IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 7, April 2023

# Traffic Prediction for Intelligent Transportation System using Deep Learning

**Bergi Veeresha Gowda[1], Asif Ali[2], D Sreepada Reddy[3], Lokesh K[4], K Siddartha[5],**

Assistant Professor, Department of Computer Science and Engineering[1]

Students, Department of Computer Science and Engineering[2,3,4,5]

Rao Bahadur Y Mahabaleshwarappa Engineering College, Ballari, Karnataka, India

**Abstract:** *The most important challenge to sustainable mobility is persistent congestions of differing strength and duration in the dense transport networks. The standard Adaptive Traffic Signal Control cannot properly address this kind of congestion. Deep learning-based mechanisms have proved their significance to anticipate in adjective outcomes to improve the decision making on the predictions of traffic length. The deep learning models have long been used in many application domains which needed the identification and prioritization of adverse factors for a simplifying human life. Several methods are being popularly used to handle real time problems occurring from traffic congestion. This study demonstrates the capability of DL models to overcome the traffic congestion by simply allowing the vehicles through a signal depending on the length of vehicles. Our proposed method integrates a numeral of approach, intended to advance the cooperativeness of the explore operation. In this work, we implement the application to detect the number of vehicles in the images from the user and gives vehicles counts. To detect the vehicles count here we are using the YOLO pretrained weights.*

**Keywords:** Traffic, YOLO, Deep Learning, CNN (Convolution neural network)

## I. INTRODUCTION

Over the last decade by solving many very complex and sophisticated real-world problems. The application areas included almost all the real-world domains such as healthcare, autonomous vehicle (AV), business applications, and image processing. DL algorithms' learning is typically based on trial-and-error method quite opposite of conventional algorithms, which follows the programming instructions based on decision statements like if-else. One of the most significant areas of DL is simplifying human problems, in many application areas including medical domain, governments every sector is showing their interest to introduce AI to their systems. Various models have wide applicability in working with the conditions of real time. There are lots of studies performed for regulating traffic using deep learning techniques such as image segmentation, object detection etc.., In particular, the study is focused on live traffic regulating near a traffic signal and study is also focused on the decreasing the waiting time depending on vehicle counts and early response. These systems can be very helpful in decision making to handle the present scenario to guide early interventions to manage these traffic regulations very effectively. This study aims to provide an better system which can be able to release the traffic depending on the count of vehicles.

## II. LITERATURE SURVEY

Here is literature survey of traffic prediction for intelligent transportation system using deep learning,

1.Urban Traffic Prediction Based on Graph Convolutional Networks and Multitask Learning" by He et al. (2021).The authors proposed a deep learning model based on graph convolutional networks (GCNs) and multitask learning to predict traffic flow in urban areas. The model uses both spatial and temporal features and takes into account the relationship between road segments. The results showed that the proposed model outperformed traditional methods such as ARIMA and SVR.

2.Mehul Mahrishi and Sudha Morwal. Index point detection and semantic indexing of videos - a comparative review. Advances in Intelligent Systems and Computing, Springer, 2020- Mobile Ad Hoc Network (MANET) has the ability to self-configure and establish a mobile wireless mesh that can be used in extreme conditions, such as in areas affected by disasters. One of the routings in MANET is AODV routing.


DOI: 10.48175/IJARSCT-9527

3.C. Zhang, P. Patras, and H. Haddadi. Deep learning in mobile and wireless networking: A survey. IEEE Communications Surveys Tutorials, 21(3):2224–2287, third quarter 2019-The rapid uptake of mobile devices and the rising popularity of mobile applications and services pose unprecedented demands on mobile and wireless networking infrastructure. Upcoming 5G systems are evolving to support exploding mobile traffic volumes, real-time extraction of fine-grained analytics, and agile management of network resources, so as to maximize user experience

4..A Deep Learning Framework for Traffic Forecasting Based on Graph Convolutional Networks" by Yu et al. (2019) - The authors proposed a deep learning model based on a graph convolutional network (GCN) to predict traffic flow. The model uses both spatial and temporal features and takes into account the relationship between road segments. The results showed that the proposed model outperformed traditional methods such as ARIMA and SVR.

