Real Time Moving Vehicle Congestion Detection and Tracking using OpenCV

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Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 28 April 2021

Abstract: In this era people using vehicles is getting increased day by day. To plan, monitor and also controlling of these vehicles is becoming a big challenge. A system is to be implemented without altering the infrastructure, so a video- based vehicle capturing and analysis of that video without affecting the traffic is required, by which traffic accidents and congestion can be determined. In this paper, we have come up with a solution for the above problem using the video surveillance considering the video data from the traffic cameras. We have used adaptive thresholding method, Gaussian based background subtraction with tracking methods such as blob tracking and virtual detector. The implementation was done using OpenCV Python as a tool. Our proposed system can identify, track the congestion and help in counting the objects precisely.

Keywords: Object detection and tracking, Background subtraction, Video analyzer, Virtual object detector, Blob- based tracking.

1. Introduction

The roads are becoming over crowded due to increasing vehicle count. An Intelligent transport system (ITS) is needed to manage the congestion in traffic and to give smooth planning for drivers. Contrasted with different strategies, the video-put together with arrangements based on the observation camera mounted outside are handily affected by situations, for example, climate, enlightenment, shadow, and so on.

Figure 1: Block Diagram of ROI

Be that as it may, in light of the fact that video-based frameworks can offer a few favorable circumstances over different techniques, for example, traffic stream undisturbed, effectively introduced, helpfully changed, and so on., they have drawn noteworthy consideration from scientists [1][2] in the previous decade.

With respect to constant vehicle following framework, the essential issue is starting a track naturally. Here we depict two methodologies in which the issue can be sorted in an intelligent away. The first one is virtual object finding, this method will describe rectangular areas for detecting the object

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object area to map each object in the Region of Interest (ROI) as the vehicle approaches the camera the region will be created and objects in those will be detected and tracking of the same will be done based on the object area. The other method to trace the object as blob-based object tracking. Here the background and foreground will be separated based on thresholding and for the respective area's blobs will be detected.

Initially the video is considered as frames and the absolute difference between two frames will be determined to separate the foreground from background by continued frame subtraction method removing the artifacts giving clear and neat image, so that vehicles can be detected easily and non- vehicles can be eliminated by thresholding and morphological operation.

To overcome previous drawbacks a thresholding method called Otsu is used in which adaptive thresholding will be done for background modeling. Here we have also concentrated on false alarms due to shadow, so shadow elimination was also done to get the clear object.

2.Literature Review

Bas et al. presented a video examination strategy to check objects [10] depending on the area of the

object with respect to the distance of it from camera point. Based on the objects within the frame a boundary will be considered to detect the moving objects that is Region of Interest (ROI). Despite the fact that the calculation is improved to manage some climate conditions it can't follow vehicles when they change their bearings. `

In the other proposed method, the idea of optical flow was introduced. Here the vectors will be generated with respect to the object moment and the complex conjugate values will be determined. These vectors give us the congestion from one object to other. If more vectors are generated it refers to more congestion.

In certain works, for example, [11], forward and in-reverse picture differencing technique used to extricate moving vehicles in a street view. A few examinations like [9] and [4] demonstrated that the utilization of highlight vectors from picture district can be amazingly productive for vehicle recognitions objectives. Some others spoke about the exact vehicle measurement estimation utilizing a lot of facilitate planning capacities as it very well may be seen in [6]. Besides, a few investigations have built up an assortment of boosting calculations for object recognition utilizing AI strategies which can identify and characterize moving items by both kind and shading.

3.Adaptive Categorizing Algorithm

The structure programming oversees picture traces read from video game plans, with the objective that we can make picture binarization. The whole picture of the flowchart is shown up in Figure 2.

Initially, our estimation scrutinizes picture diagrams from video, breaks down the basic 85 images traces into RGB channels, loads typical of the principle 85 images, and gets a one of a kind establishment pictures. If the objects are in motion then there may be errors in defining a particular background as it will be changing with respect to the moving objects, but the background will remain constant when the system is provided large number of frames which will be called as “Background updating”.

3.1.Thresholding for clearing shadow

The video which will be converted to frames will be binarized to get the foreground. For this process of thresholding black and white image Otsu’s method will be used with is available in computer vision library. Otsu algorithm works on the method of thresholding it considers the given frame has two levels i.e., background and foreground.

This method of thresholding it considers the given frame has two levels i.e., background and also foreground, after these corresponding edges will be retained and these edges will be not be affected. This algorithm is seen as one of the good algorithms for binary segmentation prospect, and isn't impacted by the image magnificence and intricacy; thus, it has been commonly used in modernized picture planning. In the wake of getting matched picture by thresholding, we see a couple of goofs in light of shadow appearance in the video. The proposed method uses morphology isolating on picture to clear the shadow, recalling adventures for mix of disintegration and augmentation. In authentic setting up we directly off the bat and do disintegration and following by augmentation.

It can clear out little things, the objects boundaries will be made smooth, Segmentation of bigger object with smaller will be defined with edges. By this method the unwanted shadow will be removed and prominent objects will only be considered from the frame.

The initial step is to take a pre-recorded traffic video and to get the foreground and background information from each frame checking the area of the object using contour method from ROI. The structure performs course of action of assignments for instance applying establishment shroud, removing spread, performing equal edge, morphology using crumbling and extension, center murkiness, the data which will be masked will be applied for each frame, entire frame will be converted to monochromatic gray color .From this process we can extract the contours. At the point when shapes are perceived; structure examinations the depictions of the structures, signifies the recognized structures. Considering the distinguished counters, the ROI (Region of Interest) will be made.

