JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SPEED ESTIMATION USING DEEP LEARNING WITH OPEN CV

Dr. A. Prakash, R. Ashwin M. Bhuvaneshwari, M. Chandhanu

Professor, Student, Student, Student Pg & Research, Department Of Computer Applications, Hindusthan College Of Arts And Science Coimbatore, India

ABSTRACT

In intelligent transportation systems, vehicle speed estimation plays a crucial role in infrastructure optimisation, safety, and traffic control. This work investigates the use of deep learning methods with Open CV to estimate vehicle speeds from video feeds in real-time and with high accuracy. The suggested method uses a Convolutional Neural Network (CNN) to recognise and follow automobiles in the video frames automatically. Next, by examining the displacement of identified vehicles over a series of frames, speed estimation is accomplished. To achieve accurate and efficient vehicle detection, the solution makes use of the YOLO (You Only Look Once) object detection paradigm. The system is more adaptive to changing traffic scenarios and environmental factors when deep learning techniques are used. The suggested approach's efficacy in delivering dependable vehicle speed estimations is evidenced by the experimental findings, which also highlight its potential for use in intelligent transportation systems and traffic monitoring applications.

1. INTRODUCTION

In today's transportation environment, precise vehicle speed prediction is essential for maintaining effective traffic control, improving road safety, and making the best use of infrastructure. Conventional techniques for estimating speed have frequently depended on specialised sensors or human interaction, which has limited their scalability and flexibility. An increasing number of people are interested in using deep learning and computer vision technology to automate and provide real-time vehicle speed estimation.

The goal of this work is to create a reliable system for vehicle speed estimate by utilising deep learning, namely Convolutional Neural Networks (CNNs), in combination with the OpenCV library. Deep learning algorithms are integrated to enable automated tracking and detection of vehicles in video feeds, thereby resolving issues related to dynamic traffic scenarios, occlusions, and fluctuating vehicle sizes. By leveraging the effectiveness and precision of the YOLO (You Only Look Once) object identification model, the suggested method improves the system's capacity to accurately recognise cars in real-time. Addressing the requirement for precise and flexible vehicle speed estimation systems that can support intelligent transportation systems and traffic monitoring

applications is the driving force behind this research. This work intends to overcome the drawbacks of conventional techniques and open the door for a more flexible and adaptable approach to speed estimate by utilising deep learning. This thorough introduction walks readers through the background of vehicle speed estimate, outlines the problems with traditional techniques, and highlights the revolutionary potential of deep learning. The method, findings from the experiments, and comments will all be covered in detail in the parts that follow, giving readers a thorough understanding of the suggested strategy and its implications for the fields of computer vision and transportation engineering. The study's ultimate goal is to advance the further development of intelligent transportation systems by providing a creative and effective method for estimating vehicle speed.

2. EXISTING SYSTEM

The current vehicle speed estimation system is based on conventional techniques and technologies, and it frequently uses specialised sensors, such radar or lidar, to detect vehicle speeds along roads. By identifying the Doppler shift in radar or lidar signals reflected off of moving vehicles, these devices make it possible to determine the speeds of those vehicles. Although these systems are popular and useful in many situations, they could have trouble detecting speeds precisely in congested areas, handling occlusions, or adjusting to changing environmental factors. Specialised sensor deployment and upkeep might also need a lot of resources. A rising number of people are interested in investigating alternative methods that use deep learning and computer vision to provide more flexible and adaptable vehicle speed prediction as technology develops. The shortcomings of the current systems highlight the need for creative fixes that can improve precision, processing speed in real time, and flexibility to various traffic situations.

3. PROPOSED SYSTEM

By combining deep learning methods with computer vision—specifically, Convolutional Neural Networks (CNNs) and the YOLO (You Only Look Once) object detection model—as well as the OpenCV library, the suggested system for vehicle speed estimation aims to completely transform the industry. The goal of this system is to automatically identify and follow cars in video feeds so that their speeds may be accurately and in real time estimated. By using CNNs, traffic scenarios can be more easily adjusted to, and obstacles like occlusions and fluctuating vehicle speeds can be overcome. The YOLO model contributes to the system's overall efficacy by being a crucial part of accurate and efficient vehicle detection. The suggested system seeks to address the drawbacks of conventional techniques by emphasising a more dynamic and data-driven approach. It provides a scalable, flexible, and cutting-edge technological solution for vehicle speed estimation in intelligent transportation systems and traffic monitoring applications.

5. MODULES DESCRIPTION

5.1. VEHICLE DETECTION MODULE

Using deep learning techniques, the first module of the proposed implementation system focuses on reliable vehicle detection. This module makes use of Open CV's YOLO (You Only Look Once) object detection model to effectively and precisely identify cars in video streams. The objective is to identify and locate automobiles in real-time automatically while navigating obstacles including changing traffic circumstances and occlusions.

