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# Traffic Analysis and Vehicle Flow Control using Deep Learning

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**Abstract:** *In recent times, traffic congestion is a main problem at every junction.Traffic timer controlling system will display green signal for each lane at regular time intervals.If a lane does not consists of vehicles,the traffic controlling system still display the green signal for a period of time.At that time, vehicles at other lanes has to wait for the signal.This problem is prevented by the project " TRAFFIC ANALYSIS AND FLOW CONTROL USING YOLO-v3. "YOLO-v3 stands for "You Look Only Once" and it is a real-time object detection algorithm that identifies objects in videos, images and helpful for detect object in environment. This project is developed for regulating the traffic flow by releasing better signal at time intervals*

***keyword:*** *Traffic flow, YOLO-v3, Deep Learning*

## 1. INTRODUCTION

By the last two decades the traffic congestion is increasing day by day due to increasing of vehicles.The traffic congestion is the irritating part in the daily life. Even if there is no traffic in the junction due to timer controlling system, it is getting late to work, school, college or any other emergency. By reducing these type of problems introducing the method "traffic analysis and vehicle flow control by using deep learning" this method can solve the problem of traffic congestion.it can also help to reduce the time wasting in the traffic junction. In the project, deep learning is going to be used in it. It is a sub part of machine learning, which helps in decision taking for image processing. It also helps to detect in real time image processing. It provide accurate results short time. There are few algorithms are there for image processing like CNN,RCNN, faster -RCNN,YOLO. In this project the YOLO method is going to use for speed analysis and accuracy. There are also versions in the YOLO algorithms v1,v2,v3,v4,v5.So YOLO-v3 is using in this project. The YOLO-v3 is compatible for traffic image processing. It detect auto, bike, bus, car, tractors, tankers.

## 2. Literature Survey

*Night time vehicle detection and tracking by analysing vehicle parts from multiple cameras*-It is a challenging task for traffic cameras at night to track vehicles. because of the paired vehicle headlight or tail light it is difficult to determine the vehicles[2]. The method in this paper going to help to recognize vehicles by combining the vehicle headlight and tail light. Vehicle head light and tail light will be reconstruct by following geometric distance between vehicle parts for detection of vehicle[6]. In the process of vehicle detection the algorithm will remove duplicate vehicle lights for detect the vehicle. It was designed for to detect cars, bikes, auto, rikshaws, etc, in the night time by combining the headlight and tail lights. But it not compatible for heavy vehicles like trucks[5].

*The Traffic flow prediction based by using deep learning in internet of vehicles*-In internet of vehicles (IoV), the traffic flow prediction of roads and junctions will be helpful to drivers for time saving, that they not struck in traffic. Previous traffic methods are not accurate in

traffic flow prediction because of slow analysis, it cannot analysis the large scale roads network data because of less performance[3][4]. This paper will be help to solve the road network issues. By eliminating anomaly nodes, road network volume of traffic dataset features are extracted. By using spectral clustering compression scheme we compress road network traffic dataset. Based on LSTM and sparse auto encoder a hybrid traffic flow prediction is designed[7][8].

*Multi scale detector for accurate vehicle detection in traffic surveillance data by using deep learning*-In recent times we are not achieved with traditional machine learning when compared to deep learning algorithm[2]. Mostly in the environment purpose the object detection is used with the help of deep learning. Convolutional neural networks is an old method used for object detection that detect object and it takes more time to feature map the object, and it has less performance in image analysis[9]. Due to this we are going to use YOLO-v3 algorithm in deep learning for high performance.

## 3. Proposed Methodology

Any technique that uses information and control technologies can be divided into small functions:

A. Collection of Data
B. Processing of Data
C. Decision Making System

**A.Collection of Data:**

The data can be collected from different sources to train the images of different things. This collection of data must be done in order to detect different objects. As in this mechanism we can simply use YOLO pre-trained weights to reduce time complexity and space complexity.

**B. Processing of Data:**

There are so many possible lanes in roads, in order to detect the vehicles the data must be collected and processed and data is automatically collected and observed and simplified the data and then it will be sent to different input and output signals which required by Traffic Light Algorithm. Some of parameters that which can include length, queue, inflow, and outflow.

