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Vehicle Feature Detection Using Image Processing and OPENCV

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A B S T R A C T

In this report, VFDS vehicle feature detection system presents a new sys- tem which is alternative to a radar technique. VFDS implements and use different image processing methods on a video streaming device while capturing online from a single camera, as well as in offline mode, which makes this VFDS capable to calculate the speeding of the motor vehicle or the object, even the colour of the motor vehicle. VFDS is an inex- pensive system in comparison to traditional radars with good accuracy or much better. This report gives highlights to present another approach for estimating the speed and detecting features of the vehicle. In this study, VFDS captured the traffic movies that was collected by the camera which was mounted. Bhatt (2021) [2] mathematical conditions and geometrical equations determine the alignment of the camera and calibration of camera; information is taken from videos from which the speed and other features are mainly determined. Tensorflow and opencv are used for all of these processes to take place. The objectives of the object tracking are determined by their identities, their states and the number of objects.

Keywords:Colour prediction, Speed detection, Direction prediction, Object detection, Type detection.

INTRODUCTION

- Everyone in their daily life experiences many problems as the population is constantly increasing traffic on roads turns out to be more rushed because of the population and lesser proportion of street limitations and foundation. It is crucial to focus on proficient or practiced solutions to reduce these issues as there are a plenty of common problems in real life.

- Vehicle feature (mainly speed) recognition is important to confirm speed impediment law and likewise shows traffic state. Conventionally, vehicle speed discovery or exploration was received utilizing radar innovation system, especially, radar indicator and radar firearm. With increased population increase in high temperature people prefer their own vehicle hence , demand of vehicles have been increased to much higher level ,which has surely helped in easy travel but also caused a lot of commotion through high speeding, accidents etc.

- Edwards (Edwards) [20] traditionally, radar technology, namely radar detectors and radar guns, were used to detect or monitor vehicle speed. Radar system is a traditional method which was used for detecting speed in which sound was reflected off a moving vehicle. It had various drawbacks such as the cosine inaccuracy, the expense of equipment, radio interference, and the fact that a radar sensor can only follow one automobile at a time. Computer vision and image processing technique is used in this paper. In this paper, we are proposing a technique using python, TensorFlow and OpenCV for more efficiency and not only speed but some other features are also being detected and for all this to be successfully implemented, even a good quality camera has to be mounted at a certain angle so that the vehicles can be detected properly.In this report, we are making a survey by analyzing and studding on topics of our project by going through multiple research papers and IEEE paper that have also implemented the techniques related to our project topics. This survey report will differentiate those papers on the basis of the methodologies used , their accuracy, feasibility , their advantage and number of disadvantages. This paper will offer a fundamental perception regarding the approach that is used in this model and also regarding the progress/extension created in the domain.

- Object tracking of vehicles refers to the difficulty of using sensor estimation to determine the path, location and characteristics of object of interest. A sensor can be a estimating device, such as ladar, sonar, camera, radar, infrared sensor, ultrasound, microphone or any other sensor that can be used to gather data or information about the objects in the view of the device or environment. The common

objective of object tracking is to determine the number of objects, their states and their identities, such as velocities, positions and in some cases their features also. A common example of target/object tracking is the tracking of a moving vehicle. We can use various target tracking algorithms to track the position of a moving object. Some famous methods includes the Shi-Tomas corner detection algorithm and the Lucas-Kanade object tracking using optical flow. Image processing is extensively used in traffic analysis for a diversification of purpose. Since traffic research field is very broad has many aims which comprise detection of incident, detection of queue, counting of motor vehicles classification of vehicles. Traffic jam and speeding poses many problems to many people because of which many accidents happen. To lessen these difficulties, a new approach is developed for calculating the over speed of a vehicle, namely a radar technique is used on highways to calculate the over speed of motor vehicle.

METHODS

Open CV:

Destoyer byte (2021) [3], it is a library of python binding which is mainly used for developing the real-time computer vision applications and image processing (Image enhancement, segmentation, background subtraction etc.) object detection, video capturing etc. The CV2 library is used to access the video that the camera has collected. In this project, OpenCV is mainly used to get input frames. It reads the input video frame by frame. It is used to calculate and manipulate picture pixels to anticipate the vehicle's speed. In the prediction of colour of the vehicle also, OpenCV is used along with a machine learning algorithm.

Tensor Flow:

Johnson (2022) [1] TensorFlow is a powerful open-source neural network library developed by Google. It follows a lazy programming paradigm. Data in the form of tensors is how it is accepted by TensorFlow. Tensors are a generalization of vectors and matrices with possibly greater dimensions. Object detection and classification can be developed using TensorFlow. It process the video frames to detect objects.

