Traffic Management System using Machine Learning Algorithm

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Abstract **- In cities where the number of vehicles continuously increases faster than the available traffic infrastructure to support them, congestion is a difficult issue, and it becomes even worst in case of vehicle accidents. This problem affects many aspects as modern society including economic development, traffic accidents, increase in greenhouse gas emission, time spent and health issues. In this context, modern societies can rely on traffic management system to minimize traffic congestion and its negative effects. To address this effect, machine learning based traffic management system (TMS) have been proposed. This proposed system focuses on monitor the vehicles in order to reduce the time spend in traffic signals, detect, and prevent traffic congestion and suggest alternative routes to the vehicles.**

Index Terms **- Traffic Management System, Machine learning, YOLO, Convolution Neural Networks**

I.INTRODUCTION

Now-a-days vehicles are increasing rapidly. This is one of the reasons for traffic congestion. People are able to use different transportation facilities such as automotive vehicles, subways, and bicycles. However, among all these transportation facilities, automotive vehicles are still the most adopted due to this comfort and practically. In this way, assuming a continuous population growth, the number of vehicles in large cities will increase as well, but much faster than transportation infrastructure; consequently, traffic congestion will become a pressing issue. It creates several negative concerns for the environment and society such as increasing number of traffic accidents, economic development, increase in greenhouse gas emission, time spent and health issues. By considering these effects, machine learning based traffic management systems have been proposed. In this proposed system video sequence is the input for convolutional neural network. Thus, the training process was implemented using convolutional neural network topology of the YOLO algorithm. A spatial detection of the object in a video-frame is necessary as a first input of most tracking algorithms. Rectangular Region of Interest (ROI) is used for segmenting the objects. The frame rate of the videos was 45 FPS in YOLO object detection.

II. LITERATURE REVIEW

Shwetha R.J et al. (2018) described an Intelligent traffic signal management system using cloud vision API and Machine learning. The images of the next traffic junction are taken and updated to cloud and by the help of cloud vision API density and type of vehicles are detected which in turn returns status to the previous signal. The previous signal which is now the present signal will check for the status of the next signal based on the status it does further operation. This trigger the RFID place next to signal to be enabled and detects the vehicles crossing it resulting which a penalty to be paid to traffic control. AditiYadav et al. (2019) proposed an Adaptive traffic management system using IOT and Machine learning. Camera sensors and two controller boards will play major roles. The camera sensor will capture the details from the lane with live streaming and pass it on to first controller board. This board will differentiate all the vehicles from obtained data by using Tensor Flow and maintain the count of vehicles in a particular lane. This count will be passed on to another controller board. This board will use this count to adjust the traffic signals and congestion lights accordingly. If there is a great difference between the counts of two lanes, then using the Min-Max Fairness algorithm, the priority will be given to low average waiting time. If the

difference is not much, then using the Round Robin algorithm, the priority will be given to low traffic congestion. D.Venkata et al. (2019) proposed a smart traffic management system for smart cities using Reinforcement learning algorithm. Compound optimization error can be successfully handled by using reinforcement learning technique and thus Deep learning technique has drawn enormous fascination. Seeing the various merits in combining reinforcement with deep learning method we have decided to work on setting proper and effective traffic controlling system using these effective techniques.

III. MACHINE LEARNING – OVERVIEW

Machine Learning is an application of artificial intelligence where a computer/machine learns from the past experiences (input data) and makes future predictions. The performance of such a system should be at least human level. Machine learning algorithms have the ability to improve themselves through training. Fig.1 shows that the general process of machine learning.

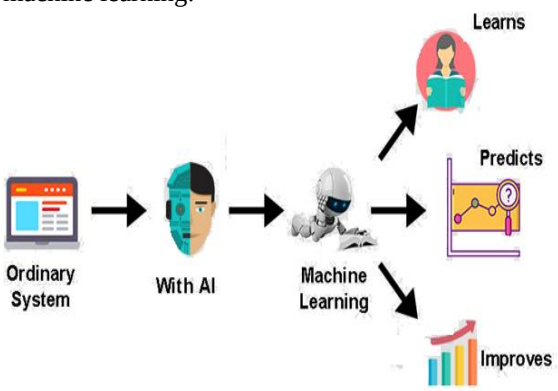


Fig.1 General process of Machine Learning

With machine learning algorithms, AI was able to develop beyond just performing the tasks it was programmed to do. Before ML entered the mainstream, AI programs were only used to automate low-level tasks in business and enterprise settings. This included tasks like intelligent automation or simple rule-based classification. This meant that AI algorithms were restricted to only the domain of what they were processed for. However, with machine learning, computers were able to move past doing what they were programmed and began evolving with each iteration. Machine learning is no exception, and a good flow of organized, varied data is required for a robust ML solution. In today's online-first world, companies have access to a large amount of data about their customers, usually in the millions. This data, which is both large in the number of data points and the number of fields, is known as big data due to the sheer amount of information it holds.

