IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-8, Aug 2019 E-ISSN: 2347-2693

Vehicle Detection in Denser Environment Using Gaussian Model

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DOI: https://doi.org/10.26438/ijcse/v7i8.4448 | Available online at: www.ijcseonline.org

Accepted: 17/Aug/2019, Published: 31/Aug/2019

Abstract— Vehicle area n/w (VANET) has been come a long distance since its inception. After smart cities and smart village, smart roads are required to manage the traffic effectively and efficiently. VANET recognize a vehicle and trace it. Establishing connection and serving the request come once a vehicle is recognized appropriately and trekked it serves a great help in video surveillance of moving objects too. Purpose of surveillance but recognizing them in a difficult environment is always a challenge the proposed work detects single moving vehicles and multiple moving vehicles under dense environment like foggy condition. The frames are read as images, noise is filtered on two Averaging and Median filter. An improvised Gaussian mixture model on two dimensional structural elements has been proposed in the thesis. The results obtained are compared with standard optical flow algorithm to detect moving vehicles; the proposed algorithm improves false alarm rate, precision, accuracy, occlusion rate. It concludes that the proposed algorithm works better than existing optical flow algorithm for single and multiple vehicle detection in a dense environment.

Keywords—object detection, precision, occlusion rate, accuracy, false alarm

I. INTRODUCTION

Moving Object detection and tracking are receiving a growing attention with the emergence of surveillance systems. Video surveillance has been in used in the monitor security sensitive areas (such as banks, department stores, highways, crowded public places and borders, and etc.).

In this thesis, paper we will discuss single and multiple moving vehicles through video object detection algorithms faces various difficulties for detecting various objects. It has to track object in various lightening condition and has to overcome many failures. Model has to track the important details of the vehicles if it is speeding. It can detect single as well as multiple objects in single video scene. Detection for multiple tracking objects is very challenging task to computer vision for video surveillance system.

Moving object detection and tracking system is basically used for detecting vehicles through video surveillance. It analyze the geometry (i.e. shape and size) and speed of vehicles and its important details i.e. vehicle no., model, etc. Few important methods under multiple moving object detection and tracking system are background subtraction, optical flow and frame difference. Availability of different types of detection algorithms makes difficult task for researchers to make decision on which detection algorithm is more suitable for which situation or environmental conditions.

Problems face by video surveillance system-

- Noise
- Track moving objects
- Detect moving object
- Lightning conditions
- Occlusion

II. RELATED WORK

Mishra,P.k',,Saroha GP.[1] Author introduced Moving object detection and tracking system is basically used for detecting vehicles through video surveillance. It analyze the geometry (i.e. shape and size) and speed of vehicles and its important details i.e. vehicle no., model, etc. This algorithm is successfully implemented using MATLAB integrated development environment. As a result, the algorithm is able to detect and track a moving object that is moving, as long as the targeted object emerged fully within the camera view range.

Qiang Chen, Quan-Sen Sun,et al[2] presented a two-stage object tracking method. Using the kernel-based method, we can locate the object effectively in complex condition with camera motion, partial occlusions, clutter, etc., but the tracking precision is not high when the object severely deforms.

Pawan Kumar Mishra and GP Saroha[22] proposed video surveillance system is useful to detect behavior of moving objects after analysis of objects. it describes the concepts of object tracking and also describes the background subtraction, optical flow, frame difference it use the feature extraction technique to track moving objects.

III. METHODOLOGY

In the system methodology we considering the purpose of our thesis, in the methodology we conduct all the steps of implementation, design and analyze.

The steps are elaborated-
A) False alarm rate
B) Precision
C) Accuracy

A. FALSE ALARM RATE

Generally false alarm rate is illogical radar target detection decision which causes by noise or other interfering signal noise exceeding the detection and thresholding false alarm rate is indication of the incorrect target when there is no valid aim is indicated. False alarm rate is calculate with the help of following formulas-

$$FAR = \frac{\text{False Target Per PRt}}{\text{Number of Range Cells}}$$

B. PRECISION

Precision is also known as positive predictive value; the precision is fraction of relevant instances recall in context is also stand for true positive rate or sensitivity. There are two classifications of precision true positive rate or true negative rate. Precision is a description of random errors which comes in environment it measure of statically variability.

$$\text{Precision} = \frac{\text{true positive rate + true negative rate}}{2}$$

C. ACCURACY

Generally accuracy is a description of semantic errors it calculates the statics bias these bias causes between true positive or true negative the values ISO called trueness. In detection high accuracy requires high precision and high trueness rate. In simple terms there the same quantity of data sets are given repeated those sets are calculated in same quantity. And the value of precision rate accuracy is close to each others. There are two concepts are independent to each other the particular set of data can be either accurate or precision or both or neither of them.

