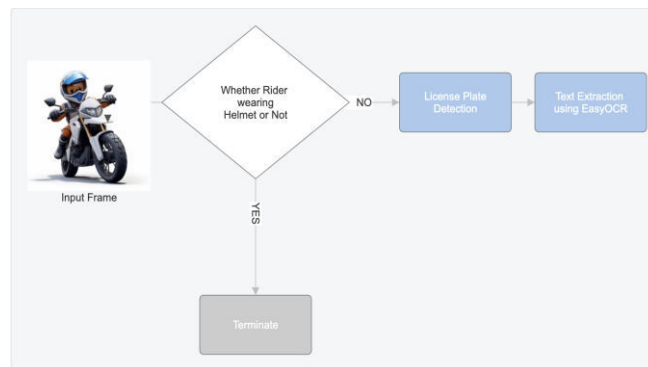


Fig : Flow diagram prepared for proposed methodology

IV. EXPERIMENTAL RESULTS

In the framework of our project, we utilized the capabilities of YOLOv8 specifically, the YOLOv8m version, played a crucial role in our pursuit of helmet detection. Through diligent after training on our own dataset, this model displayed remarkable proficiency in distinguishing riders with and without helmets inside images. It operates with a picture resolution of 640 pixels shown to be the best option for the assignment, balancing accuracy and computational efficiency. We refined the model through an extensive training routine lasting 150 epochs, enhancing its performance with a batch size of 3



Fig 1: Model differnciating between scarf and helmet

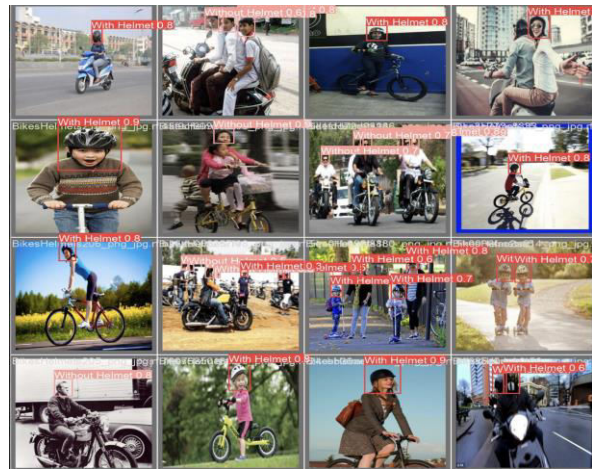


Fig 2: Helmets identified by Yolov8

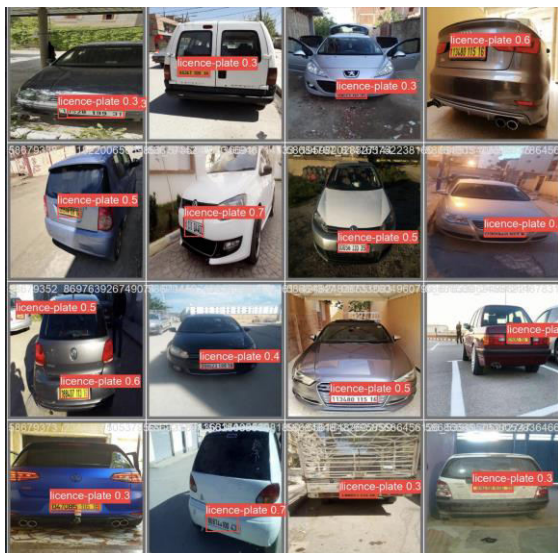


Fig 3 : License plates identified by Yolov8



Fig 4: frame from output video



Fig 5: Helmet detection using Yolov8

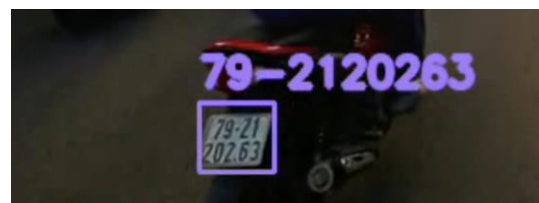


Fig 5 : license-plate number extracted using easyOCR



V. CONCLUSION

We have implemented an Automatic helmet monitoring system using YOLOv8 and EasyOCR, enhancing road safety and enforcing helmet-wearing regulations. It detects helmet compliance in real-time, promoting safe riding practices and reducing head injuries. The system integrates seamlessly with existing surveillance systems.

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