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Smart Traffic Signs detection & control system based on Convolutional Neural Network

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***Abstract* – There are many standard regulations for traffic light detection and regulations through the world that has been constituted by many regulatory bodies, traffic authorities and government agencies. But constant updation of technology implementation such as machine learning and deep learning algorithms, innovative solutions for real time problems like traffic plate detection and automation has a long way to go. This paper implements the use of neural networks using deep learning technique to detect and automate the traffic in the street lights that has been a problem since long. Many significant works done on the same what this paper stands rest by using the updated deep learning Technology and the latest algorithms providing accuracy level, comparative analysis and visualization to the real time scenario.**

Index Terms – Traffic Sign Detection , Congestion, Traffic Density, Computer Vision, Deep Learning, Convolutional Neural Networks, Python

I. PROBLEM STATEMENT

Traffic congestion worldwide specifically in India poise to be a serious problem with large number of vehicles on road. Vehicles queue at the traffic signals to cross the junction or the tolls in constantly on the rise. Conventional traffic signals or lights cannot efficiently schedule the same due to the longer waiting time and the delay in deployment of the latest technology in the implementation. A real time traffic light control algorithm based on the traffic flow is the necessity of the hour. With the advent of EV and its profluent popularity, this increases to the woes of the traffic control systems as larger number of vehicles plunge on the road in addition to the existing conventional vehicles.

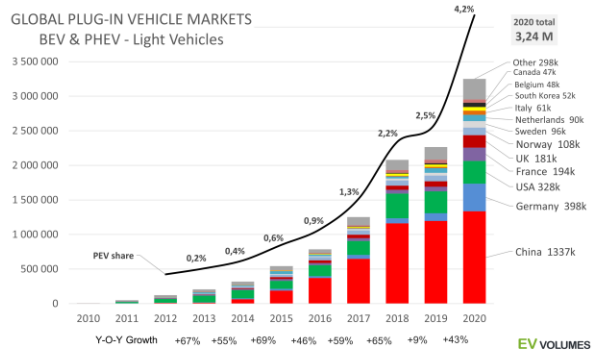


Fig 1. Market size of Global Vehicle Traffic Markets

Computer vision technology and machine learning algorithms can be used to detect, predict the characteristics of the competing traffic flows at the signalized road intersection. Then traffic signal phases are optimized according to collected data, mainly queue density and waiting time per vehicle, to enable as much as more vehicles to pass safely with minimum waiting time. Region based convolutional neural networks provide with high accuracy results in the prediction & Analysis of the traffic control systems.

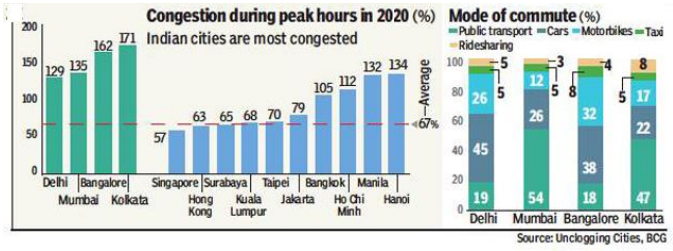


Fig 2. Vehicle Congestion Data 2020

Traffic signs has been always remaining the same. However, recognition and reduction of the traffic in the mainstream is always a daunting task. Because this process may be applied or detected by using different algorithms. Newly randomised customer algorithms and deep learning specifications, Artificial networks, CNN's or any other means, whatever the methods that can be implemented it is always safe that we prefer to go with the most accurate model.

Hence a design of specific regulatory system that can easily detect , predict traffic signs and make a suitable arrangements to reduce the traffic conditions at mainstream routes with the use of deep learning or any other advanced technology is the need of the hour .This will not be this will not only reduce the traffic conditions but also will help the impaired visually impaired persons or those with temporary impairment in their sight to detect the traffic signs and make the moment on the way.