IV.YOLO ALGORTHM

YOLO (You Only Look Once) real-time object detection algorithm, which is one of the most effective object detection algorithms that also encompasses many of the most innovative ideas coming out of the computer vision research community. Object detection is a critical capability of autonomous vehicle technology. It is an area of computer vision that's exploding and working so much better than just a few years ago. At the end of this article, we will see a couple of recent updates to YOLO by the original researchers of this important technique. YOLO is a clever convolutional neural network (CNN) for doing object detection in real-time. The algorithm applies a single neural network to the full image, and then divides the image into regions and predicts bounding boxes and probabilities for each region. These bounding boxes are weighted by the predicted probabilities. Fig.2 shows that the analysis of YOLO model.

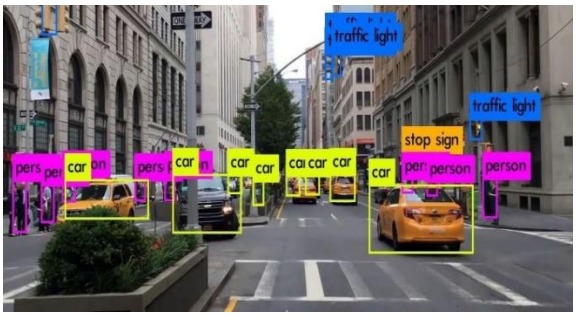


Fig.2 Analysis of YOLO Model

YOLO achieves high accuracy while also being able to run in real-time. The algorithm "only looks once" at the image in the sense that it requires only one forward propagation pass through the neural network to make predictions. After non-max suppression, it then outputs recognized objects together with the bounding boxes. With YOLO, a single CNN simultaneously predicts multiple bounding boxes and class probabilities for those boxes. YOLO trains on full images and directly optimizes detection performance. Fig.3 shows the object detection.

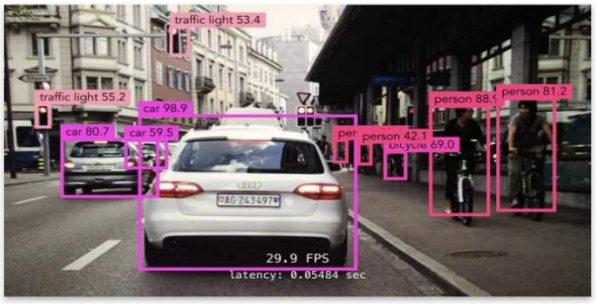


Fig.3 Object detection

Object detection

A. Convolution Neural Networks (CNN):

CNN is widely used neural network architecture for computer vision related tasks. Advantage of CNN is that it automatically performs feature extraction on images i.e. important features are detected by the network itself. CNN is made up of three important components called Convolutional Layer, Pooling layer, fully connected Layer. Considering a gray scale image of size 32*32 would have 1024 nodes in multi-layer approach. This process of flattening pixels loses spatial positions of the image.

B. Region-based Convolutional Neural Networks (R-CNN):

The Region-based Convolutional Network method (RCNN) is a combination of region proposals with Convolution Neural Networks (CNNs). R-CNN helps in localising objects with a deep network and training a high-capacity model with only a small quantity of annotated detection data. It achieves excellent object detection accuracy by using a deep ConvNet to classify object proposals. R-CNN has the capability to scale to thousands of object classes without resorting to approximate techniques, including hashing. The fig 4. shows that Regional based convolutional neural network.