5..Deep Learning for Traffic Prediction and Customized Route Planning in Intelligent Transportation Systems" by Li et al. (2018) - The authors proposed a deep learning model based on a long short-term memory (LSTM) network to predict traffic flow and provide customized route planning. The model uses both spatial and temporal features to predict traffic flow and provide customized route planning for individual users. The results showed that the proposed model outperformed traditional methods such as ARIMA and SVR.

6.Short-term Traffic Flow Forecasting Using Deep Residual Networks" by Xie et al. (2018) - The authors proposed a deep learning model based on a residual network (ResNet) to predict traffic flow. The model uses both spatial and temporal features and takes into account the residual connections between layers. The results showed that the proposed model outperformed traditional methods such as ARIMA and SVR.

7.Traffic Flow Prediction with Spatial-Temporal Correlation in Big Data" by Ma et al. (2017) - The authors proposed a deep learning model based on a convolutional neural network (CNN) to predict traffic flow. The model uses both spatial and temporal features and takes into account the correlation between adjacent road segments. The results showed that the proposed model outperformed traditional methods such as ARIMA and SVR.

8.Deep Spatio-Temporal Residual Networks for Citywide Crowd Flows Prediction" by Zhang et al. (2017) - The authors proposed a deep spatio-temporal residual network (DSTRN) to predict crowd flows in urban areas. The model uses both spatial and temporal features to predict crowd flows. The results showed that the proposed model outperformed traditional methods such as linear regression and SVR.

9.Traffic Flow Prediction with Big Data: A Deep Learning Approach" by Lv et al. (2015) - The authors proposed a deep learning model based on a deep belief network (DBN) to predict traffic flow. The model was tested on real-world data, and the results showed that the proposed model outperformed traditional methods such as support vector regression (SVR).

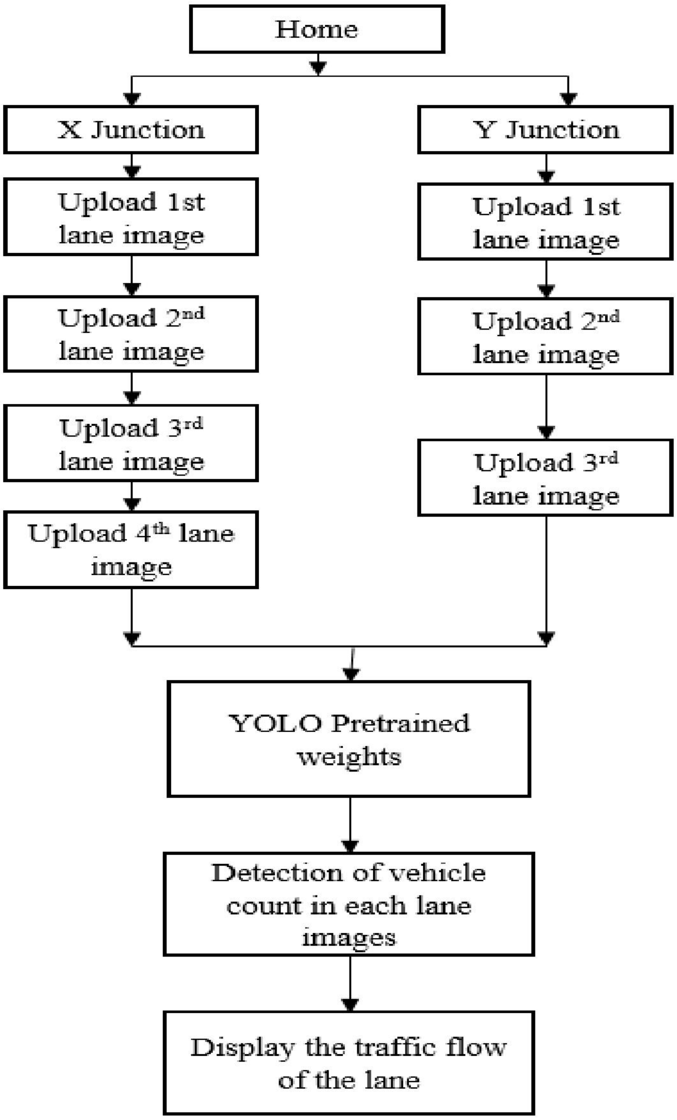
10.Rutger Claes, Tom Holvoet, and Danny Weyns. A decentralized approach for anticipatory vehicle routing using delegate multiagent systems. IEEE Transactions on Intelligent Transportation Systems, 12(2):364–373, 2011- This paper presents a decentralized approach for anticipatory vehicle routing that is particularly useful in large-scale dynamic environments. The approach is based on delegate multiagent systems, i.e., an environment-centric coordination mechanism that is, in part, inspired by ant behavior.