The accuracy can be defined as the percentage of correctly classified instance (TP+TN) / (TP +TN +FP +FN).where TP, FN, FP and TN represents the number of true positive, false negative , false positive and true negatives , respectively.

$$\text{Accuracy} = \frac{\text{Correctly Predicted Class}}{\text{Total Testing Class}} \times 100$$

IV. PROPOSED ALGORITHM-

Setup
Initialize required variables
Initialize foreground detector

Start
Step1. Initialize Gaussian mixture model by training the system
Step2. Read video
Step3. Get number of frames
Step4. Training_Frames← get 30% of the frame as training set

Pre-Process on first frame
Step5. Call foreground detector for three Gaussian modes with Training_frames
Loop from 1 to Training_Frames
Compare background model with foreground to get foreground pixel values
Apply background subtraction
Foreground ←Get foreground mask
End loop
Step6. Get 3X3 morphological structure element with 2dimensionality
1 1 1
1 1 1
1 1 1
Step7. Perform erosion followed by dilation to carry out filtering using morphological opening
on Foreground generated in 6
Step8. Further filter the detected Foreground
Apply Blob analysis
Reject the blobs having lesser pixels than the threshold
Get the boundaries of the car(s) detected
Get the area
Get the centroid
Step9. Draw the rectangular boundaries on the cars detected
Step10. Count number of cars detected by counting number of blobs detected in the frame

Process entire video
Step11. Loop till end of frame
Read frame
Perform steps 5 through 9 on each frame
Count number of vehicles detected in each frame
Vc(i) ← get vehicles centroid point
end loop
Step12. Calculate time taken
Step13. Calculate False Positive and False Negative
Step14. Calculate True Positive and True Negative

Step15. Calculate Accuracy based on Precision and Recall obtained from 14
Step16. Calculate Occlusion using eq. (1).

Here,

Vc1 is the Vehicle one centroid point and
Vc2 is the Vehicle two centroid points

V. RESULTS AND DISCUSSION

This new algorithm is designed for vehicle object detection in dense environment using Gaussian model .in this research work we removed the occlusion and improve the value of precision rate by designing a robust method for denser environment. In proposed method is also applies for single and multiple moving objects which is using for dense environment.