## 3. Decision Making System

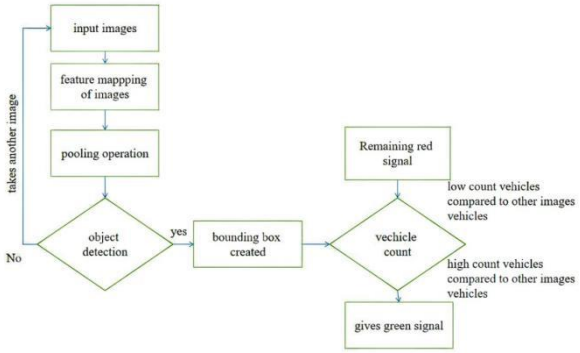


Fig.1: Flow chart

**Working procedure:**

Deep neural network is a class of CNN(Convolutional neural network) that identifies objects in an image.by the help of convolutional kernels, shared weight architecture the space invariant artificial neural networks is designed. Multi layer has regularized versions of CNN. a fully connected network in the deep learning means it is a multi layer perceptron. A node is a neuron which is connected to the all neuron in the next layer. every neuron is connected to all neuron which is around them. These cause over fitting of data due to full connectivity. A different approach of CNN towards regularization is trimming connectivity and preventing over fitting. For increasing complexity we assemble patterns with help of smaller and simple patterns used in their filter. CNN is lesser performance in the scale of connectivity and complexity. Convolution is a mathematical operation indicate in "Convolutional neural network"

**YOLO(You Only Look Once):**

You Only Look Once is used for object detection in Deep learning which is a sub class of machine learning. For human, building, animals, objects, vehicles, etc,. are detected with help of the YOLO algorithm which is a computer technology by using Image processing techniques.YOLO is a well-researched in Image processing technique for object detection.There are

applications like image retrivel and video surveillance of YOLO. It will detect object from a point to particular distance. For face detections eyes, nose, mouth and skin colour are features. and for vehicles headlights, mirrors, glasses, doors, wheels are the features. It detect object with help of class probabilities and regression problem. A forward propagation via neural networks to detect objects happens in YOLO algorithm. This means the process of object identification happen in a single step. It will predict different probabilities and bounding boxes parallely.

**The bounding box are created**

The below formulas explain the network output transformation to obtain prediction of bounding box. The predicted results coordinates are $\mathbf{d_y}$ and $\mathbf{d_x}$, where height is $\mathbf{d_h}$ and width is $\mathbf{d_w}$. The grid cell top left coordinates are $\mathbf{m_x}$ and $\mathbf{m_y}$. The outputs $\mathbf{t_x,t_y,t_w}$ and $\mathbf{t_h}$ are network outputs. The $p_h$ and $p_w$ are box anchor dimensions.

$d_x = \sigma(t_x)+m_x$…….(1)

$dy = \sigma(t_y)+m_y$……(2)

$d_w = P_w e^{tw}$……..(3)

$d_h = P_h e^{th}$……(4)

If a threshold value is greater than the class score of box, the box having class score is removed by applying a filter, for using a threshold value. For identifying the classes the class score of box value is less due to this reason it is removed. Still there are many overlapping boxes even after using a threshold value. For identifying the object, we will select only one box in the overlapping boxes. A intersection of union (IoU) function helps to non-maximum suppression for to use second filter which is used to choose desired boxes.

$IOU = B_1 \cap B2 \,/\, B_1 \cup B_2$

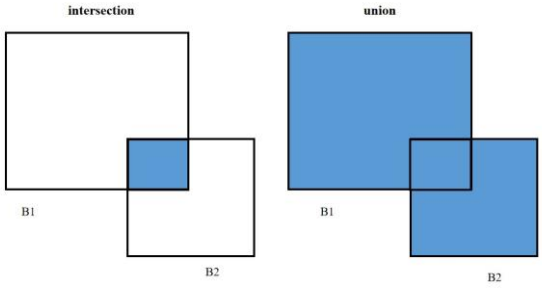


**Fig.2: Union and Intersection**

The above image top left corner and below right corner of a box is (a1, b1) and (a2, b2). By multiplying its height (b2-b1) and width (a2-a1) we can calculate the area of a rectangle. By obtaining 2 boxes for intersection we have (ai1,ai2,bi1,bi2) coordinates. The 2 boxes coordination position of a1 and b1 has the highest value of ai1 and bi. The 2 boxes coordination position of a2 and b2 has the lowest value of ai2 and bi2.