## III. PROPOSED SYSTEM

In the proposed system we are using the Yolo pretrained weights to detect the vehicles in the junctions, X and Y junction analysis we have done in this application.

Basically, in x junction the vehicles can move in free left and in this we have taken two scenarios like if 1st lane has high vehicle count those vehicles can move in free left and straight with 3rd lane and also 3rd lane can also do the same thing.

For 2nd and 4th lane also follow the same rule. For Y junction it follows on the three conditions, all three lanes follows individual rules like if 1st lane has high images it can move free left and right the same thing happen for remaining lanes also.

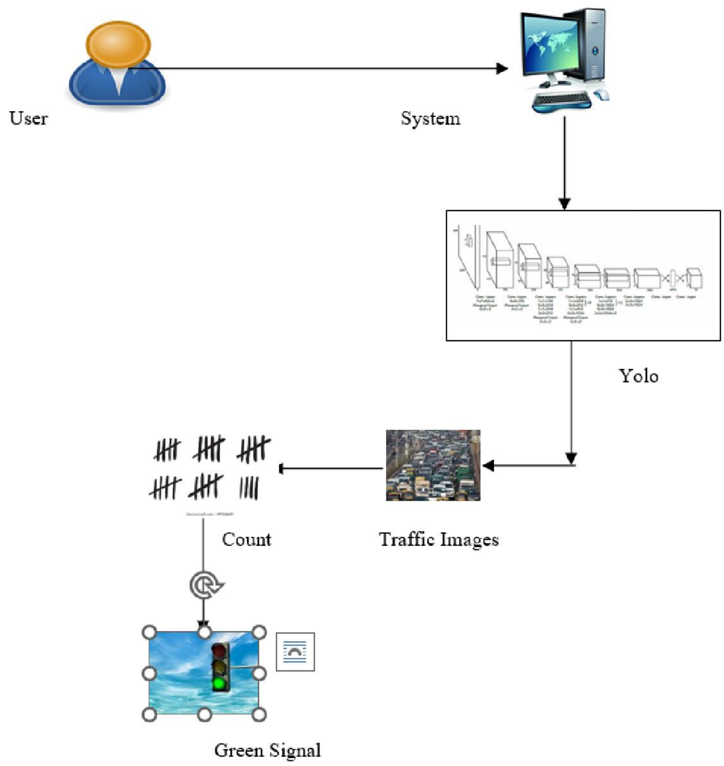



Flow Diagram

## IV. SYSTEM ARCHITECTURE

As shown in the below figure, when the image is sent to the system the image is processed by using YOLO algorithm. In this algorithm the image is divided into 19*19 grid after this we would specify the vehicles that need to be detected and the yolo algorithm will process the image grid by grid and will increase the count whenever it detects the vehicle it will increment the count. After image is differentiated and vehicles is detected in the traffic image which is sent by the user based on the count of the vehicles. The lane in which most vehicles are there will be Cleared first and next with most vehicles will be cleared.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 7, April 2023