Video & Image capture analysis can be a better option in case of control in a traffic in congested areas because this might prove baffling effects and it will be having the control of traffic signal detection at the same time , application of random signals for processing . Moreover, Signal Processing is a vast field and the application of random algorithms in video can be of better Optimisation and provide better accuracy. Processing of a video might take a considerable amount of time but the process is authentic and satisfactory compared to the image processing techniques. The process of video Signal Processing will be more secure. Datasets of the traffic signs can be taken randomly and can be processed with the pixels of the videos obtained, so that we can process the data.

II . RELATED WORKS & SYSTEMS

Many Research Works has been accomplished on reducing the wait time of the vehicles on the traffic signals. Conventional Traffic control systems deploy the waiting time as in Fig 3. The wait time is approx 60 sec per signal. The traditional traffic control system does not take into account the traffic density or the timing of stranding vehicles. Certain papers propose to use the Traffic control systems through Wireless protocols such as Communication via Wifi , Zigbee , Lora has been tried , each with its own drawbacks. Implementation of the latest algorithms using algorithmic modules are being used. But the algorithms need to be updated from time to time , as this is not the scenario in the existing systems.

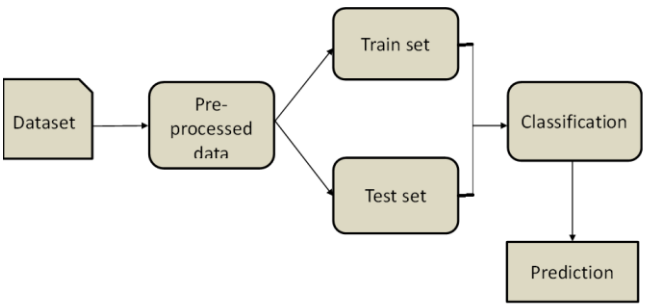


Fig 3. Conventional Traffic Signal Systems Time Analysis

The only consideration to decide use of the communication protocol is to have a large range, less cost effective and more accurate protocol that can transmit and receive signals with high end security model. This has been tested for a lot many protocols some had its own pros and cons.

However, the use of Wi-Fi was subtle but it has not been large range and covered with security risks. The use of MQTT protocol was also considered but open to the hardware consideration that mounts to project because of huge demand. Implementation of the same with NFC or RFID or Bluetooth models was considered and deployed for some instances.

Use of MANET protocol was also considered but the frequency of the same will be sufficient to collaborate with the traffic signals detection and calculation of the same in the lesser amount of time and space. It also needs to have a look at the behind vehicles into consideration.

III. PROPOSED SYSTEM

Our system proposes to install the cameras in the traffic junction in which we intend to detect and process the traffic congestion. The videos / images from the camera will be streaming on all four roads of the traffic circle. The values are read frame by frame in the streaming video of these roads. The captured input videos are processed and stored as the input dataset. The input Dataset is processed by the background algorithm and the count density of vehicles is extracted.

