A New Approach to Automate the Traffic Signal Lights using Deep Learning

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Abstract - With growing population in metropolitan cities like Bengaluru. Traffic issue is becoming major problem faced by common man in is daily life, where his/her 10% of time will spend in traffics in a day. Existing traffic light systems use a fixed waiting time for different traffic directions and do follow a particular cycle while switching from one signal to another, during peak hours, loss of man-hours and eventually decline in productivity. To address this problematic situation a new approach is proposed in making traffic signals behave intelligently and monitor the traffic. A deep learning CNN architecture is integrated with rule based approach to switches from one signal to another based on the different scenarios.

Keywords - Traffic signal, Intelligent, CNN, rule based system

I. INTRODUCTION

In the recent days due to increasing in urbanization worldwide [12] had creates various challenges in different sectors of the government. Traffic is one among such challenges faced by traffic department. Due to increasing population and urbanization in main cities, traffic issue has seen more problematic and critical issue for the civilians. This issue had causes problems in different verticals such as number of accidents are increasing; pollution is increasing, and frustration of public. In peak hours as increasing in traffic volume streets become more and more crowded. This problem is due to lack of proper maintains and monitoring the traffics by traffic departments and in the meantime it is also a responsible of public to follow the traffic rules and regulation.

To monitor the traffic in junctions traffics signal are mounted. These signals are operated manual or automated to indicate the different signal to monitor the traffic. In the peak hour it's hard to monitor the traffics as these signals are not efficient which required a human to interact and set the timing. This is not proper way to monitoring the traffic if this way is followed. Human resources are required more. Against this backdrop, it is necessary to develop intelligent and economical solutions to improve the quality of service for road users [13].

In traditional system human intervention are more in making decision in critical and emergencies situations. In the peak hours traffic policemen have to decide time for traffic signals depending upon number of vehicles in the specific line. The fixed time will fail to this above situations and create traffic problems. Recent research also carried out to predict real time traffic for fast and scalable to full urban networks [14].

This method uses a massive traffic data that helps to monitor traffic density, and make immediate decisions based on traffic prediction algorithm to guide traffic flow. To automate the process of monitor the traffic signals intelligently without human interaction are required urgently. This system must be capable of finding the density accurately and make decision properly in predicting the time of traffic signals. The proposed approach addresses the above issue by using deep learning and rule based technique. The presentation the paper follows with literature in the second section and methodology in the third section.

II. LITERATURE SURVEY

In the traffics monitoring system time and safety is given more priority. Many researchers address this issue and proposed different solution and approaches. Few of them are referred in this section.

Maram Bani Younes et al have proposed intelligent traffic light controlling algorithm in which traffic signals coordinate with each other to generate a traffic schedule [15]. Europe and western countries used artificial intelligence in traffic control system. In ordered to control traffic, and provide a safety and reduce the travelling time.

In India, manual traffic management has become highly impractical due to rapid urbanization. Additionally, central monitoring systems are facing scalability issues as they process increasing amounts of data received from hundreds of traffic cameras. So Deep learning methodology can be the solution in developing an intelligent traffic management solution to tackle these problems.

- In the existing system of traffic control the processing takes place at intersections themselves, this avoids the delays experienced with previous solutions in which video streams from hundreds of traffic cameras are sent to a central cloud environment to be processed and monitored.

Video surveillance is also one of the proposed approaches by Nemade B to monitoring the traffic [16]. Using kalman filter for vehicle classification in the day time and headlight based detection for night time for tracking of vehicles successful.

Several works had been published about traffic surveillance using MAG sensors [17] a reliable algorithms for vehicle detection, classification speed and length estimation with time synchronization were proposed.

Here in the After a vast survey on the problem, detecting the vehicle using cameras at road intersection has a practical problems installation in the traffic area. Other major problem when vehicle behind big vehicles like truck small vehicle are not visible. In this case length of the traffic in the line. While be estimated in the proposed work.

The above problem needs to be address immediately. This kind of problem can create huge distraction on public. The development of artificial intelligence –based approaches to junction control will be promising technologies which makes better traffic monitor system.

III. METHODOLOGY

As to overcome the disadvantages of the current system used in controlling the traffic. Research is been carried and it follows a step to be performed.

- Using powerful cameras videos are captured and channelized to the system.
- CNN or ConvNet Technology is used to recognize and classify the vehicles in the video
- Based on classified results algorithm is used to find the count of the vehicles.
- Automated rules are generating based on the number of vehicles.

Thesis rules help to predict the timing of traffic signal. Two major algorithms are used in making the traffic signals intelligent and control the traffic without interaction of humans. A convolution neural network (CNN) is selected to recognized and classify the vehicles in the real-time videos. Recently, Convolutional Neural Networks (CNNs) [11] have been demonstrated as an effective class of models for understanding image content, giving state-of-the-art results on image recognition, segmentation, detection and retrieval. The performance of CNNs in a video classification, network will access the complex temporal evolution.