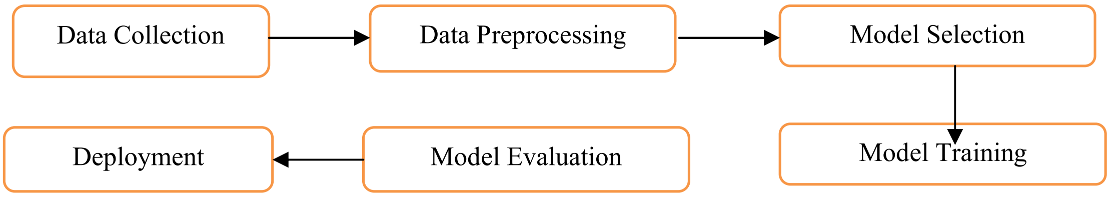

## V. METHODOLOGY

The methodology for traffic prediction using deep learning for intelligent transportation systems generally involves the following steps:

- **Data Collection:** The first step in any traffic prediction project is to collect the relevant data. This typically includes historical traffic data, weather data, road network data, and other relevant data sources. The data can be collected through various sources such as sensors, cameras, GPS devices, and other IoT devices.
- **Data Preprocessing:** Once the data is collected, it needs to be preprocessed to ensure that it is in a format suitable for deep learning models. This typically involves data cleaning, normalization, and feature engineering to extract relevant features such as time of day, weather conditions, and road network topology.
- **Model Selection:** The next step is to select an appropriate deep learning model for the traffic prediction task. This can include various types of models such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and graph neural networks (GNNs). The selection of the model depends on the specific requirements of the task, such as the input data format, the prediction horizon, and the level of accuracy required.
- **Model Training:** Once the model is selected, it needs to be trained on the preprocessed data. This typically involves splitting the data into training and validation sets, defining the model architecture, and optimizing the model parameters using techniques such as backpropagation and stochastic gradient descent.
- **Model Evaluation:** After training, the model needs to be evaluated to assess its performance. This typically involves measuring various metrics such as mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE). The model is then compared against baseline models such as ARIMA and support vector regression (SVR) to assess its effectiveness.
- **Deployment:** Once the model has been trained and evaluated, it can be deployed in a production environment. This typically involves integrating the model into an intelligent transportation system (ITS) platform that can provide real-time traffic predictions and enable traffic management decisions.


DOI: 10.48175/IJARSCT-9527

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 7, April 2023




Flow Diagram

In Data Collection the data from user will be collected by taking images , In next phase the data will be preprocessed and the model is selected using CNN Alogorithm and model is trained with various images using YOLO algorithm and the images will be evaluated and it will return the count of images and the traffic will be deployed according to the highest count of vehicles.

### 5.1 CNN Algorithm

CNN, or Convolutional Neural Network, is a type of neural network commonly used for image classification, object detection, and other computer vision tasks. It is inspired by the way the visual cortex of the human brain processes visual information.

The key idea behind CNN is to learn a set of features directly from the images, rather than requiring them to be manually engineered. This is achieved through a series of convolutional and pooling layers, followed by one or more fully connected layers.

In a convolutional layer, a set of learnable filters (also called kernels) slide over the input image, computing dot products at each position to generate a set of feature maps. These feature maps capture local patterns and textures in the image.

The pooling layers are used to downsample the feature maps, reducing their spatial dimensions while retaining the most salient information. Common pooling operations include max pooling and average pooling.

After several convolutional and pooling layers, the output is flattened and fed into one or more fully connected layers, which are similar to the layers in a traditional neural network. Finally, the output layer produces the predicted class probabilities.

During training, the network learns the optimal set of weights and biases for each layer using backpropagation and gradient descent. The goal is to minimize the difference between the predicted output and the true label for each training example.

CNNs have achieved state-of-the-art performance on many computer vision tasks, including image classification, object detection, and semantic segmentation.

The equations for the CNN algorithm can be written as follows:

In a convolutional layer:

$$Z[i, j, k] = (W[k] * A[i:i+f, j:j+f, :]) + b[k]$$

where, Z is the output feature map of the layer,

W[k] is the kth learnable filter of the layer,

A is the input feature map,

f is the filter size,

b[k] is the bias term for the kth filter,

i and j are the spatial coordinates of the output feature map, and

k is the channel index.