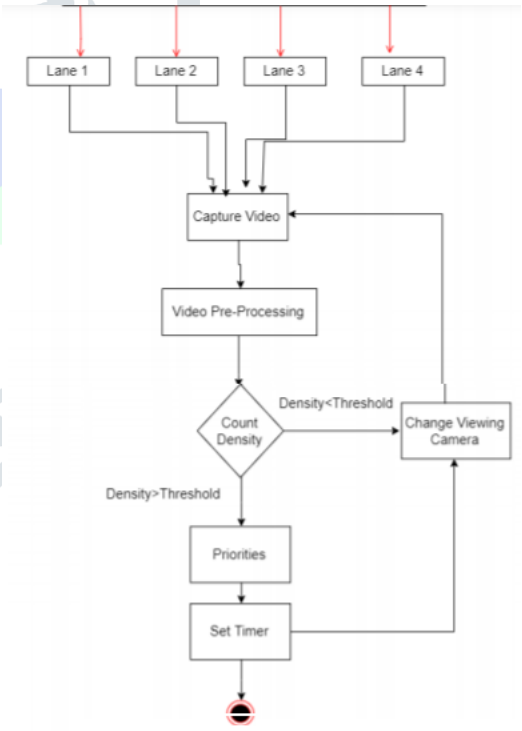


Fig 4. Flow Chart of the Proposed System Design

Data sets of various traffic signals and traffic signs used worldwide are fit into the system it is trained with the captured video signals. In recent years, the rapid growth of public vehicles and smart devices has a unique opportunity for data capturing, storage and transfer. We can capture data from the objects we see every day. Datasets are being continuously generated as people use these devices in their day-to-day life. Both the same are compared to have some classifications model that suits the best for the application designed. The data

that is taken is compared with the trained data and the classification model is generated. This classification model will be useful in the detection of signals the train data + test data and is a predictive analysis and this will provide assistance model for the detection of traffic sign.

We created a classification model of prediction such that if there are a smaller number of vehicles or a smaller number of public transports in a lane or street, for example less than 8 cars, it depicts that the system will recognise that the traffic is low. If there are 9 to 20 vehicles in a current time then the deflection will be considered as moderate traffic. In this way we can have a wide range of vehicles depending upon the city, depending upon the traffic and depending upon the time. This classification will be routing and it will be able to detect the signs and it will be able to control the traffic signs. density means if the lane is empty, then no green signal will be turned on for that lane till its density count reaches the threshold. In this way it will be efficient for automated traffic control using R CNN Deep learning.

Classifier	Meaning	Definition
Empty	Almost empty street	0-8 Cars
Low	Only a few cars	9-20 Cars
Medium	Slightly filled street	< 50 cars
High	Filled Street or Blocked Lane	< 100 cars
Traffic Jam	Traffic almost not moving	> 100 cars

Fig. 6 Process Flow diagram of the proposed system in a lane

III .A. ALGORTHIMIC IMPLEMENTATION

The R – CNN Deep Learning algorithm is used for the detection and classification of traffic signs in a digital image. The main advantage of its use is to reduce the number of false detections made by its intelligent processing capability which retains an accurate and controlled output for desired results.

