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Survey towards Helmet Detection Using Artificial Intelligence

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ABSTRACT: The proposed framework for detecting whether a motorcycle rider is wearing a helmet or not is an example of using computer vision and deep learning to automate a task that would otherwise require human intervention. By using the You Only Look Once (YOLO)-Darknet deep learning framework, the system is able to accurately classify images of motorcycle riders and determine whether they are wearing a helmet or not. The YOLO framework is a popular approach for object detection in images and videos. It uses convolutional neural networks (CNNs) to identify objects in an image and their locations. The YOLO architecture is designed to be fast and efficient, making it well-suited for real-time object detection tasks. In the proposed framework, the YOLO network is modified to detect three classes: motorcycle riders with helmets, motorcycle riders without helmets, and background. The system uses a sliding window approach to process the images and extract features that are used to classify the objects in the image. The system is trained on the Common Objects in Context (COCO) dataset, which contains a large number of images and annotations of common objects in real-world scenes. The system achieves a mean average precision (MAP) of 81% on the validation dataset using the training data.

Overall, the proposed framework has the potential to automate the detection of motorcycle riders without helmets, which could help reduce the number of road accidents and injuries caused by lack of helmet use. However, it is important to note that the system's accuracy may depend on various factors such as lighting conditions, image quality, and the variety of helmets and motorcycles present in the dataset.

KEYWORDS: Video Surveillance, Anomaly Detection, Machine learning, Convolutional neural networks, Image processing.

I. INTRODUCTION

The issue of motorcycle accidents and the importance of wearing helmets cannot be overstated. It is indeed a serious concern, and the development of an automated system that monitors and detects motorcycle riders without helmets can be a step in the right direction towards curbing the issue. Such a system can be designed using computer vision technology that analyzes video footage from cameras mounted in strategic locations. The system would be able to identify motorcycles and detect whether the rider is wearing a helmet or not. It can also be programmed to detect number plates of motorcycles that violate the helmet law and issue fines accordingly. However, the implementation of such a system raises concerns about privacy and civil liberties. It is crucial that the system is designed and used responsibly, and adequate measures are put in place to protect individuals' privacy. It is also important that the system is not used as a tool for indiscriminate surveillance or harassment.

In conclusion, the development of an automated system to monitor and penalize motorcycle riders without helmets can be an effective way to address the issue of motorcycle accidents. However, it is essential to ensure that the system is designed and used in a responsible and ethical manner, with due consideration for individual privacy and civil liberties.

II. RELATED WORK

According to [1] The proposed framework for automated detection of helmet violation by motorcycle riders in traffic videos is a significant contribution to smart traffic systems. The framework leverages the state-of-the-art object detection model, YOLOv3, for detecting motorcycle riders in the first stage. The second stage uses a CNN-based architecture to detect whether the detected riders are wearing helmets or not. The framework can help in identifying violators of traffic and safety rules related to helmets, which can significantly reduce the number of motorcycle accidents and injuries. The use of deep learning techniques such as YOLOv3 and CNNs in the proposed framework is a promising approach to automated detection of traffic rule violations. The evaluation of the proposed model on traffic videos has shown promising results in comparison with other CNN-based approaches. However, it is essential to note



that the accuracy of the model may vary depending on various factors such as lighting conditions, camera angles, and the number of riders in a motorcycle.

According to [2] This paper proposes a machine learning approach to detect two-wheeler riders without helmets on the road and provide them with a user interface to pay their challans. The system uses real-time image capture and OpenCV to differentiate two-wheelers from other vehicles and check whether the rider and pillion rider are wearing helmets or not. If any rider is found not wearing a helmet, their vehicle number plate is processed using optical character recognition (OCR), and a challan is generated against the respective vehicle. The details of the challan are sent via email and SMS to the concerned person, and a user interface in the form of an app and website is provided for paying the challans. The proposed system has the potential to improve road safety by encouraging two-wheeler riders to wear helmets, which is critical in reducing the risk of head injuries in the event of an accident. The use of machine learning and computer vision techniques to detect helmet usage is an innovative approach that can be further developed and deployed in other areas of traffic enforcement. Additionally, the provision of a user interface for paying challans can reduce the administrative burden on law enforcement agencies and make the process more accessible to violators.