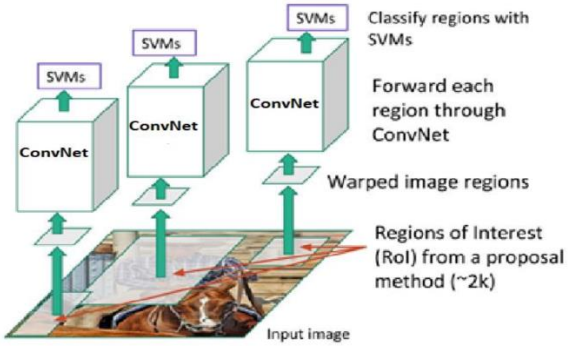


Fig.4 Regional based CNN

C. Single Shot MultiBox Detector (SSD):

Single Shot Detector (SSD) is a method for detecting objects in images using a single deep neural network. The Single Shot Detector network combines predictions from multiple feature maps with different resolutions to naturally handle objects of various sizes. Fig 5. shows Single Shot MultiBox Detector.

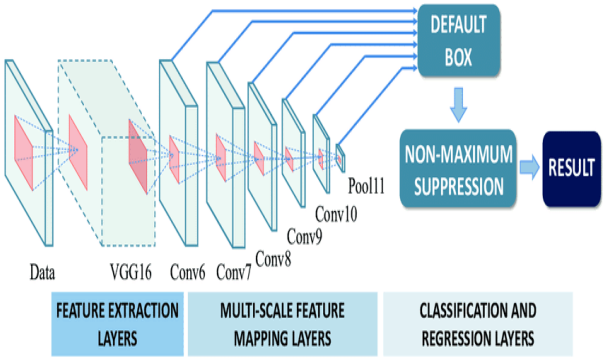


Fig.5 Single shot MultiBox detector

V. PROPOSED SYSTEM

It consists of pre-trained YOLO model algorithm to predict the traffic congestion of vehicles. This algorithm is used to count, detect, and track the different types of vehicles. It determines the vehicle count earlier and suggests alternative routes to the vehicles. It requires only a single neural network to the full image.

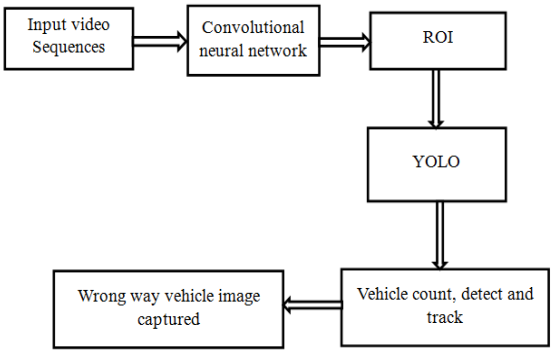
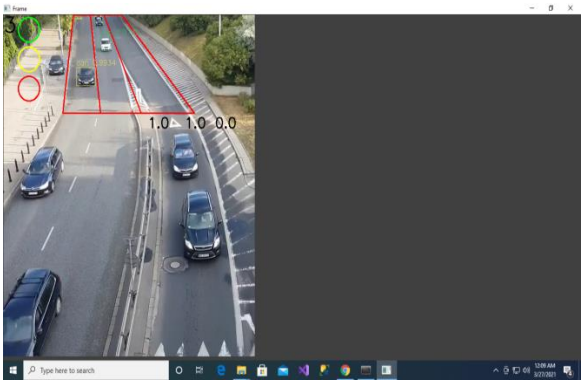


Fig.6 Block diagram for proposed system

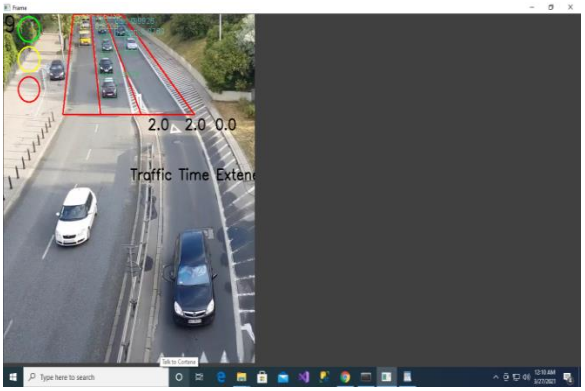
The input video sequence is given as input to convolutional neural network. The training process was implemented using convolutional neural network topology of the YOLO algorithm. A spatial detection of the object in a video-frame is necessary as a first input of most tracking algorithms, in our case, the object is segmented by using a Rectangular Region of Interest (ROI), in our implementation the frame rate of the videos was 45 FPS. Then the frames are given to

YOLO model for counting, detecting and tracking purposes. The object detection algorithm operates in every frame. Finally counting the entire vehicle. If vehicle count is less than the threshold it is normal traffic signal switching otherwise the vehicle count is more suggest alternative routes to reduce the time spent. The final step is to detect the wrong way vehicle. In our system, we defined that if the vehicle moves away from the camera, it will be detected as a wrong way vehicle. Suppose the vehicle is coming towards the camera and is in the right way. A wrong way vehicle after its detection, an image of the frame will be captured automatically. By using captured image further inception will be handled for wrong way vehicle.

