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ELUCIDATING DEEP LEARNING BASED TRAFFIC CLASSIFICATION USING YOLO

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Abstract: Intersections should have traffic signals for the purpose of ensuring safe driving. They disrupt and lessen traffic flow because of the queue delays at each traffic flow. In areas with high population densities, traffic congestion is a major challenge. Your location can be reached in a short while or up to an hour. Because to inefficient traffic management, which might be remedied much more swiftly in the technologically advanced world of today. For better traffic control, image processing techniques are developed as opposed to a time-based approach. Image processing enables us to more quickly clear traffic by calculating the number of vehicles in each traffic lane. This project makes use of the Yolo algorithm. The real-time characteristics of the traffic flows intended to cross the intersection at each traffic light are taken into account by this algorithm during the planning phase. The new algorithm will result in a decrease in traffic waiting time at intersections with signalised traffic, which will improve traffic flow. Also, more cars will be passing the crossing every second.

***Keywords*:** Traffic Management, Yolo Algorithm, Signalized Traffic.

1.INTRODUCTION

The ever-growing traffic is just one of the difficulties we confront in today's environment. Willpower in the face of traffic can be really helpful in learning more about them. An accurate record of the volume of traffic is provided by the study of censorious flow routines, which also covers the impact of large vehicles and parts on vehicle traffic. The fact that this data is utilized to manage increasing traffic during periodic intervals of traffic lights makes it an extremely important piece of information. Traffic flow can be measured using routes depending on the volume of vehicles passing through at any particular time. In the culture of today, cameras are far better possibilities for tracking a vehicle's data. A new firmware-based approach of automotive detection is what this project aims to offer. The approach recognizes the automobiles in the original image by assigning each and every one of them a preexisting identification. Each vehicle is then separately counted and classified later on in the program based on its type. It was important to obtain high accuracy, high dependability, and few issues in order to implement the established technique in a firmware program. Every day, traffic lights play a hugely significant role in controlling the flow of traffic. Using Python, the road density is computed, and the microcontroller modifies the display of the green light based on the results of image processing. Due to the wide variety of vehicle models available today, the number of cars has greatly expanded. It is challenging to manage traffic in metropolitan settings because of the wide range of vehicles. Currently, there are often lengthy traffic jams and it can take an hour or more to cross a single red light. Currently, traffic lights are changed every minute, and during that period, cars are allowed to cross the intersection. In some situations, this strategy is ineffective. The suggested method for traffic management makes use of image control. We deploy traffic surveillance cameras at a traffic signal to discover cars in a lane, identify the kind and quantity of vehicles individually, and operate traffic lights using this camera-based approach. This kind of approach has more 2 accuracy, greater perseverance, and few to no errors. With the ability to detect stop signs and tell pedestrians from lampposts, autonomous vehicles are still in the early stages of development. Smartphones, tablets, televisions, and hands-free audio systems are just a few examples of the consumer goods that use this technology. For good reason, deep learning has attracted a lot of attention recently. The use of technology has led to previously unthinkable outcomes. Deep learning (DL) techniques have demonstrated forecasting accuracy of 90% and higher on a constant basis when compared to machine learning (ML) and statistical methodologies. Deep Learning approaches are applied in the sector and are based on neural networks. The two or more layers of linked nodes (neurons) that make up Artificial Neural Networks (ANN) and Neural Networks (NN) are designed to function similarly to the human brain. For a number of reasons, numerous unique neural networks have been developed. Here are a few illustrations from forecasting and traffic modelling. Deep learning refers to a computer model's capacity to do categorization tasks using images, words, or voice. In terms of classification, this technology can occasionally outperform humans. Types of neural network topologies that may have several layers are trained using a sizable quantity of labelled data. A variety of algorithms are used in deep learning, a branch of artificial intelligence that rely on the structure and functionality of the human brain. One subclass of machine learning is deep learning. Deep learning is the name given to the type of machine learning that we employ in our work. Neural networks, which in some ways resemble the human brain, are used in deep learning, for instance.

Unlike traditional machine learning, which frequently uses structured data, deep learning also necessitates the study of enormous volumes of unstructured data. Unstructured data of various kinds, including text, audio, video, and images, can be used to feed the system.