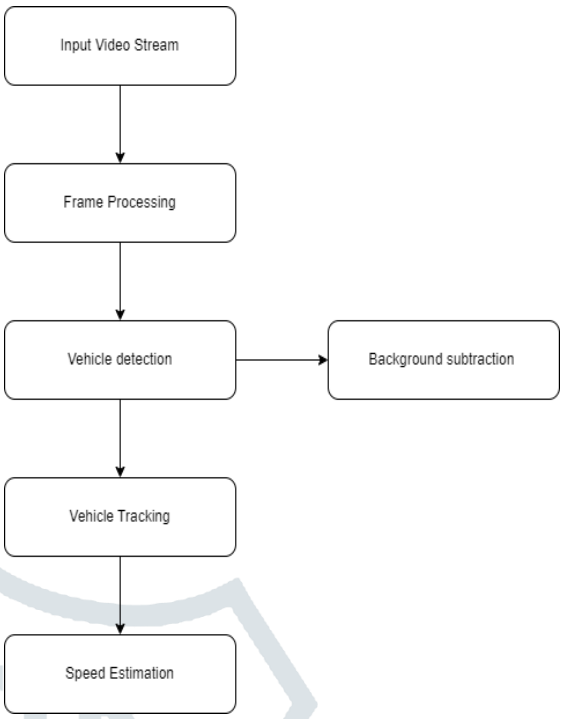
5.2. TRACKING AND SPEED ESTIMATION MODULE

The purpose of this second module is to estimate the speeds of the identified cars by tracking them over a series of video frames. In order to convert the displacement of recognised vehicles over time into real-time speed estimates, algorithms must be implemented. The goal of the tracking and speed estimation module is to deliver precise and fast data regarding the dynamic behaviour of cars in the area that is being observed.

5.3 INTEGRATION AND VALIDATION MODULE

This last module deals with combining the tracking, speed estimation, and vehicle detection elements into a single, functional system. Additionally, this module has real-time processing and adaption methods for various traffic conditions. A crucial component is validation, which is evaluated by this module utilising extensive experimental datasets with ground truth speed annotations to evaluate the overall system performance. The suggested vehicle speed estimation system's correctness and dependability are guaranteed by the validation procedure.

SYSTEM FLOW DIAGRAM



6. CONCLUSION

In summary, this study has offered a thorough investigation of vehicle speed prediction by combining computer vision and deep learning methods. While the current approach, which uses specialised sensors and conventional procedures, has shown to be useful, it is limited in terms of adaptability and real-time processing. The suggested method provides a revolutionary approach by utilising Convolutional Neural Networks (CNNs) and the YOLO (You Only Look Once) object identification paradigm inside the Open CV framework. The modular strategy, which includes tracking, speed calculation, and vehicle detection, is intended to improve accuracy and flexibility in a range of traffic situations.

The suggested approach has a substantial potential impact on applications for traffic monitoring and intelligent transportation systems. The system helps to improve safety, optimise transportation infrastructure, and manage traffic more effectively by automating the speed estimation process and tackling issues related to occlusions and shifting

traffic dynamics. The application of deep learning methods guarantees scalability and flexibility, signifying a change to a more dynamic and responsive method of estimating vehicle speed.To ensure reliable performance, it is crucial to recognise potential obstacles, such as the complexity of training models and the requirement for large datasets. The suggested solution can be further improved and optimised thanks to ongoing developments in deep learning and computer vision technology. The suggested approach is a creative and intriguing concept that presents new opportunities for vehicle speed estimates in intelligent transportation systems as technology develops.

7. FUTURE ENHANCEMENT

Future study will focus on optimising model parameters and investigating more sophisticated deep learning architectures in order to further refine the suggested solution. Further work can be done to increase the system's flexibility to various traffic situations and environmental variables. Incorporating edge computing for decentralised processing and investigating real-time feedback techniques to improve the system's dynamic responsiveness are potential directions for future research.

8. REFERENCES

1. Farhadi, A., and J. Redmon (2018). YOLOv3: A Gradual Enhancement. preprint arXiv:1804.02767; arXiv.

2. The OpenCV Library. (www.opencv.org)
3. Wang, C. Y., Bochkovskiy, A., and Liao, H. Y. M. (2020). YOLOv4: Maximum Accuracy and Speed for Object Recognition. preprint arXiv:2004.10934, arXiv.

4. He (2017); Gkioxari (2017); Dollár (2017); Girshick (2017). R-CNN mask. In IEEE International Conference on Computer Vision (ICCV) Proceedings.

5. Wu, Y., and Z. Wang (2012). A Flexible New Technique for Camera Calibration. IEEE Transactions on Machine Intelligence and Pattern Analysis, 35(7), 1483–1499.

6. Zisserman, A., and K. Simonyan (2014). Very Deep Convolutional Networks for Large-Scale Image Recognition. The preprint arXiv is arXiv:1409.1556.