VI. RESULTS AND DISCUSSIONS



(a)



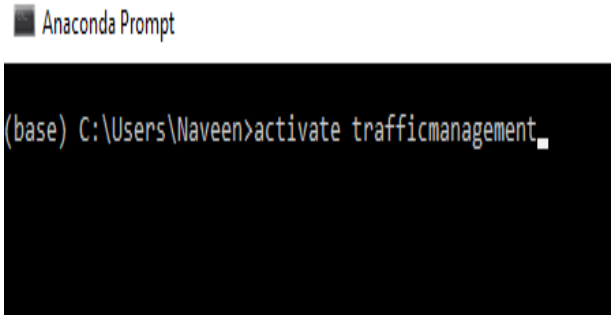
(b)

Fig.7 Vehicle Detection

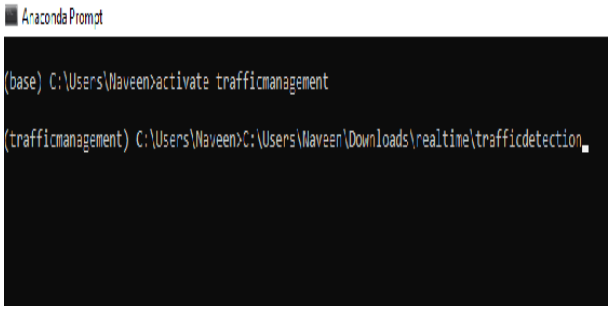
The above figures shows that the vehicle detection image. The experimental result shows that the three divisible lanes reduce the accident and time spent. A threshold level is set initially as 8. In image 1, the threshold level is 3. That is the vehicle count is less than the threshold level, so it is consider as normal traffic routing. In image 2, the threshold level is 9. The count is high, so we suggest alternative routes to the vehicles in order to reduce the time spent.

STEP BY STEP PROCESS:

Step 1: Activate traffic management in anaconda prompt

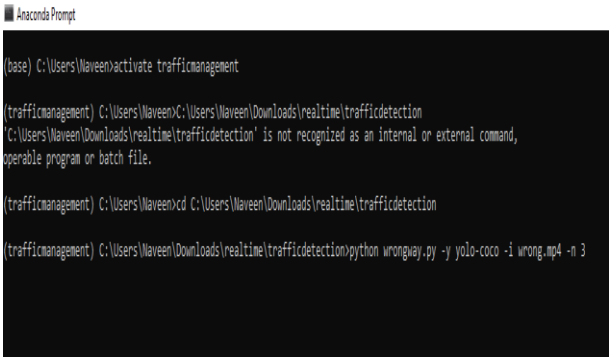


Step 2: Calling the file of traffic detection

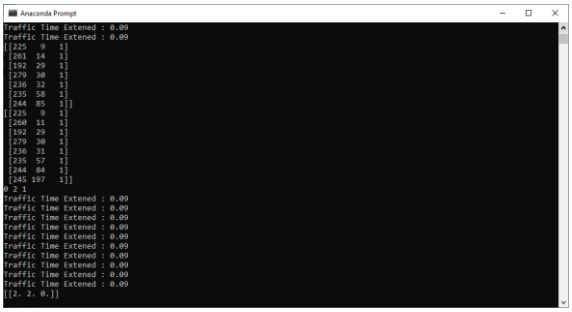


Step 3: Taking the videos as input.

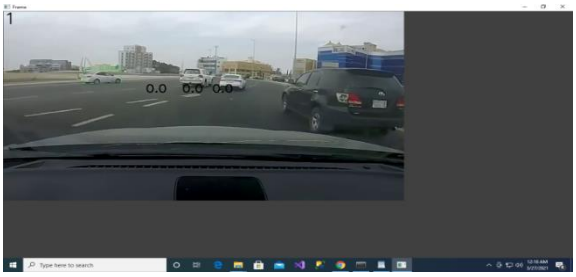
Step 4: Interpreting the coding.