The above equation computes the dot product between the filter and a local region of the input feature map at each spatial position, followed by adding the bias term.


DOI: 10.48175/IJARSCT-9527
ISSN 2581-9429 IJARSCT

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 7, April 2023

### 5.2 YOLO Algorithm

YOLO (You Only Look Once) is a popular object detection algorithm used in computer vision tasks, developed by Joseph Redmon, Ali Farhadi, and other researchers at the University of Washington and the Allen Institute for Artificial Intelligence.

The key idea behind YOLO is to use a single neural network to both classify the objects in an image and localize them with bounding boxes. This is achieved by dividing the image into a grid of cells and predicting the bounding boxes and class probabilities for each cell.

The YOLO algorithm consists of two main parts: a backbone network that extracts features from the input image, and a detection network that uses these features to predict the object classes and bounding boxes.

The backbone network is usually a pre-trained CNN such as DarkNet or ResNet, which is used to extract high-level features from the input image. The detection network then takes these features as input and predicts the object classes and bounding boxes for each cell in the grid.

YOLO uses a single loss function to jointly optimize the classification and localization tasks. The loss function penalizes errors in both the object classification and the bounding box prediction, and is optimized using backpropagation and stochastic gradient descent.

One of the advantages of YOLO is its speed. Since it processes the entire image in a single pass, it is much faster than other object detection algorithms that use region proposal networks. This makes it suitable for real-time applications such as autonomous vehicles, security cameras, and robotics.

YOLO has been improved and updated over time, with the latest version being YOLOv5.

By using the above two algorithms the image that is received by the user will be processed by the computer using these two algorithm. Where CNN(convolution neural network) used in object detection and YOLO(you only look once) will help dividing the image in the form of 19*19 grid for the count of the vehicles and the lane in which most vehicles will be cleared. This process will continue to clear until all the lanes are cleared.

## IV. RESULTS AND DISCUSSION

As we demonstrate the concept by using deep learning algorithms like CNN and with the help of YOLO algorithm we develop the application by using softwares like pycharm and SQLyog enterprise. Firstly we need to upload 4 different images as shown in the figure 1