Application Programming Interface (API):

Application Programming Interface also known as API presents a collection of common operations so that it becomes easy for the developers as they wouldn't have to write the code from scratch.

TensorFlow- Object Detection API:

The TensorFlow object detection API provides a platform for building a deep learning network that can address a wide range of object detection tasks. Sethi (2020) [5] .The framework, which is known as model zoo, contains pre-trained models. The coco data set, the KITTI data set, and other data sets are used to train a collection of pre-trained models. In this project COCO data set has been used.. Here, we have used this for the detection and classification of the vehicle.

SSD:

SSD IS USED FOR OBJECT DETECTION AND CLASSIFICATION

To detect objects in a picture, a single shot detector (SSD) uses just one shot. Hui (2018) [11] .The SSD network consists of base architecture known as MobileNet SSD also has a VGG-16 network as a foundation, followed by MultiBox conv. layers. The SSD architecture is essentially a single convolutional network that learns to anticipate and categorise bounding box positions in a single run. SSD can be trained from end to end.

MACHINE LEARNING ALGORITHM:

Machine learning algorithm that we have used in our project is: KNN

Harrison (2018) [10] K-Nearest Neighbor also called lazy learner algorithm is a Machine Learning algorithm which is a Supervised Learning technique.

The K-NN approach may be used for both regression and classification, classification tasks require this K-NN approach usually.

K-NN makes no assumptions about the underlying data. K Nearest Neighbor classifies the new data based on the neighboring data and its class so it basically puts the new data point or new case into the category in which its neighbors are. We used this algorithm for the prediction of the colour of vehicle. For colour prediction, KNN algorithm is trained is trained with a code.

- ***Tables***

Table 1. Average Vehicle Detection and Tracking Accuracy of the Proposed Approach in Different Daylight Conditions.

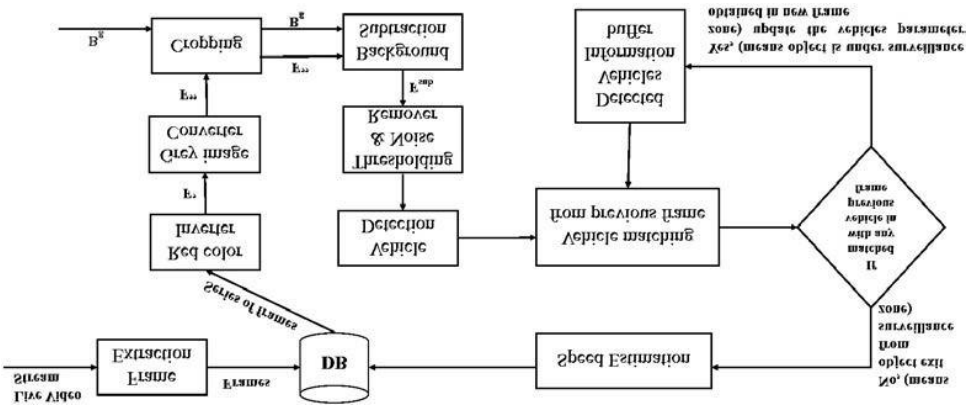
Videos	Session	No. of Frames	Total no. Vehicles	Avg. Detection Accuracy	Avg. Tracking Accuracy
Video 1	Morning	189	7	94.2%	88.1%
Video 2	Afternoon	256	11	93.8%	98.3%
Video 3	Evening	198	14	92.9%	91.5%
Video 4	Cloudy day	101	1	70.03%	91.08%

- **Illustrations**

As mentioned before, we are trying to create a more precise and efficient approach for detecting and tracking the vehicle, its speed and its features. YOLO and Regions With Convolutional Neural Networks (RCNN) are efficient algorithms for object detection and tracking but still lack in certain areas therefore Single Shot Detector (SSD) algorithm is being used for this study, but if speed had a higher priority then, You Only Look Once (YOLO) would have been a much better fit.

Between a static calibrated camera fixed on a pole and a UAV platform, a well calibrated fixed camera turned out to be better as the UAV platform lacks precision and accuracy. Leaving behind the traditional radar method we found how image processing techniques like background subtraction, edge detection, acquisition, segmentation and computer vision techniques are much better.

While identifying colour, K-Nearest Neighbor (KNN) algorithm promises an accurate colour detection although it should be kept in mind that it faces certain issues due to lighting. Lighting is an issue not only in detecting colour but generally in detecting objects also. That's why the image quality should be good and the image should be improved for the least errors. There are still many new approaches coming up, each and every method having its own tweaks and drawbacks.



$$d(\mathbf{p}, \mathbf{q}) = d(\mathbf{q}, \mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

Equations

Figure 4.14: EUCLIDEAN FORMULA

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