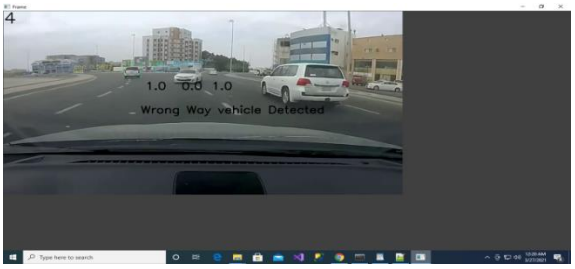
Step 5: Get the output.



WRONG - WAY DETECTION



(a)



(b)

Fig.8 Wrong way detection images

The above figure shows the wrong way detection images. In image 8(a), the vehicles are moving normally. In image 8(b), one vehicle is turning suddenly. It is moving wrongly in a one-way road; a camera is fixed to detect such types of vehicles. If the vehicle is moving in front of the camera, it is considered as right way. If it is moving away from the camera, it is consider as moving in a wrong way. An image is captured for further inception.

From step 1 to step 3 the process is same as threshold level. In step 4 interpreting the program for wrong way and outputs can be observed in Anaconda Prompt.

VII CONCLUSION

In a smart city road would be equipped with the sensors for analyzing the traffic flow. Hence, free flowing of road traffic is important for faster connectivity and transportation systems. Few traffic flow prediction methods use Neural Networks and other prediction models which take more time with manual intervention which are not suitable for many real-world applications. So, here, we proposed a machine learning based traffic management system which can be used for analysing the traffic and predicting the congestion on specific path and notifying well in advance the vehicles intending to travel on the congested path. Vehicle counting is a process to estimate the road traffic density to access the traffic conditions. Here, video-based vehicle counting method has been proposed the processing of a video is achieved in three stages such as object detection by means of YOLO, tracking and counting. YOLO attained renewable outcome into object detection area and achieved green accuracy into cogitative speed in tracking. This proposed system gives a simple, accurate and early prediction of the traffic congestion and can give high accurate results.

REFERENCES

[1] Prof. SunayanaJadhav, SiddharthVaghela, ShubhamTawde, RashmiBharambe, “Traffic Signal Management using Machine Learning Algorithm”,International Journal of Engineering Research & Technology (IJERT),June 2020.

[2] Shwetha R.J, Srinath M, Vibha S, “Intelligent traffic signal management system using cloud vision API and Machine learning”, International Journal of Engineering Research & Technology (IJERT), June 2018.

[3] AditiYadav, Vaishali More, NehaShinde, ManjiriNerurkar, NitinSakhare, “Adaptive Traffic Management System Using IoT and Machine Learning”, Journal of Electrical Technology, Vol 4, pp.221-226, Jan 2019.

[4] PawełGoraxi, MaciejBrzeskixi, Katarzyna Karnasxi, Hubert Dryjaxi, Magdalena Kukawskaxi, MarcinMozejko, “Solving Traffic Signal Setting Problem Using Machine Learning”, IJAT, Vol.8, pp.1021-1025, Mar 2019.

[5] Julian Nubert, Nicholas Giai Truong, Abel Lim, Herbert IlhanTanujaya, “Traffic Density Estimation using a Convolutional Neural Network Machine Learning Project”, National University of Singapore, 5 September 2018.

[6] M Luo, SC Lin, IF Akyildiz, “Software defined network traffic congestion control”, Scientific Programming Volume 2017, Article ID 3579540, December 2017.

[7] Q Wang, J Wan, Y Yuan, "Locality constraint distance metric learning for traffic congestion" Pitu, Larry Head, A real-time traffic signal control system: architecture, algorithms, and analysis, NOV 2016

[8] MayuriLakhani, Shivansh Dave, Jignesh J. Patoliya "Internet of Things based Adaptive Traffic Management System as a part of Intelligent Transportation System (ITS)", IEEE 2018.

[9] Sonali P. Kshirsagar, Priyanka H. Mantala, Gayatri D.Parjane, Kalyani G. Teke, "Intelligent Traffic Management based on IoT", International Journal of Computer Applications (0975 - 8887) 2017.

[10] JuntaoGao, YulongShen, Jia Liu, Minoru Ito and Norio Shiratori, "Adaptive Traffic Signal Control: Deep Reinforcement Learning Algorithm with Experience Replay and Target Network", IEEE 2017.