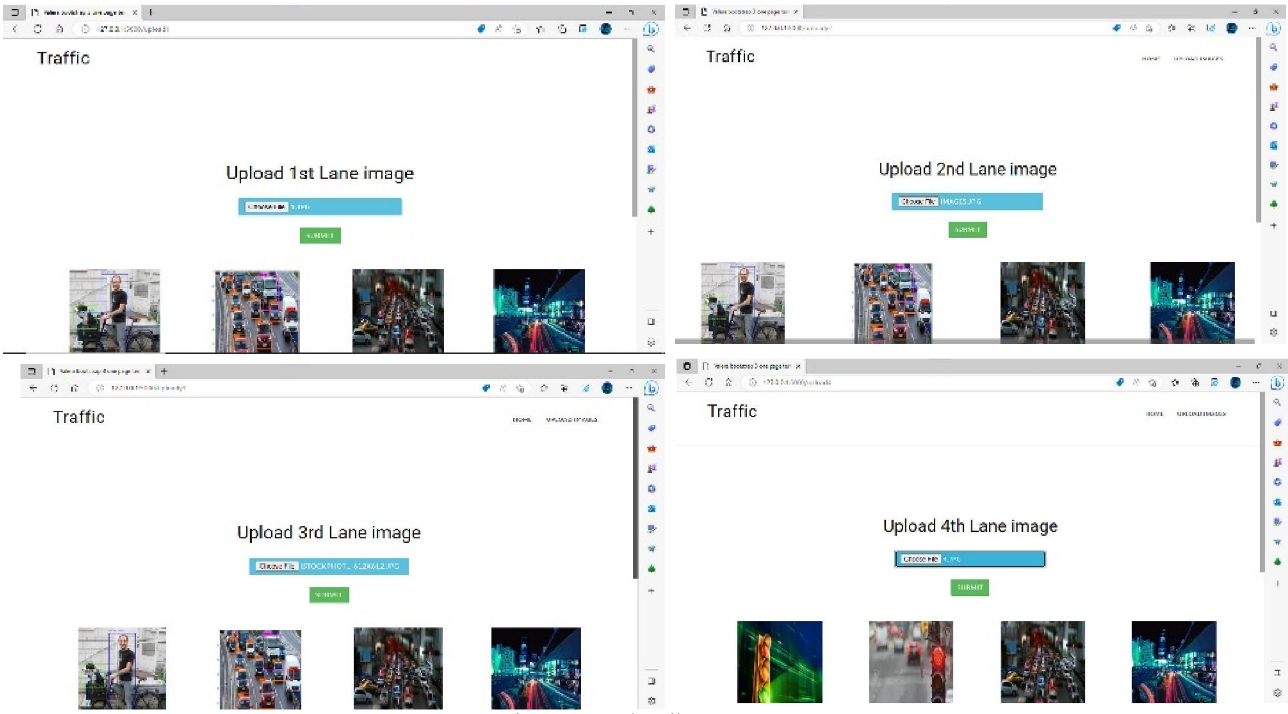



Figure1: Uploading Images

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 7, April 2023

After Uploading images the system will process the images with the help of the DL algorithm like CNN (Convolution Neural Network) and YOLO(You Only Look Once) will detect the vehicle and will return the count of the vehicle. As shown in example of the figure 2 the count of vehicle in the images will be counted and It is shown in figure 2 for the four images of the vehicles.

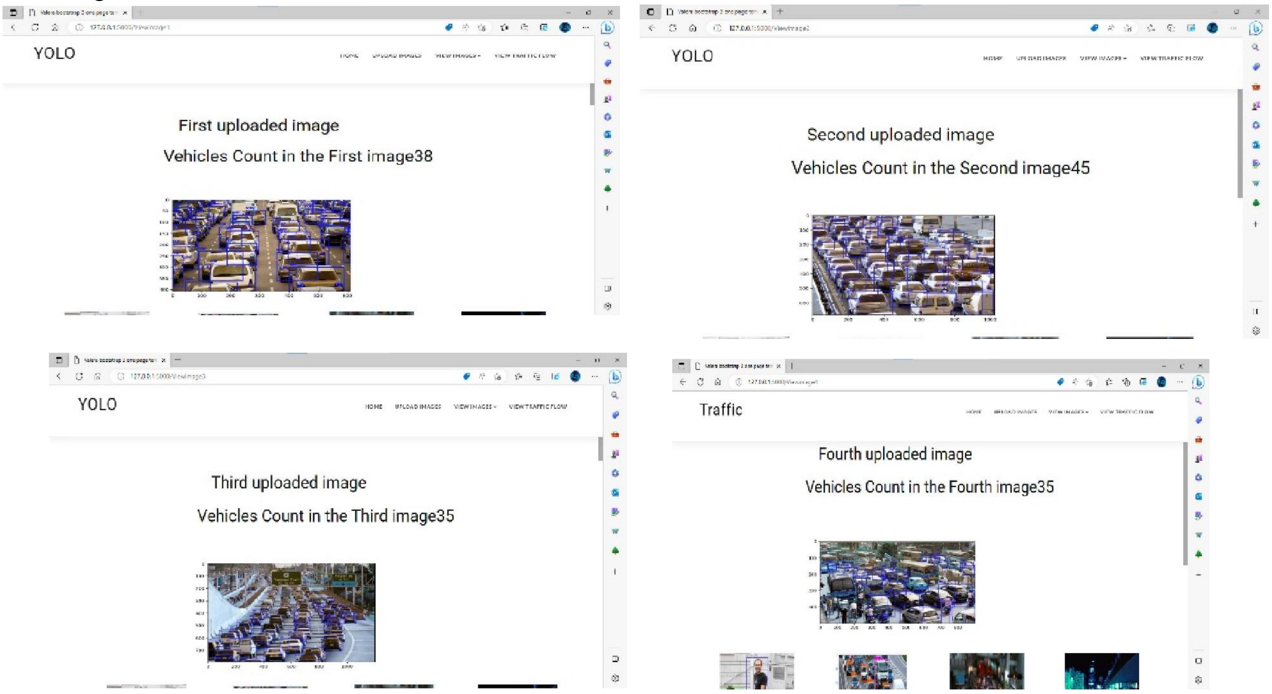



Figure 2: Count of Uploaded images

After uploading images the lane having the count with most number of vehicle will be cleared along with it the lane with second most highest vehicle count will also be cleared as shown in figure 3. Similar to we can do the same implementation for three way road. For the example above we have shown the figure 3 traffic flow of vehicle for the above vehicle count.

