Car Detection in Live Surveillance Using Deep Learning

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Abstract- **With the increase in number of vehicles in the country vehicle detection is an important in road traffic management system. Different traffic parameters such as vehicle speed, count, traffic movement rate, travelling time, traffic congestion level can be calculated by using vehicle detection method. The results obtained from traffic parameters can be applied for vehicle tracking, vehicle classification, parking area monitoring, road traffic monitoring and management etc. The main objective of this project is to decrease the deaths caused by accident occurring because over speeding ensuring public safety and also a building a better system for managing the traffic on the roads. The aim of this paper is to develop a system that can detect the vehicle, classify and count the vehicle and detect speed of the vehicle on city roads using deep learning technology. A prototype system is developed and tested.**

Index Terms- Deep Learning, Heatmap, OpenCV, ROI, SSD Model, TensorFlow.

INTRODUCTION

With the increasing number of vehicles on the road there is a need to develop a system which provides information of vehicles to the driving assistant system in intelligent transportation system. It is an essential building block for traffic monitoring and many other applications. Smart traffic monitoring system is incomplete without the existence of system that is capable of detecting any traffic problems automatically, such as traffic rules violation and traffic jam. Thus, the problems solved by this project are:

A. Accident in India

In our country road accidents is a negative externality associated with expansion in road network, motorization and urbanization in the country. A major public health problem is the road traffic injuries, leading to loss of life and forever sufferings to the family of the victim causing disabilities and hospitalization. In case of India, road injuries is the number one causes of death and health loss among persons of age group 15-29 years. During the calendar year 2016, the total number of road accidents is reported at 4,80,652 causing injuries to 4,94,624 persons and claiming 1,50,785 lives in the country. and their number increases around 10% annually. Rail and coastal shipping account for about 32 per cent and 7 per cent, respectively, while the share of inland waterways transportation and air is less than 1 per cent each. Railways are a relatively cheaper mode of transport and are mainly used for transporting bulk materials over long distances.

B. Traffic jam in India

Traffic jams is one of the daily and irritating problems faced by each people in the national Capital. More than 100 areas that face traffic congestion on daily basis are listed on the Delhi traffic police website. New Delhi is among the top 10 cities in the world having the worst traffic jams according to study made by IBM's global Pain. It also leads to increase in number of road accidents in peak hours. Traffic jams interferes and blocks the path of emergency vehicles, thus causing unnecessary delay.

C. Deaths due to Over Speeding

Over speeding or dangerous driving is the single largest killer on India's roads. According to data compiled by the Ministry of Road Transport and Highways, in 2015, 44.2 per cent (64,633 out of 1,46,133 deaths) of road accident deaths were a direct consequence of over speeding, while of the total accidents 47.9 per cent (2,40,463 out of 5,01,423 accidents) were linked to this.

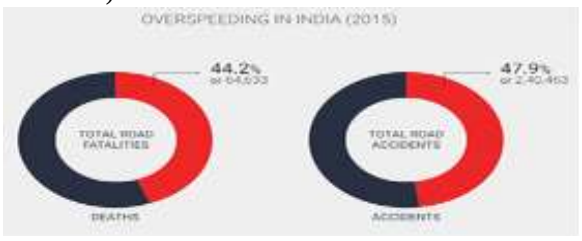

Figure 1

II.PROPOSED SYSTEM

The proposed system will help in developing a smart city transportation system that is capable of detecting car, counting the cars and detecting the speeds of the car which can help us in solving any traffic problems automatically, such as traffic rules violation and traffic jam. Traffic jam can be detected by slow speed and high volume of vehicles, and we can estimate road profile based on it. The road accidents can be reduced by speed detection of a vehicle and also adds to stop the violation of traffic rules to maintain smooth flow to traffic on city roads.

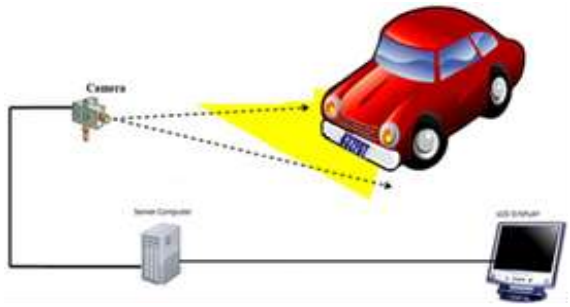

Figure 2

A. Software and Libraries used

The main libraries used in this project to implement different modules together are:

i. Python 3

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. The other languages use punctuation, but python uses English keywords instead. Python 3.0 is a new version of the language that is incompatible with the 2.x line of releases.

ii. OpenCV

OpenCV (Open Source Computer Vision Library) is a machine learning open source computer vision software library. OpenCV is built to increase the use of machine perception in commercial sector by providing a common infrastructure for new technologies and computer applications. By using this library code can be modified easily and utilized for business.

iii. TensorFlow

TensorFlow™ is a high-performance numerical computation open source software library. The TensorFlow Object Detection API is built on top of TensorFlow open source frame work that makes it object detection models easy to construct, train and deploy on the projects.

III.WORKING OF PROPOSED SYSTEM

The proposed system consists of 3 different modules. These are explained below –

Car Detection Module automatically detects the car on the roads and help to reduce the road accidents and prevent traffic congestion

Car Count Module counts the number of cars passed by up and down lanes and help us to control the traffic movement thus preventing from the traffic jams.

Car Speed Module detects the speed of the car ensuring the road safety and reduce in the number of road accidents caused due to overspeeding.