2. LITERATURE SURVEY

It is customary to observe nonlinear, complex, and time-dependent patterns of traffic rather than traffic-dependent patterns. As a function of traffic density and volume, Khushi (2017) proposes in this paper a traffic control system that alters the duration of green, amber, and red signals based on image processing MATLAB code. Green and amber lights are controlled by one Arduino UNO, and red lights by another.[1]

Using digital image processing and clever edge detection, in this paper Tahm id& Hossain (2017) seeks to develop a method for measuring real-time vehicledensity to control traffic in real-time. Compared to existing systems, this imposing traffic control system offers significant improvements in response time, vehicle management, automation, reliability, and overall efficiency. Additionally, a complete demonstration of the entire design process from image acquisition to edge detection and finally green signal allocation is illustrated with appropriate schematics and tested by hardware implementationwith four sample images of different traffic conditions.[2]

In order to address the issue of traffic congestion, this paper introduces a brand-new system. Decisions will be based on real-time traffic monitoring and the traffic circumstances that the system has observed. In addition, the technology is utilised to track down vehicles with licence plates that are breaking the law. A confirmation message informing the driver of the fine amount will also be issued, in addition to that number plate being reported to law enforcement organisations. Throughout the paper, Uddin et al, (2021) have demonstratedhow this system is more advanced and efficient than the existing manual traffic control system. The SSD protocol was used instead of YOLO by Imran Uddin. As a compact Unnatural Intelligence Machine, the 8 Jetson Nano is made by NVIDIA. Four threads can be used simultaneously. With the YOLOprotocol and a server deployed the system will operate very slowly.[3]

Laplacian, Arbitrary, Sobel, and Prewitt are some domain approaches. As seen in the study, LabVIEW's image acquisition procedure loads both the reference picture and a real-time image from the camera. To get an edge detection picture, the obtained image must be processed using four distinct kernels: Arbitrary, Laplacian, Prewitt, and Sobel. In order for traffic signal lights to work dynamically on a four-lane road, the Root Mean Square Error is determined using edge detection photos. The simulation is created with the LabVIEW graphical programming tools, and the results are shown. An image quality measure RMSE value was used to anticipate the time necessary for cars to drive in a certain direction and switch control between vehicles dynamically to evaluate the effectiveness of the four strategies.[4]

A traffic management system called the Adaptive Traffic Management System(ATMS) proposed by Sham Sankaran and Logesh Rajendran (2021) adapts thetiming of traffic signs according to real-time traffic demand. Control of the system is accomplished through the use of both hardware and software. The hardware consists of a sensor that measures traffic density in real-time, and software is designed after analysing the city's current flow of visitors. Using cameras, this article shows how a system that minimizes cycle time and has special provisions for emergency vehicles could be created.[5]

2.1 PROBLEM STATEMENT

Reducing traffic congestion and long-time delays is a significant challenge in urban areas. It requires a multi-faceted approach that considers different factors such as the density of traffic, the road network, and the behaviour of drivers. One possible approach to reducing traffic congestion is to implement intelligent traffic management systems that make use of real-time data and advanced algorithms to optimize traffic flow.

A key aspect of this approach is to use the density of traffic at each part of the road to determine the optimal

traffic signal timing. For example, some roads may have higher traffic density during peak hours, while others may have more consistent traffic throughout the day. By using sensors and cameras to monitor traffic density, an intelligent traffic management system can adjust the timing of traffic signals to reduce congestion and delays.

Some roads may not require traffic signals at all, particularly if there are fewer vehicles on them. By using real-time data to monitor traffic density and adjusting traffic signals accordingly, an intelligent traffic management system can optimize traffic flow and reduce congestion on these roads. This can help to reduce overall travel times and improve the efficiency of the road network.

a) Providing a better approach to reducing traffic congestion and long-timedelays is the goal of this project.

b) Providing the best solution to reduce traffic congestion based on the density oftraffic at each part of the road.

c) Some roads should not be given a green light indication since there are fewer vehicles on them.

3. PROPOSED SYSTEM

We'll use a traffic light system based on crowds in this system. According to the number of people in the desired lane, a lane will be opened. It can be found by taking pictures of the vehicle crowd in the target lane and counting how many vehicles are in it.

Advantages Of Proposed System:

i. Accurate & Convenient.
ii. User can have access to 3 pairs of currency exchange rates.
iii. Result can be easily figured out.

3.1 SYSTEM ARCHITECTURE

It is represented in the Fig 1 below the step-by-step work done by the system in a flow type starting from selecting a currency exchange pair.

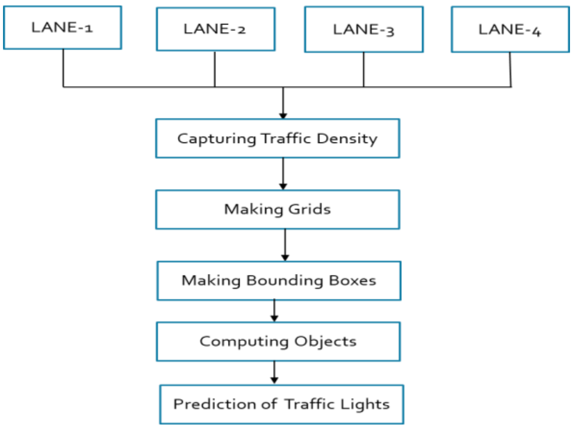

Fig 1. System Architecture

3.2 ALGORITHMS USED

In our system, five Machine learning algorithms are used for the prediction are:

Convolutional neural networks serve as the foundation for "You Only Look Once" object detection method. YOLO is one of the fastest methods for finding objects (You Only Look Once). When real-time detection without sacrificing too much precision is needed, this is an excellent option. A detection algorithm, in contrast to a recognition algorithm, predicts class labels as well as locating objects. As a result, it can identify a variety of objects inside a picture and classify it. With this method, the entire image is processed by a single neural network. The image is divided into areas by this network, which also forecasts bounding boxes and probabilities for each area. The weighting of these bounding boxes is based on projected probability. Since only convolutional layers are used in the YOLO network, it is entirely convolutional (FCN). Darknet53, a new, more complex feature extractor architecture, is introduced by the authors of the YOLO v3 paper. It comprises 53 convolutional layers, each followed by a batch normalization layer that, as the name implies, uses Leaky Re LU activation. The feature maps are down sampled using a convolutional layer with stride 2, and there is no pooling. This avoids the common loss of low-level properties brought on by pooling. YOLO is unaffected by the size of the image that is sent. However, it is advised to retain a particular input size in practice because there are a number of problems that only become obvious once the method is put into use. These are the three terms you need to comprehend before you can understand YOLO. The process of classifying involves giving each item in a picture a name. Localization is the process of creating bounding boxes for the object in the image. This gives us the bounding boxes and the object's label. Finding several objects in an image is the process of object detection. Several items are simultaneously detected via object detection. The approach used by Yolo may recognize numerous things at once. The process for classifying traffic using the YOLO algorithm is divided into several steps. Let's dissect this into three easy steps to be more explicit. Convolutional neural networks (CNNs) input, output We can maintain traffic flow and control traffic signals thanks to a variety of techniques.

3.3 IMPLEMENTATION PROCEDURE

i. Importing the packages used in our program Pandas, numpy, matplotlib, sklearn(ensemble, pre-processing, linear model metrics, tree ,model selection), seaborn, plotly stats model.
ii. Using "if else" statements for getting the user defined currency exchange rates.
iii. Creating dfl variable which stores the corresponding data using pandas.
iv. Using null (). Sum () function for knowing the null values in the dataset.
v. Displaying the numerical features, categorical features, discrete features.
vi. Filling the null values using the fillna method.
vii. Knowing the relation between the features using correlation matrix.
viii. Plotting box plot for open, high, low, close, adj close features in the data.
ix. Plotting a line graph for the data.
x. Splitting the data into training and the testing models using traintestsplit() method.
xi. Fitting the training data into Multiple Linear Regression, Random Forest Regression, Decision Tree Regression, Gradient Boosting Regressor Algorithm, Voting Regressor.
xii. Testing the data and then knowing how good the model predicts the values using r2 score.
xiii. Representing the predicted values in a scatter plot for visual representation.
xiv. Implementing the Ordinary Least Squares (OLS) Regression Table.

4. RESULTS

The proposed method shows red and green signals based on the traffic scenario. If the traffic density is more than green signal is shown and if traffic density is less than the red signal is shown. Minimum number of vehicles is set to 7 as mentioned above.

Figure 4.5 Green Signal

Figure 4.6 Red Signal

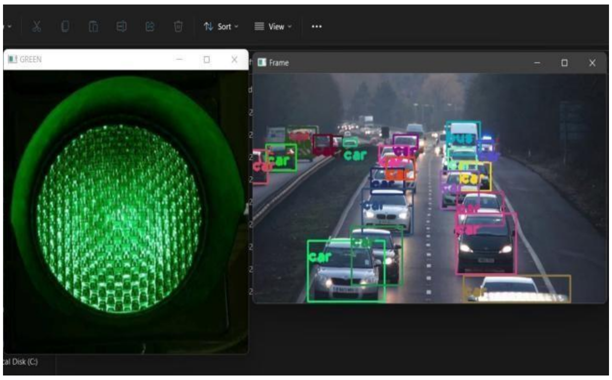

Figure 4.7: Traffic Signal

4.1 CONCLUSION

The number of cars in the modern period has expanded dramatically as a result of the large number of vehicles, it is difficult to control traffic in metro polytan centres. Nowadays, we witness long lines of traffic, and it might take up to an hour to cross a single traffic light. The current way is to change the traffic light for every minute and let vehicles to cross the signal during that time. This strategy is inefficient in some scenarios. For traffic control, the suggested technique utilizes image processing. This is a camera-based strategy in which we use traffic surveillance cameras at a traffic signal to detect cars in a lane and identify the kind and number of vehicles individually; this information is used for traffic light management. This method has higher accuracy, more consistency, and little to no mistakes. Because traffic lights play a significant part in traffic control, this strategy aids in more efficient traffic control. This technique is implemented in Python. The Yolo algorithm was chosen for its high and consistent measurements.

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