Union(A,B) = A+B - Inter (A,B)

Inter_area= (ai2-ai1)*(bi2-bi1)

Box1_area=(box1[3]-box1[1])*(box1[2]-box1[0])

Box2_area=(box2[3]-box2[1])*(box2[2]-box2[0])

Union_area=(box1_area+box2_area)-inter_area

IOU=inter_area/Union_area

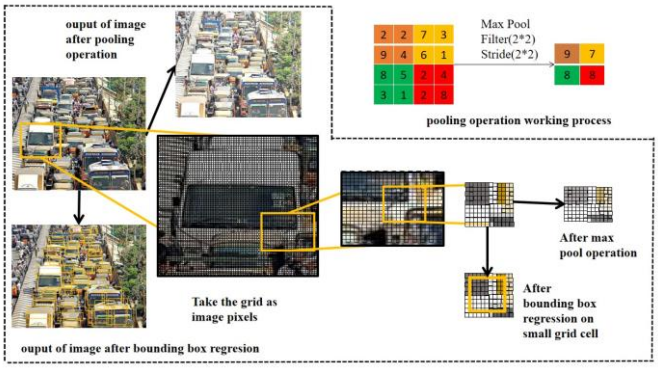


Fig.3: image view of feature mapping working process

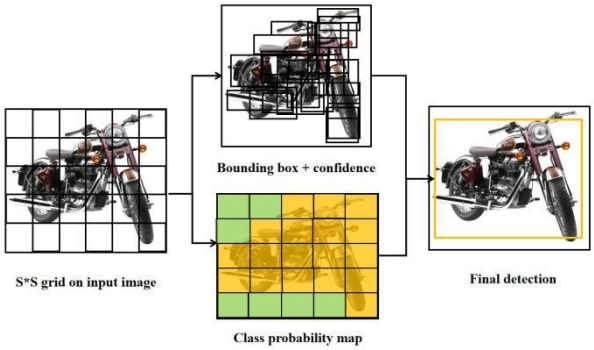


Fig.4: Working of YOLO

Three working techniques of YOLO :

I) Residual blocks
II) Bounding box regression
III) Intersection Over Union (IOU)

### i. Residual blocks

A dimension of s*s applied to image and divide it into grids. The above image **FIG4** shows how the image is divided into s*s grid type.

### ii. Bounding box regression

For to detect the features of an image the bounding box is created in the image of each feature in it.The attribute bw(width), (bh)height, class like car, scooter, bike, rikshaw etc,. "C" is denoted to class. (bx,by) is known as bounding box centre. **FIG4** denotes how a bounding box created

### iii. Intersection over union (IOU)

Boxes over lapping in image processing due to phenomenon of Intersection of Union(IoU). IoU Gives an rectangular line surrounded to an object to specify that it detected the object. For to predict confidence score and bounding boxes a grid cell in the image is responsible. If it predict bounding box then IoU is equal to 1 otherwise 0.

**Step by step procedure:**

Step1: User have to upload images in traffic lanes one by one in the order.

Step2: processing images by using following algorithms

i. CNN
ii. YOLO-V3

Step3: It detects the no of vehicles are passing and also count.

Step4: Release Green signal for highest vehicles Count in the junction.

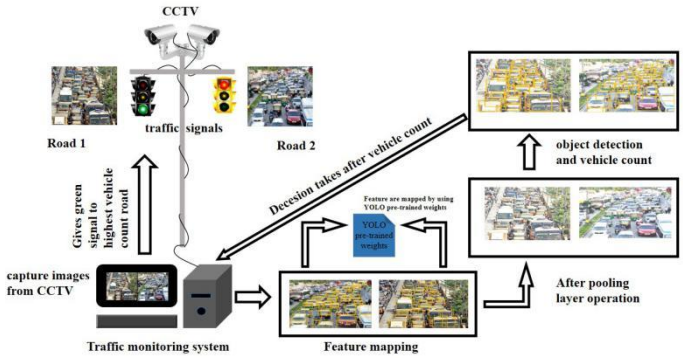


Fig.5: Block diagram of Traffic Analysis and Vehicle Flow Control

## 4. Result:

In the first step we need to give the input to system of each road images of junction where congestion has been occurred.

**Fig.6: image input1**

**Fig.7: image input2**

**Fig.8:image input 3**

After giving input, the images are processed with algorithms(CNN and YOLO-V3) that are used in the system.Then the vehicles in each image are counted and the road having highest count of vehicles will be given green signal to it, for clearing the congestion of traffic.


Fig.9:red signal for input image 1


Fig.10: green signal for input image 2


Fig.11:red signal for input image 3

## 5. CONCLUSION

In this manner, we have successfully created a system that controls traffic signals in X junction and Y junction automatically. This is developed in a user-friendly environment using Flask via Python programming. The system is likely to collect images from the user to clear signals for the lanes which has highest count of vehicles.

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