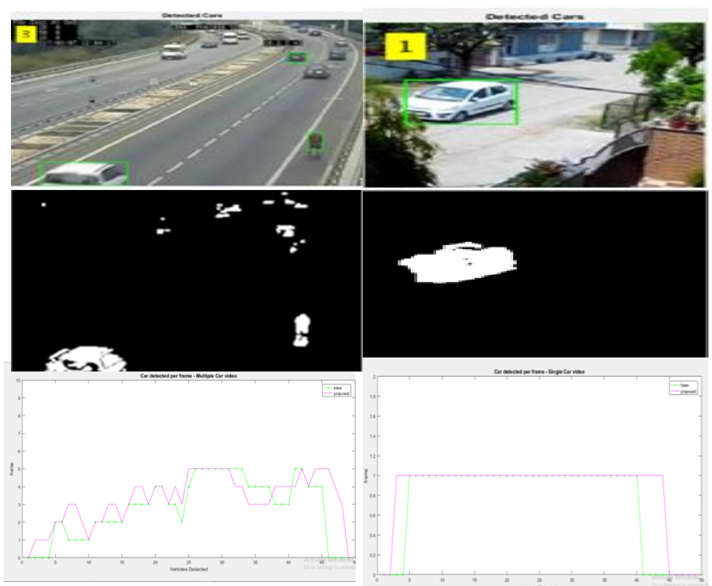

Figure 1. SHOWING SINGLE AND MULTIPLE MOVING DETECTION CARS PER FRAME

A. *Multiple Vehicles*

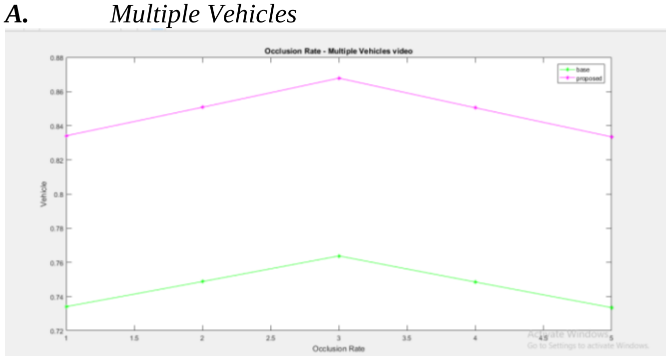

Figure 2. OCCLUSION RATE –MULTIPLE VEHICLES

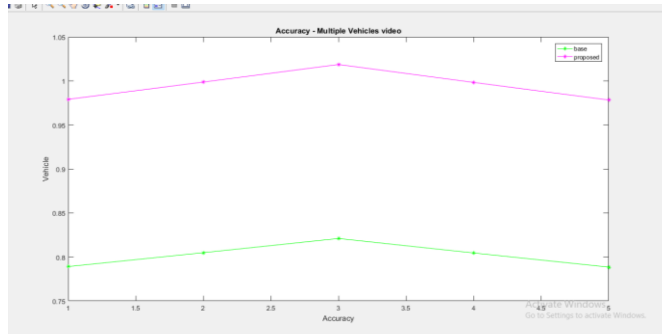

Figure 3. ACCURACY–MULTIPLE VEHICLES

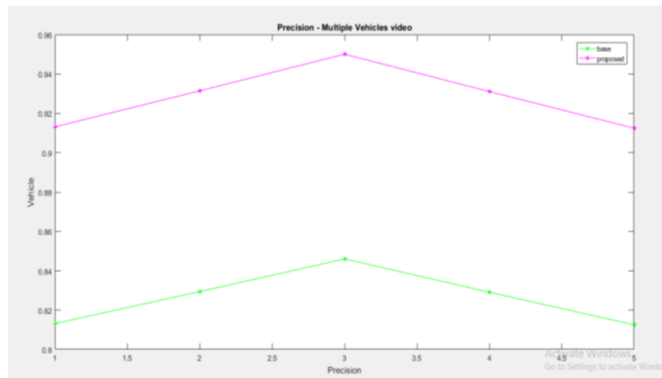

Figure 4. PRECISION–MULTIPLE VEHICLES

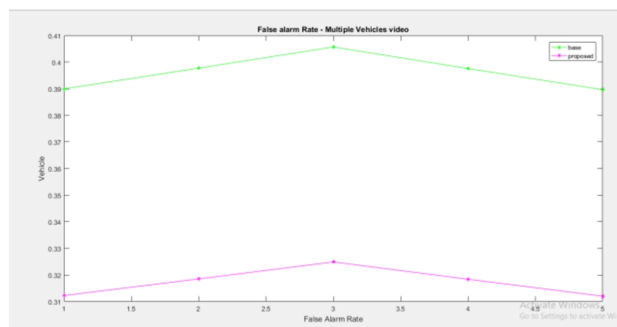

Figure 5. FALSE ALARM R RATE

B. *Single Vehicles*

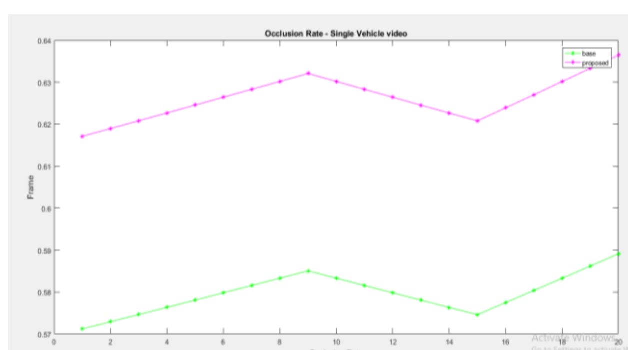

Figure 6. OCCLUSION RATE –SINGLE VEHICLE

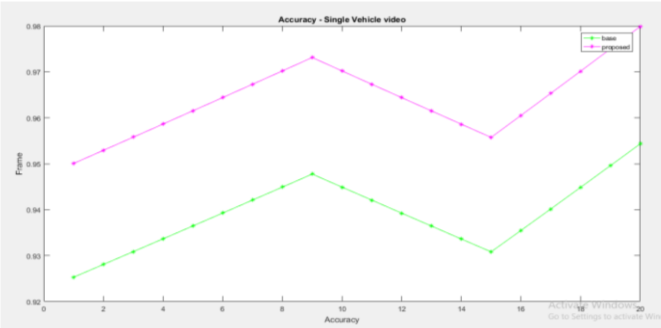

Figure 7. ACCURACY-SINGLE VEHICLE

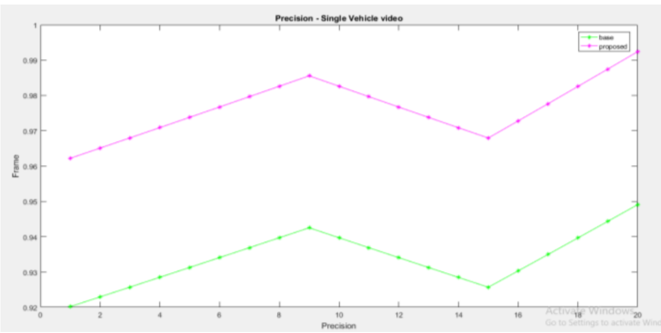

Figure 8. PRECISION-SINGLE VEHICLE

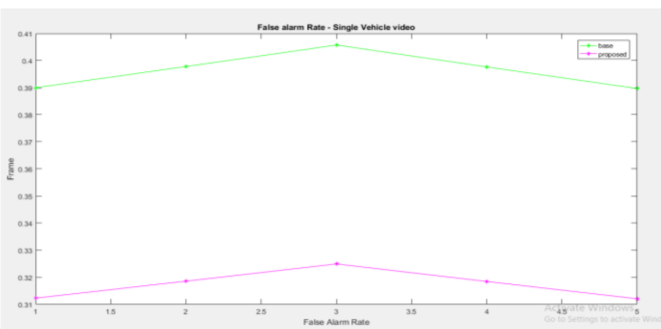

Figure 9. FALSE ALARM RATE-SINGLE VEHICLE

TABLE I. COMPARISON TABLE OF PRE-EXISTING PAPER AND NEWLY IMPLEMENTED PAPER PARAMETERS FOR SINGLE MOVING OBJECTS

Method	False alarm rate	Precision	Accuracy	Occlusion rate
Background subtraction	0.0502	0.9252	0.9334	0.5714
Optical Flow	0.048192	0.94833	0.956735	0.594256
Proposed method	0.0443366	0.9862632	0.995004	0.61802624

TABLE II. COMPARISON TABLE OF PRE-EXISTING AND NEWLY IMPLEMENTING PAPER PARAMETER FOR MULTIPLE MOVING OBJECTS

Method	False alarm rate	precision	accuracy	Occlusion rate
Background subtraction	0.18988	0.84378	0.81826	0.78202
Optical flow	0.198144	0.82369	0.798783	0.753064
Proposed method	0.18229248	0.889585	0.862685	0.81330912

VI. CONCLUSION AND FUTURE SCOPE

Video Surveillance system is the method which is used for monitoring various types of moving objects and various activates. Like objects shape, type, size etc there are various types of methods are used for vehicle detection in denser environment has been described such as background subtraction, optical flow, morphological opening filters, and frame differencing. Background subtraction provides complete information about objectives. Object tracking method which is using for feature extraction in video scenes. In this paper also describes the precision and occlusion rate designing by robust method for denser environment.

Experimental results of proposed algorithm on real video sequence have been compared with existing methods like background subtraction background subtraction, optical flow, and foreground detection. Proposed method provides batter results using these parameters false alarm rate, precision, accuracy, and occlusion rate. It also uses the morphological filters to remove noise so that the occlusion rate improved. In future we can move out with other advanced techniques to get better results and classify a robust denser environment.

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Authors Profile

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