



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 4, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

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Deep Learning Based Traffic Light Control System Using Yolo Algorithm

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ABSTARCT: India is home to 10% of all traffic deaths worldwide and has the second-largest road network in the world. Moreover, in smart cities, traffic congestion, pollutants, and noise pollution have increased due to a constant rise in vehicle kinds, technical problems with traffic signal management equipment, and inefficient road traffic management. Despite the fact that current traffic control systems rely on fixed time-based techniques, conventional traffic control systems are unable to manage the complicated traffic flow at junctions. Roadblocks increase mileage, increase transport costs, and pollute the air in addition to adding to the driver's stress and further delays. Therefore, we designed a smart traffic light management system employing the recently launched YOLO V7. The new version V7 of the YOLO algorithm outperforms all previous object detection models in both speed and accuracy. As it is the fastest and most accurate real-time object detection model Hence it is the best algorithm to deploy in traffic controlling system. YOLO V7 is +120% faster than other previous models and shows the best speed to accuracy balance.

I. INTRODUCTION

1.1 OVERVIEW

Due to the unchecked increase in vehicle traffic in the modern world, a snarl of traffic has turn into a frenzied activity. The quantity of vehicles on the road each day greatly increases and thus causing a variety of problems. Though we have installed traffic control system like traditional traffic light systems are becoming inefficient in controlling the evergrowing traffic on the roads. In India, traffic congestion costs 1.47 lakh corer annually, according to a Boston Consulting Group analysis from 2018. Numerous studies have been carried out and is presently ongoing on the efficient traffic controlling systems. The development of intelligent traffic signal systems is one of the main areas of research. Therefore, we designed the deep learning based smart control of traffic light system using image processing with YOLO V7 [3]. YOLO V7 is the most powerful object detection algorithm in 2022 as it is the newly launched version of YOLO architecture. It already becomes the industry standard for object detection surpassing the previous version YOLO V4. We will briefly go over the fundamentals of YOLO V7's operation and how it will be the greatest object detecting algorithm in this essay. After that we will discuss the methodology to implement this algorithm in traffic light control system and its advantages.

A smart traffic light system is an intelligent transportation system that utilizes advanced technologies such as artificial intelligence, deep learning, and computer vision to optimize the flow of traffic on roads, reduce congestion, and enhance safety. One of the key components of such a system is image processing, which involves analyzing visual data captured by cameras installed at traffic intersections to detect and track vehicles, pedestrians, and other objects. Deep learning is a subset of machine learning that utilizes artificial neural networks with multiple layers to analyze and process complex data. YOLOv7 is an object detection algorithm that uses deep learning to detect objects in images and

videos in real-time. YOLO stands for "You Only Look Once", which means that the algorithm processes the entire image in a single pass, making it very fast and efficient.

In a smart traffic light system, YOLOv7 can be used to detect and track vehicles and pedestrians at traffic intersections. By analyzing the speed, direction, and volume of traffic, the system can adjust the timing of traffic lights to optimize the flow of traffic and reduce congestion. For example, if the system detects heavy traffic on one side of the intersection, it can adjust the timing of the traffic lights to give more time to that side and reduce wait times for drivers and pedestrians.

Overall, a deep learning-based smart traffic light system using image processing with YOLOv7 has the potential to greatly improve traffic flow and reduce congestion, leading to safer and more efficient transportation systems.

II. LITERATURE SURVEY

1. Intelligent Traffic Control System Using Deep Learning

Author- Inba Malar T M¹, BharathaSreeja G², Amala Justus Selvam M³, Jemima Sharon E², Jeevitha K², Keerthi R² and Mahalashmi R

Year- 2022

Traffic congestion and regulating traffic in traffic signals are major issues in cities. Nowadays, in most of the cities, traffic management centers installed numerous cameras all over the roads and traffic signals. Such cameras can be effectively used for the automation of traffic signals. The objective is to develop a real time system that can automatically monitor real time traffic and make the system intelligent using artificial intelligence techniques. Specifically, Deep Convolutional Neural Networks are employed to perform the task. From statistical traffic data, it determines count, type of vehicle, average speed, distance between vehicles, etc. Based on traffic, the algorithm instructs to stop vehicle or queue or move. It can also record a wrong-way driver. Using license plate recognition, security applications such as unauthorized vehicles are identified.

