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Enhancing Road Safety through Automated Enforcement Systems Using CNN

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Abstract: This article explores the enhancement of traffic law enforcement through utilization of augmented reality and deep learning techniques, specifically centering on the implementation of YOLOv3 for detecting violations like signal jumping, speeding, and traffic volume monitoring. The goal is to reduce traffic offenses and enhance road safety by accurately identifying and penalizing offenders. It covers the fundamentals of traffic violation detection, including image representation and the YOLOv3 algorithm, along with concrete instructions for architecture and implementation. The article emphasizes the significance of computer vision technology in overseeing and enforcing traffic regulations, showcasing its ability to detect multiple violations concurrently with great accuracy. Simulation and analysis results illustrate the effectiveness of the architecture in identifying issues such as signal irregularities, offering comprehensive insights into the detection procedure and resulting data. In summary, this piece underscores how AI and deep learning can advance traffic management and promote road safety.

Keywords: Convolutional neural networks,traffic violation, YOLOV3.

I. Introduction

As the vehicles increases on roads the calming of the traffic also increases. These systems are essential for calming the traffic in identifying and fining people who do not follow the instructions. In previous years, traffic violations were typically detected by police stationed at intersections, nonetheless, this step has been shown inefficient and time-consuming, especially during periods of heavy traffic. To address these challenges, the hypothesis of traffic analysis and enforcement using computer vision technology has emerged. Computer vision involves using intelligent algorithms to interpret visual data from images and videos. By employing computer vision algorithms, traffic violation detection systems can analyze video feeds from road cameras to identify and sanction drivers for infractions such as speeding or illegal crossing. Computer vision offers scalability and cost-effectiveness compared to traditional methods. These systems can work without any break with less man oversight, reducing operational expenses and improving efficiency. Moreover, tthis is deployed in various locations such as urban areas and highways, providing comprehensive surveillance and enforcement services. In summary, using manmade thinking tech for traffic management purposes leverages artificial intelligence and image processing to efficiently address traffic-related challenges and enhance overall road safety. The adoption of mmanmade thinking can completely upgrade the traffic management and upgrade traffic calming for all people.

II. RELATED WORK

G. Sasikala et al. [3] introduced a system based on RF transmitter and receiver to enhance helmet features and provide additional protection during accidents. However, this approach may lead to an increase in helmet costs and does not provide a solution to mandate helmet usage for all riders and non-riders.. Narong Boonsirisumpun et al. [4] proposed a system using a CNN to classify helmets and motorcycles. However, CNN's performance is limited by training samples, making it prone to false recognition, especially if individuals wear different types of helmets or cover their faces. Liang-Bi Chen et al. [5] suggested a system employing IR sensors in an intelligent helmet for detecting nearby heavy vehicles and alerting riders to potential dangers. This system uses a helmet-mounted camera to identify approaching heavy vehicles. Mario Andres Varon Forero et al. [6] developed a project using CNN and background subtraction to highlight riders wearing helmets. The system classifies helmets using support vector machines based on training data, achieving decent accuracy but facing challenges in real-world scenarios such as obscured faces or passengers without helmets. Rohith C A et al. [7] proposed a CNN-based system capable of detecting two-wheelers with and without helmets. However, CNN's limitations with training data mean it may struggle to handle diverse situations effectively. Detecting multiple helmets and distinguishing heads alongside motorcycles poses significant challenges.

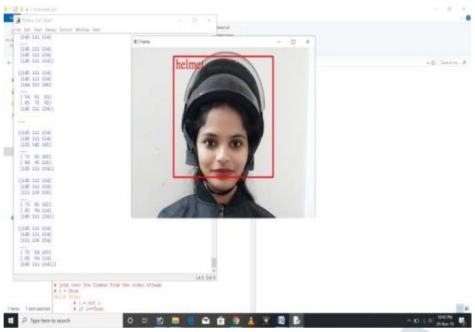
III. PROPOSED SYSTEM

This part explains recommendations for addressing the problem of helmetless cyclists through a structured two-stage approach. In the initial stage, cyclists are captured on video using surveillance systems or cameras deployed in strategic locations. In the subsequent stage, a series of checks are performed on the detected individuals, including analyzing the presence of a passenger's head, verifying their driver's license, and checking if they are wearing a helmet or not. To amplify measurement and minimize false predictions, a method of aggregating consecutive results is employed, leading to a final decision or prediction regarding helmet usage. The block diagram accompanying this approach illustrates various critical steps within the framework. These steps encompass processes like background subtraction, object detection, and classification, all of which are critcal for correctly identifying helmetless individuals.

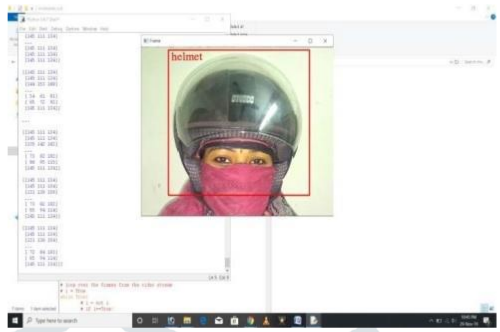
Cost considerations are integral to this process, ensuring that the implementation remains economically viable. Techniques such as background subtraction are applied to grayscale images to isolate abnormal or static objects, facilitating subsequent analysis and decision-making. In the upcoming discussions, we will delve deeper into the modeling aspects of this approach, exploring the methodologies employed in each stage of the framework. By adopting this comprehensive strategy, we aim to effectively address the challenge of
ensuring helmet compliance among cyclists while optimizing resources and technology for maximum impact on road safety.

IV. RESULT AND DISCUSSION

The project evaluates the working of YOLO and OCR through various scenarios, including frames depicting individuals with helmets, without helmets, different types of heads, and multiple heads or helmets.



Giant. 6.1. Helmet detection



Giant. 6.4. Helmet Detection Even Face Covered

Giant 6.4 demonstrates the system's ability to detect helmets even when faces are covered. In cases which consists a single person on the given area and the system detects a helmet instead of a head, it suggests that no intrusion is detected. However, if multiple people are present in the motorcycle frame and the system detects a helmet on one individual but not on another, such as a passenger being helmetless while the rider wears a helmet, this represents a violation of safety standards.

V. CONCLUSION

The proposed framework serves as a substitute for police officers in monitoring traffic. It utilizes traffic surveillance techniques focusing on motion detection, license plate extraction, and feature recognition. When a violation occurs, the framework captures an image of the incident, extracts the license plate information, and verifies the tag characters. A traffic violation notice is then issued, and vehicle owners are notified of the specific violation type and the corresponding fine amount.

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