The CNN system we train the accurate annotations showing the individual vehicles within the crowd. This helps in identify vehicles in a crowd image. CNN will classify the vehicles based on the annotations and recognize. The recognized vehicles are classified into the categories.

This is how the cameras will be trained in order to identify the vehicles in a crowd. These cameras are well trained in such a way that it can differentiate the Trees, Humans and the vehicles waiting in a traffic lane. As we know the neural network starts seeing the things in a much deeper way it can be very easy to identify the vehicles and to count the number of vehicles in a traffic lane and to give an estimation of the crowd.
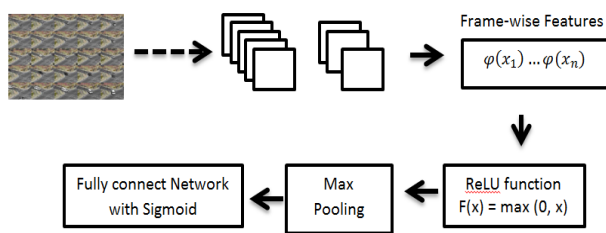

Fig 1: A convolution architecture used in the system for classifying the vehicles

In second phase of the system algorithm is developed to find the density of the vehicles in the video. Based on classified $F(x) = X1, X2,…,Xn$, number of vehicles are counted i.e count = classified Vehicles and vehicles density are

identified. The traffic Signal times are manual handle by humans or an automated cyclic time is fixed for all the signals. Based on density of vehicle time will be predicted in traffic signals. The Signal time will be predict from the rules such as

We have defined three categories of vehicles they are i) Heavy vehicle, ii) Medium Vehicles and iii) Two wheeler, each categories consist of different varieties of segments.

Table 1: represents different classes of Vehicle

Heavy Vehicles	Medium Vehicles	Two Wheeler
Bus	Car	All types of two wheelers
Tracks	Jeep	
Mobile crane	Auto Rickshaw	
Dump truck	Van	
Garbage truck	Goods truck	
Log carrier		
Refrigerator truck		

CNN is used to classify the vehicles based on these three classes. We have defined different a condition that for example:

If (Heavy Vehicles < 5 to 10 && Medium Vehicles < 5 to 10 && Two wheeler < 5 to 10) then do green signal 3min
Else
If (Heavy Vehicles < 1 to 5 && Medium Vehicles < 1 to 5 && Two wheeler < 1 to 5) then do green signal 2 min

Similarly, using permutation and combination of number from 1to 10 many rules where constructed. These rules predict the green signal time. This avoids wasting of waiting time of vehicles even other lines are free.
Constraints to be followed - Sometimes there are situations where a big vehicle such as Bus or Truck is hiding the vehicles behind it at that time the cameras will start estimating the distance till the end where the vehicles are standing

Once the Vehicle and crowd density is estimated from all the four angles the automated rules starts working

a) Based on the density the Signal starts operating i.e the lane which has maximum crowd will be given more green signal time.
b) The flow of the signal is sometimes clockwise in nature so that based on the vehicle density in the particular lane the time will be adjusted for example: Let's consider a lane number 2 has only 20 vehicles so allotting 1min or more than that doesn't make any sense so at that point of time the timing should be set automatically for 1min or 2min. In the same way if the crowd is huge and if the time allotted will be 1 min even this doesn't make any sense so the timing should be set to 3 min so that atleast half of the crowd will be reduced.
c) Let's Now consider lane 1 has green signal and the time been allotted is 100 sec but suddenly the camera captures an image of an Ambulance somewhere in lane 2 it's obvious that now lane 2 should be given priority so it should not even cause any abstraction to the vehicles passing in lane 1 so There can be one more new technology comes into picture that is LED Display and a

huge or heavy beep sound with a message on LED saying "Please Cooperate and stop due to Emergency and a way to Ambulance".

d) Even the walkers should be given the priority based on the signal for example Let's now consider lane1 has a green signal and a option of only going straight so the priority now can be given to the people or walkers to the left of lane 1 to cross the road.

Figure2: In the above image we can see the criteria which are mentioned above.

It is very important to co-ordinate all the four signals in a junction .and even it is important to give priority to the walkers to cross the road very safely and to reduce the number of accidents case in the cities even there are even certain criteria to be considered in accidents case those will be mentioned in our future works.

IV. CONCLUSION

Controlling the Traffic in a city has become a very big challenge for the government and public. A lot of new technologies are been proposed to control traffics. So this paper is one of its kinds and proposed a new approach which predicts the traffic signal based on the density of Vehicles. The proposed approach gives a big description about how a ConvNet (CNN) technology can be used to estimate the vehicle density and how the automated rules (it's a module) can be performed in co-ordinating all the signals. Further a deeper study of the above technology will be carried down to make sure atleast it has some effect in controlling the traffic.

V. REFERENCES

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