2. Deep Learning based smart traffic light system using Image Processing with YOLO v7

Author- AvinashPadmakarRangari, Shanshank Kumar Singh

Year- 2022

India is home to 10% of all traffic deaths worldwide and has the second-largest road network in the world. Moreover, in smart cities, traffic congestion, pollutants, and noise pollution have increased due to a constant rise in vehicle kinds, technical problems with traffic signal management equipment, and inefficient road traffic management. Despite the fact that current traffic control systems rely on fixed time-based techniques, conventional traffic control systems are unable to manage the complicated traffic flow at junctions. Roadblocks increase mileage, increase transport costs, and pollute the air in addition to adding to the driver's stress and further delays. Therefore, we designed a smart traffic light management system employing the recently launched YOLO V7. The new version V7 of the YOLO algorithm outperforms all previous object detection models in both speed and accuracy.

3. Deep Learning-Based Intelligent Traffic Monitoring Systems

AuthorK. Mani Raj,Ramavath Rani & Shravan Kumar

Year- 2022

We are proposing an intelligent traffic monitoring system with deep learning (DL) algorithms. Monitoring videos contribute a great deal to unstructured data. Surveillance cameras are deployed everywhere, where safety is important. Manual monitoring seems long and tedious. Security can be defined in various contexts such as theft identification, detection of violence, explosion chances. This paper includes an extensive learning method, starting with detecting vehicles and recognizing vehicle in crowds and predicting the traffic.

III. PROJECT DESCRIPTION

EXISTING SYSTEM

- Due to the unchecked increase in vehicle traffic in the modern world, a snarl of traffic has turn into a frenzied activity. The quantity of vehicles on the road each day greatly increases and thus causing a variety of problems.
- Though we have installed traffic control system like traditional traffic light systems are becoming inefficient in controlling the ever-growing traffic on the roads. In India, traffic congestion costs 1.47 lakh corer annually, according to a Boston Consulting Group analysis from 2018.

- Numerous studies have been carried out and is presently ongoing on the efficient traffic controlling systems. The development of intelligent traffic signal systems is one of the main areas of research. Therefore, we designed the deep learning based smart control of traffic light system using image processing with YOLO V7 [3]. YOLO V7 is the most powerful object detection algorithm in 2022 as it is the newly launched version of YOLO architecture.
- It already becomes the industry standard for object detection surpassing the previous version YOLO V4. We will briefly go over the fundamentals of YOLO V7's operation and how it will be the greatest object detecting algorithm in this essay. After that we will discuss the methodology to implement this algorithm in traffic light control system and its advantages.

DISADVANTAGES

- A smart traffic light system is an intelligent transportation system that utilizes advanced technologies such as artificial intelligence, deep learning, and computer vision to optimize the flow of traffic on roads, reduce congestion, and enhance safety.
- One of the key components of such a system is image processing, which involves analyzing visual data captured by cameras installed at traffic intersections to detect and track vehicles, pedestrians, and other objects.

PROPOSED SYSTEM

We are proposing an intelligent traffic monitoring system with deep learning (DL) algorithms. Monitoring videos contribute a great deal to unstructured data. Surveillance cameras are deployed everywhere, where safety is important. Manual monitoring seems long and tedious. Security can be defined in various contexts such as theft identification, detection of violence, explosion chances. This paper includes an extensive learning method, starting with detecting vehicles and recognizing vehicle in crowds and predicting the traffic. The main focus is about image analysis, detecting the vehicles involved and this is the main focus of this deep learning model. The suggested traffic monitoring system is implemented, and challenges problems such as parallel training and model sync are addressed. Task and model-level parallel training methods are proposed to speed up the analysis even more for traffic prediction. We offer low latency and precise solutions for image frame analysis. Traffic monitoring and analysis can be handled efficiently by the proposed DL model. We implement deep learning model using a neural network algorithms in deep learning.

ADVANTAGES

- Traffic congestion and regulating traffic in traffic signals are major issues in cities. Nowadays, in most of the cities, traffic management centers installed numerous cameras all over the roads and traffic signals.
- The objective is to develop a real time system that can automatically monitor real time traffic and make the system intelligent using artificial intelligence techniques.

MODULES DESCRIPTION

CAPTURE VIDEO

- By using the **VideoCapture ()** function in OpenCV library, it is very easy to capture a live stream from a camera on the OpenCV window.
- This function needs a device index as the parameter. Your computer may have multiple cameras attached. They are enumerated by an index starting from 0 for built-in webcam. The function returns a VideoCapture object

YOLO: Algorithm for Object Detection

- It deals with localizing a region of interest within an image and classifying this region like a typical image classifier. One image can include several regions of interest pointing to different objects. This makes object detection a more advanced problem of image classification.
- YOLO (You Only Look Once) is a popular object detection model known for its speed and accuracy. It was first introduced by Joseph Redmon et al. in 2016 and has since undergone several iterations, the latest being YOLO v7.