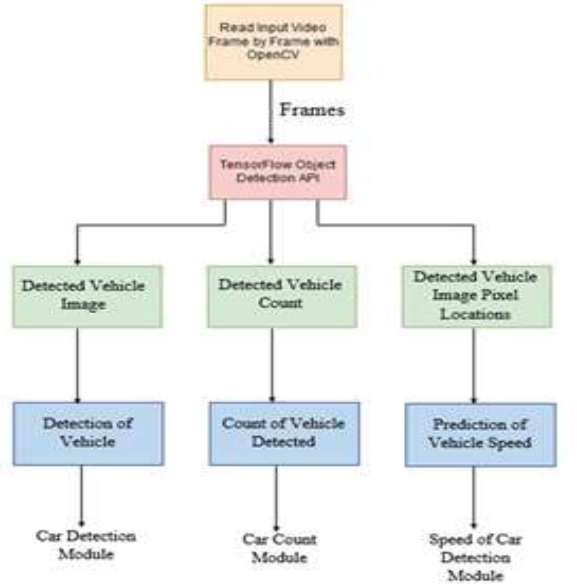

Figure 3

A.Module 1: Car Detection

In this module Tensorflow object detection API is used. I chose an SSD object detector to detect the car. SSD object detector is fast and real time detection is performed. It easily identifies the vehicle in the real time on the road. Also, it shines in identifying the vehicle on both the sides of the road. SSD detector is not perfect but does a practicable job to detect vehicle on the road. We used heatmap to smooth the detections.

Overall the results are very encouraging. In a noted dataset the many frames are taken in sequence. Heatmap of past N frames and thresholded the detections to obtain a mask image where the detector was not able to detect the vehicle in a frame. After performing the detection of the car, I determined that

a history of 5 frames is sufficient to obtain best and smoother detection results.

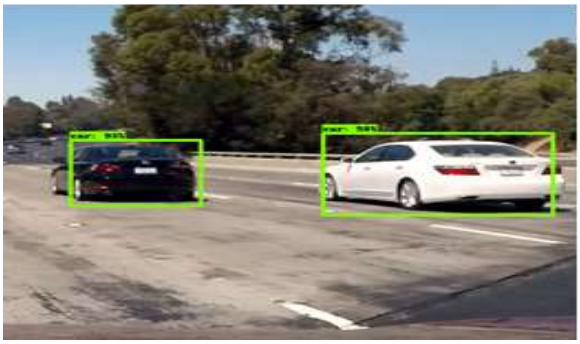

Figure 4

B.Module 2: Car Count

In first input the video is read by OpenCV. The video breaks down into different frames and the vehicle count is initialized with the zero value. The car is detected with help of the Tensorflow object detection API. Against the detected car in each frame threshold is calculated which represents the percentage of accuracy of the car detected is correct or not.

Expand dimensions since the SSD model expects images to have shape. The results of a detection are visualized and for each frame detection counter is incremented by one if the threshold value is more than the 75%. The information gathered is then inserted into the video frame and displayed on the screed.

When the vehicle passed over line and counted, the color of ROI line turns green and value of the total vehicle detected is also incremented. Also, in this module the vehicle count is checked and displayed in both the direction of the road that is upstream or downstream. The upstream is computed when the bottom position is less than the position detected of the vehicle and downstream when the bottom position is more than the position detected of the vehicle.

C.Module 3: Car Speed

In this the vehicle is detected by frames using OpenCV and then with the help of the tensorflow detection api these frames are processed and vehicle is detected. After the Vehicle is detected its image is stored and then check for the direction of the vehicle by using the approach defined in car count module.

The main area of interest for us is when the car crosses the ROI line area. The pixel length is calculated by subtracting the bottom position with the bottom position of the detected car. After that the real scale length is calculated by multiplying pixel length with 44 to convert the pixel length in meter.

Total time passed is also calculated by subtracting the current frame number at which the car is detected from the current frame number detected lists. To know the scale of the total time elapsed for a vehicle to pass through ROI area (24 = fps) the Total time passed is multiplied with 24.

Finally, the speed can be computed by:

- speed = real_length / real_time_passed / constant

To get the vehicle speed in kilometer units, compute the following mathematical calculation:

- speed = speed / 6 * 40

Figure 6

IV.FUTURE SCOPE

A.Car detection

To make automatic accident detection system and generating an automatic alert to the authorities for timely delivering help to the victim, that will help to reduce deaths caused by road accidents.

B. Car Count

Car counting system can help to optimize the traffic signaling system and control traffic flow on roads. Traffic jam can be detected from slow speed of the vehicles and followed by high volume of vehicles, so it is important to detect and estimate speed of the

vehicles for knowing road profile based on the vehicle speed.

This system can also offer an opportunity for transportation engineers and decision makers to plan their budget well before renovating or building a road.

C.Car Speed

Speed estimation process will give an idea to build a smart system for traffic monitoring that is capable of detecting, counting, classifying, and estimating speed of vehicle object from video data.

This will help us to automatically generate over speeding ticket which will reduces the number of traffic police officers needed to deploy in the real field for checking speeding vehicles.

V. CONCLUSION

This system is capable to detect car, count car and detect speed of the car together. The system detects car and count the total number of cars moving in both the direction of the road. It detects the speed of the car by capturing the image detected by the camera. The main aim of this project is to decrease the chances of loss of lives in accident occurring because over speeding of the hence improve public safety and also a better system for the managing the traffic on the roads. Based upon the deep learning technology, the system is cost-effective, scalable, fast, at a distance measuring system that can be easily housed in present live surveillance. Apart from this, it also gives an opportunity for transportation engineers and decision makers to plan their budget well before renovating or building a road and can be helpful both in case of personal as well as business purpose, to improves safety and security of the person on road.

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