Then Research paper [3] The proposed automated system for traffic surveillance and fine management appears to be a useful solution to the problem of increasing accidents caused by the negligence of helmet usage. It would not only ensure better compliance with traffic rules but also reduce the burden on the police force. The yolov2 model mentioned in the proposal is an object detection model that can be trained to identify two-wheelers with no helmets. This model can help to automate the process of identifying rule breakers, which otherwise would be a challenging task for human operators. Moreover, the proposed system can extract the number plates of the identified vehicles and generate an electronic fine management system, which can update the fine detail over the server. The system can then send a message to the registered phone number along with the number plate, notifying the violator of their fine. However, before implementing such a system, it is essential to ensure that it adheres to data protection laws and does not violate the privacy of individuals. The system must be tested rigorously to ensure its accuracy and reliability, and proper safeguards must be put in place to prevent any misuse.

According to the paper [4] focuses on an improved technique for license plate recognition using neural networks. The paper proposes a blended algorithm that consists of three major modules: license plate localization, plate character segmentation, and plate character recognition. The system is trained on a dataset of object features and is tested on 300 national and international motor vehicle LP images. The goal of the system is to provide an automated, fast, accurate, and robust vehicle plate recognition system that can be used for traffic control and law enforcement of traffic regulations. The proposed algorithm is compared with existing methods to improve accuracy. It would be interesting to see the results of the comparison with existing methods and how the proposed algorithm improves accuracy. Additionally, it would be useful to know how the proposed algorithm performs under different lighting and weather conditions, as these can affect the accuracy of license plate recognition systems.

III. SYSTEM ARCHITECTURE

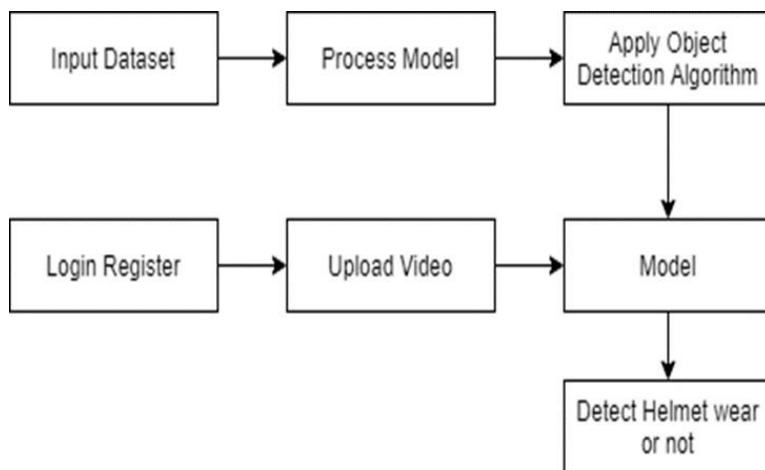


Fig. 1 System Architecture



Proposed model's work:

1. Input dataset: This refers to the data that is used as input to the system. Depending on the specific use case, this could be video footage, images, or other types of data.
2. Process model: This refers to the set of rules or steps that are used to process the input data. This could include steps such as preprocessing, feature extraction, and classification.
3. Object detection algorithm: This is a specific type of algorithm that is used to identify objects within an image or video. It might be used as part of the process model to detect the presence of helmets in the input data.
4. Login/register: This refers to the functionality that allows users to create accounts or log in to the system. This could be used to ensure that only authorized users are able to access the system.
5. Upload video: This refers to the functionality that allows users to upload videos to the system. This could be used as input data for the system to analyze.
6. Model: This refers to the machine learning model that is used to analyze the input data. Depending on the specific use case, this could be a computer vision model that is trained to detect helmets in videos.
7. Detect helmet wear or not: This refers to the specific task that the system is designed to perform. In this case, the system would be analyzing the input data to determine whether or not the person in the video is wearing a helmet.

IV. CONCLUSION

In this study, we have developed and tested a deep learning based method for automated detection and tracking of active motorcycles, identification of rider number per motorcycle, rider position, and rider-specific helmet use. We have applied our approach to diverse video data from different road environments, which presented various challenges such as occlusion, differences in camera angle, imbalanced number of coded classes, varying rider numbers per motorcycle, and varying traffic densities. Our results show that our approach achieves a high level of accuracy in detecting and tracking active motorcycles and identifying the rider number, rider position, and helmet use for each motorcycle. The high accuracy of our approach demonstrates its potential for being used as an effective tool for motorcycle helmet use registration, particularly in contexts where manual observation may not be feasible or practical. The comprehensiveness of our approach, including its ability to handle challenging scenarios and varying traffic conditions, makes it a significant improvement over earlier approaches for automated detection of motorcycle helmet use. Our study contributes to the growing body of literature on automated methods for motorcycle helmet use registration, which has important implications for public health and safety, particularly in regions where motorcycle use is prevalent.

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