TRAFFIC LIGHT PERFORMANCE

This monograph is a synthesis of research carried out on traffic signal performance measures based on high-resolution controller event data, assembled into a methodology for performance evaluation of traffic signal systems. High-resolution data consist of a log of discrete events such as changes in detector and signal phase states. A discussion is



provided on the collection and management of the signal event data and on the necessary infrastructure to collect these data.

IV. RESULT

A portfolio of performance measures is then presented, focusing on several different topics under the umbrella of traffic signal systems operation. System maintenance and asset management is one focus. Another focus is signal operations, considered from the perspectives of vehicle capacity allocation and vehicle progression. Performance measures are also presented for nonvehicle modes, including pedestrians, and modes that require signal preemption and priority features. Finally, the use of travel time data is demonstrated for evaluating system operations and assessing the impact of signal retiming activities.

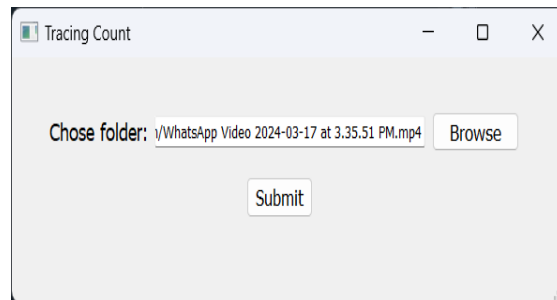


Fig1-Serach

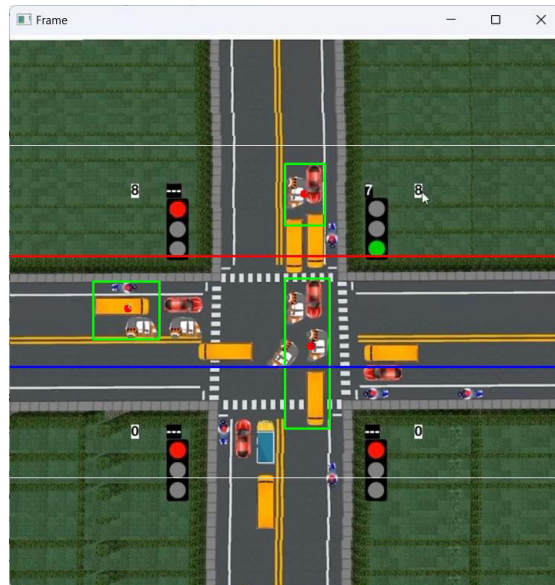


Fig2-Traffic Light -1



Fig3-Traffic Light-2

The main focus is about image analysis, detecting the vehicles involved and this is the main focus of this deep learning model. The suggested traffic monitoring system is implemented, and challenges problems such as parallel training and model sync are addressed. Task and model-level parallel training methods are proposed to speed up the analysis even more for traffic prediction. We offer low latency and precise solutions for image frame analysis. Traffic monitoring and analysis can be handled efficiently by the proposed DL model. We implement deep learning model using a neural network algorithms in deep learning.



YOLO: Algorithm for Object Detection

- ❖ It deals with localizing a region of interest within an image and classifying this region like a typical image classifier. One image can include several regions of interest pointing to different objects. This makes object detection a more advanced problem of image classification.
- ❖ YOLO (You Only Look Once) is a popular object detection model known for its speed and accuracy. It was first introduced by Joseph Redmon et al. in 2016 and has since undergone several iterations, the latest being YOLO v7.
- ❖ In this article, we will discuss what makes YOLO v7 stand out and how it compares to other object detection algorithms.

V. CONCLUSION

The proposed approach for smart traffic management, which employs YOLO and Alex Net, has the potential to accurately detect and track moving objects, analyze traffic flow, and recognize traffic signs. Real-time alerts and forecasts delivered by the system will assist drivers in reducing traffic congestion and enhancing road safety. Alex Net is capable of extracting critical information, such as vehicle type, color, and size, from the video, while the YOLO algorithm excels in detecting and tracking moving objects with precision and efficiency. This data can be utilized to anticipate traffic patterns and warn drivers about potential road hazards and regulations. While the suggested YOLO and Alex Net-based strategy presents a feasible solution to current traffic management issues, there are several limitations that need to be addressed. These include the lack of large-scale traffic datasets, the system's real-time performance, and the need for hardware optimization for practical implementation. Therefore, additional research is required to overcome these challenges and enhance the effectiveness of the proposed technique.

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