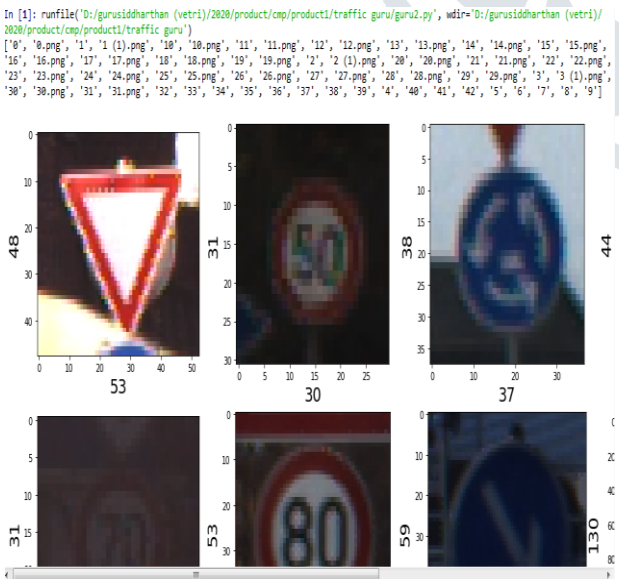
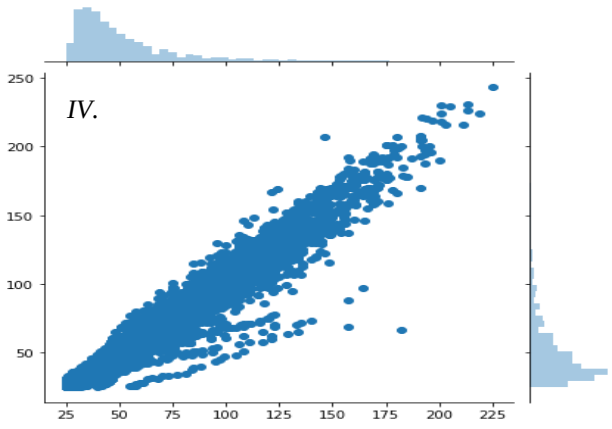
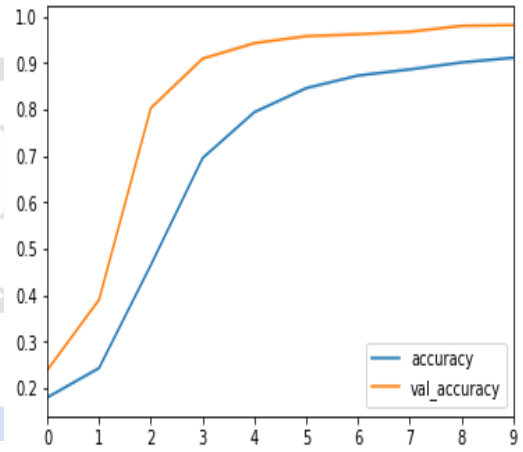
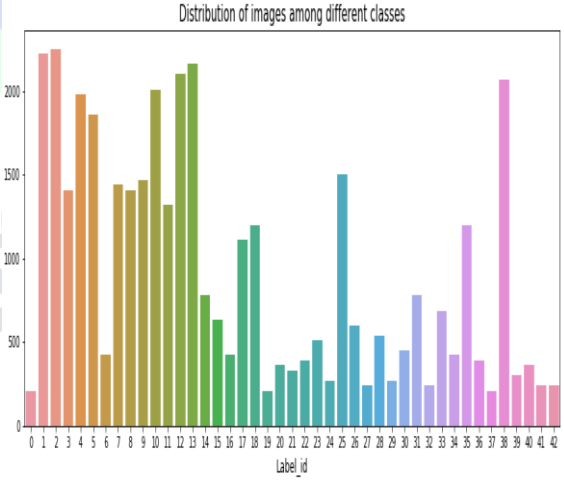
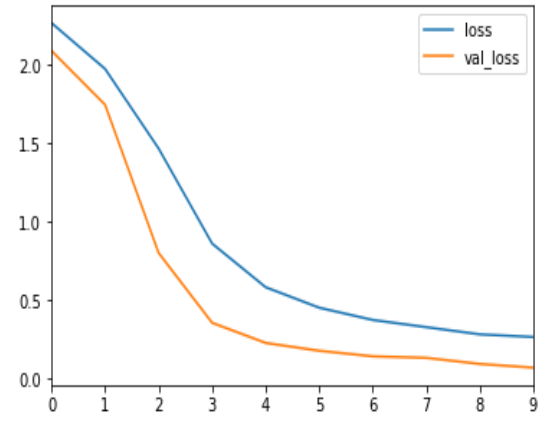


Fig 6 Architecture of the R – CNN Model









IV. SOFTWARE SYSTEM

A. Python 2.5 / 3.5

Python is used as a programming language in this project. This is mainly because of its vulnerabilities, left libraries and the option to implement latest machine learning and deep learning techniques. Python has its capability to include image processing concepts and its application to breakdown and detect images as pixels by using command lines. Moreover, the possibility of enhancing a code in Python is user friendly and compatible in all languages. Python is open source and has a vast variety of support and group forums so that any support related or queries related to dataset applications can be accessed from anywhere

B. Open CV

Computer vision or Open CV libraries in Python used for mainly image processing applications. It will be helping to detect, to convert, to manipulate algorithms, to compare and process an image processing applications or algorithms in an image or a video. This having been used in many Industries like cameras, digital forensics, aeronautics, web applications and many more

VI. FUTURE ENHANCEMENTS & CONCLUSION

Real implementation of the project has been achieved. Moreover, over the use of latest algorithms, latest techniques and the use of increased capability cameras with the live streaming can also be used as a solution to the enhanced visualisation.

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