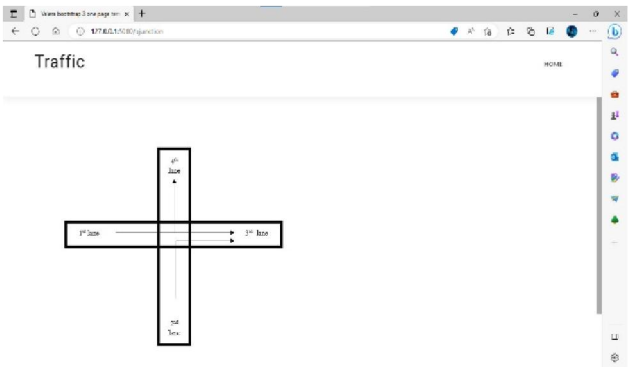



Figure 3:Traffic Flow with respect to count

## V. CONCLUSION

Traffic prediction using deep learning is an important application of artificial intelligence in the field of intelligent transportation systems. The use of deep learning models an enable accurate and real-time traffic predictions, which can support proactive traffic management decisions and help to alleviate congestion on road networks. The methodology for traffic prediction using deep learning involves a series of steps, including data collection, preprocessing, model selection, training, evaluation, and deployment. Each step is critical to the success of the overall process and requires careful consideration and attention to detail.

Despite the potential benefits of using deep learning for traffic prediction, there are also several challenges and limitations to be aware of. These include the need for high-quality data, the complexity of deep learning models, and the potential for overfitting. Therefore, it is important to approach traffic prediction using deep learning with caution and to continuously monitor and evaluate the performance of the models to ensure their accuracy and effectiveness.

Overall, traffic prediction using deep learning has the potential to revolutionize the field of intelligent transportation systems and improve the safety, efficiency, and sustainability of our transportation networks. As research and development in this field continue to advance, we can expect to see even more sophisticated and effective applications of deep learning in traffic prediction and other related areas.

## REFERENCES

**[1].** Urban Traffic Prediction Based on Graph Convolutional Networks and Multitask Learning" by He et al. (2021).

**[2].** Mehul Mahrishi and Sudha Morwal. Index point detection and semantic indexing of videos - a comparative review. Advances in Intelligent Systems and Computing, Springer, 2020

**[3].** C. Zhang, P. Patras, and H. Haddadi. Deep learning in mobile and wireless networking: A survey. IEEE Communications Surveys Tutorials, 21(3):2224–2287, third quarter 2019

**[4].** A Deep Learning Framework for Traffic Forecasting Based on Graph Convolutional Networks" by Yu et al. (2019)

**[5].** Deep Learning for Traffic Prediction and Customized Route Planning in Intelligent Transportation Systems" by Li et al. (2018)

**[6].** Short-term Traffic Flow Forecasting Using Deep Residual Networks" by Xie et al. (2018)

**[7].** Traffic Flow Prediction with Spatial-Temporal Correlation in Big Data" by Ma et al. (2017)

**[8].** Deep Spatio-Temporal Residual Networks for Citywide Crowd Flows Prediction" by Zhang et al. (2017)

**[9].** Traffic Flow Prediction with Big Data: A Deep Learning Approach" by Lv et al. (2015)

**[10].** Rutger Claes, Tom Holvoet, and Danny Weyns. A decentralized approach for anticipatory vehicle routing using delegate multiagent systems. IEEE Transactions on Intelligent Transportation Systems, 12(2):364–373, 2011