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Deep Learning Based Novel Vehicle Detection and Counting System Using Intelligent Transportation Systems

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Abstract: ***It proposes deep learning-based vehicle detection and counting system designed to enhance real-time traffic monitoring and urban planning. The system employs advanced object detection models, including YOLO (You Only Look Once) and Faster R-CNN, to identify and track vehicles in various environmental conditions, such as different lighting, weather, and traffic densities. Unlike traditional sensor-based methods, which are prone to inefficiencies and high maintenance costs, this approach offers a scalable and cost-effective solution with high accuracy. The core functionality of the system revolves around the integration of robust tracking mechanisms, which enable precise vehicle counting through line-crossing or region-based techniques. By tracking vehicles across multiple frames, the system ensures accurate counts, even in the presence of occlusions or overlapping vehicles.This deep learning-based system is designed to integrate seamlessly into intelligent transportation systems, smart cities, and urban planning efforts, providing real-time data for decision-making. It offers significant improvements in traffic management, addressing the limitations of traditional vehicle detection methods. With its ability to handle complex scenarios and provide real time analytics, this system plays a crucial role in optimizing traffic flow, enhancing safety, and contributing to more efficient urban transportation systems.***

Keywords: You Only Look Once, Multiple frames, Inefficiencies, Object detection models, Robust tracking mechanisms

I. INTRODUCTIONS

To develop robust, deep learning-based vehicle detection and counting system that can operate efficiently in real-time across a variety of environmental conditions. By leveraging state-of-the-art object detection models like YOLO (You Only Look Once) and Faster R-CNN, the system aims to provide accurate vehicle identification and counting, even in challenging scenarios such as varying lighting, weather conditions, and heavy traffic densities

II. METHODOLOGY

A. Vehicle Detection:

The vehicle detection utilizes advanced deep learning models, such as YOLO (You Only Look Once) and Faster R-CNN, to identify vehicles within video footage.

B. Vehicle Counting:

The vehicle counting worksin tandem with the detection system, counting the detected vehicles as they cross predefined lines or enter specified regions within the video frames.

C. Vehicle Tracking:

The vehicle tracking is responsible for maintaining a consistent identification of each vehicle across multiple frames in the video.

D. Speed Estimation:

The speed estimation uses pixel-to-distance conversion and frame rate analysis to calculate the speed of vehicles detected in the video footage.

E. Data Analysis and Reporting:

The data analysis and reporting aggregates and analyzes the vehicle detection and counting data collected by the system.

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III. RESULTS&DISCUSSION

It demonstrates reliable performance of the detection system under normal and challenging weather conditions, with successful outcomes in daylight, rain, and intersection scenarios. However, failure cases during night-time and high-speed conditions highlight areas for further optimization, particularly in enhancing accuracy during low-light and fast-motion situations.

IV. CONCLUSION

In conclusion,It can successfully integrate advanced deep learning techniques with real-time traffic monitoring to enhance vehicle detection, tracking, and speed estimation. The system contributes to intelligent traffic monitoring, reducing congestion and improving road safety through automated vehicle analysis.

TABLE 1. TESTCASE REPORT

Test Case ID	Scenario	Expected Outcome	Actual Outcome	Status
TC-001	Detection in night time traffic	Correct vehicle count	Overcount detected	Fail
TC-002	High-speed vehicle detection	Correct speed tracking	Inconsistent readings	Fail
TC-003	Detection in daylight traffic	Correct vehicle count	Correct vehicle count	Pass
TC-004	Detection in rainy conditions	Correct vehicle count	Correct vehicle count	Pass
TC-005	Detection at intersection	Correct vehicle count	Correct vehicle count	Pass

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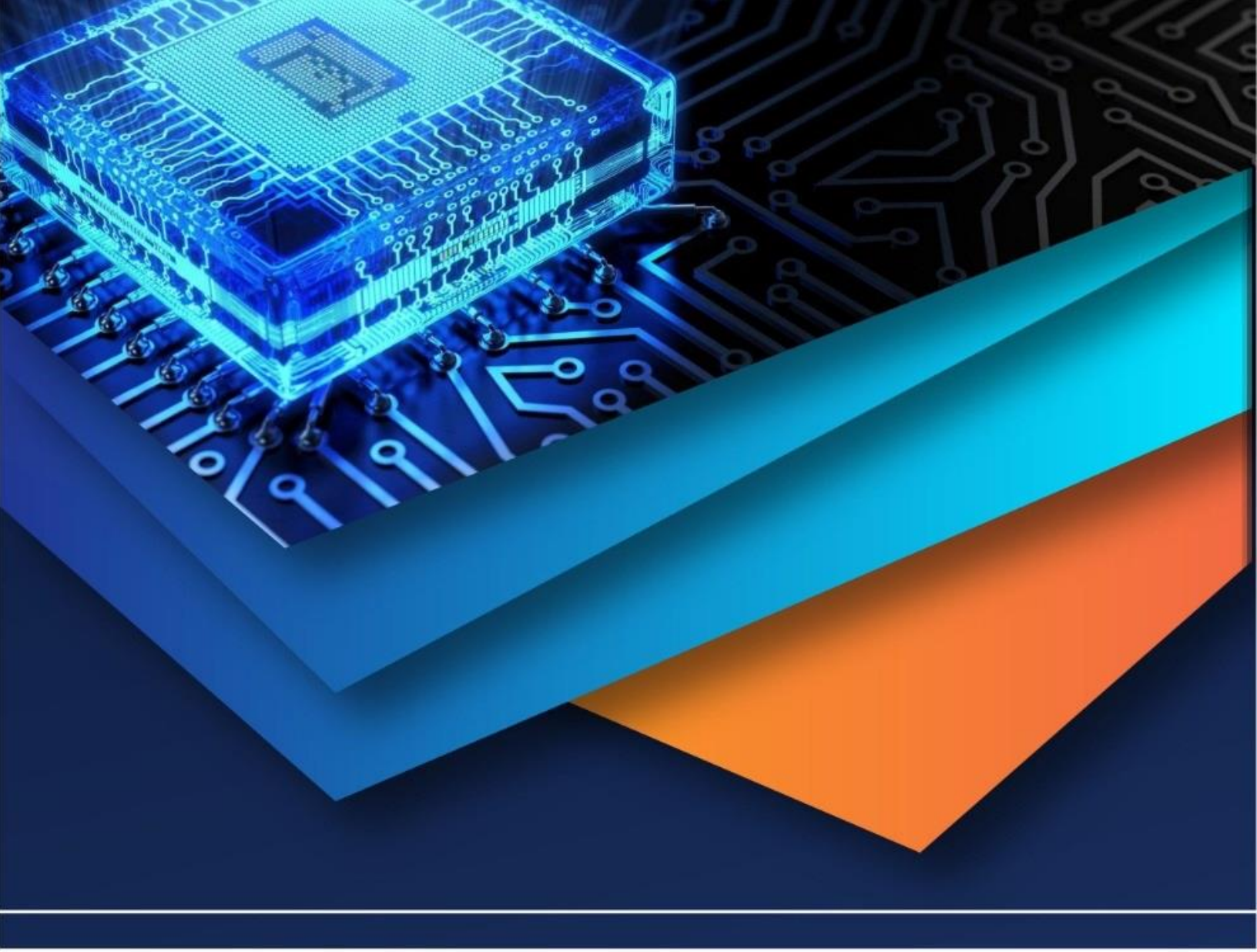

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