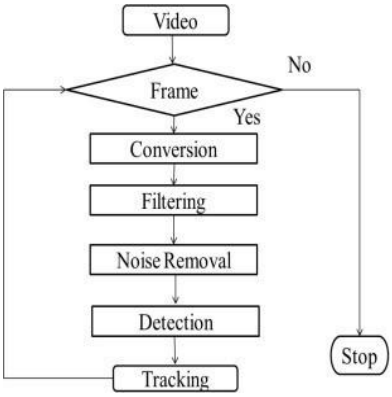

Figure 2: Detection and Tracking Flow

4.Proposed Methodology

A couple of computations have been introduced for the conditions; some of them are executed in OpenCV, for instance, Background Subtraction MOG [8] background modelling will be done using Gaussian method. The background subtraction uses 2 to 4 distributions in clearing small artifacts. Other method for removing separating foreground and background is Background Subtractor GMG in OpenCV which relies upon [7] and unites the establishment picture estimation methodology with Bayesian division.

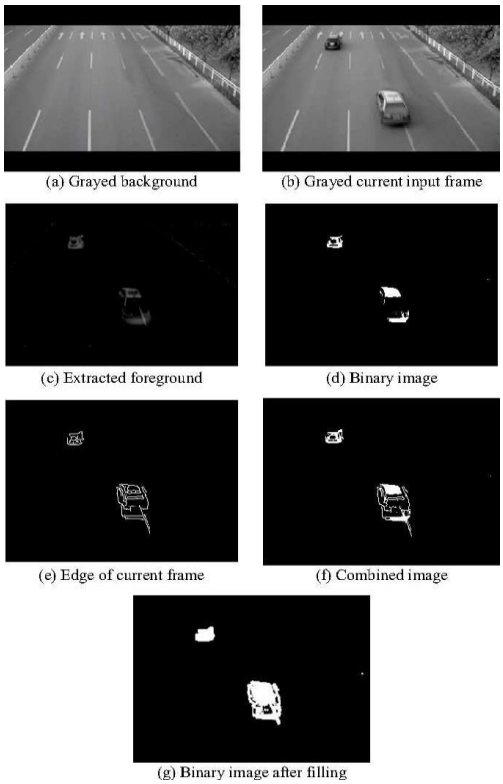

Figure 3: Algorithm Process flow

The count used in the use of proposed structure is called establishment Subtractor MOG2. It relies upon two assessments [9] and [10] by Zikovic. One of the huge features of this count is that not under any condition like [8] where amount of disseminations for the modelling of establishment methods are portrayed, Background SubtractorMOG2 uses a robotized prospect and picks a relevant amount of the Gaussian mixes for pixel.

Thus, this methodology is good, if there are any issues with contrast and brightness in any frame. This method also provides good visibility on the shadow of the objects, ability in defining the shadow and also helps weather shadow to be detected or not in particular scene. In default settings are set to detect shadow of an object.

4.1.Extraction of Contour:

These contours are the binary representation of an object. The shape and the co-ordinates of an object are considered for object recognition. The finding of contour can be increased with the help of canny edge detection technique which is the best method in defining the object boundaries. OpenCV has inbuilt package for detecting these counters

4.2.Vehicle Count:

The count of objects will be taken when the contour areas centroid touches the ROI. This ROI is an imaginary line drawn diagonally across the road touching the two ends. It is also noted that when the centroid nears this imaginary line the counter value will increase indicating an object moment is observed.

4.3.Tracking:

4.3.1.Virtual Object Detector

For counting moving objects form a lane a method known as "Virtual Object Detector" is proposed here. Usually the objects on the road can be detected by using the old theories of induction. It was to be a sensor-based technique in which, sensors were to be kept below road. Here the objects will be detected when the vehicle passes on the road depending the its induced loop the calculation of object nearness was to be calculated. By using this method, it was found out that the practically it is challenging due to cost will be huge, difficult to place under road, lifetime of these systems will be short etc. Here, we propose new computer vision -based technique to detect objects and also to track them by counting number of vehicles on road. In this method of virtual detector, a rectangle box will be drawn and that will be considered as ROI (Region of interest) the objects within that box will be identified based on their area and motion vectors. The colors will be specified to track the object this will be a histogram- oriented technique.

4.3.2.Blob Tracking

In moving vehicles tracking refers to detecting the motion of a particular object by tracing its line of activity. In our research we have considered a pre-recorded traffic video and applied blob-based tracking method so that we can track all the moving objects in the given area by subtracting the background.

This procedure of tracking using blob methodology has some stages: Detecting the Foreground, detecting new blob, tracing the blob module, Generation of new path module, detection of flow direction module.

- Detecting the Foreground: Identification of pixels from the image and categorize weather object is in foreground or in the background. The result of this step will be continued as input to step 2.
- Detecting new blob: After getting the foreground information from the previous step next is to find out the object entering the ROI.
- Tracing the blob module: Here tracing of new objects and those blobs will be monitored and the tracing will be done for already present objects.
- Generation of new path module: Checking the traced moving objects and saving their new path at the end of every frame.
- Detection of flow direction module: The path will be made soft trajectory after one path is saved.

5.Implementation Results

Here the results obtained from the experiments are discussed. The rate in which the vehicle detection recognition and tracking based on two methodologies are tabulated in Table 1. Tracking with the identified counters with respect to the moving vehicles are shown in Figure 4 and its implementation is shown in Figure 5.

All product programs are created in python OpenCV stage. OpenCV, representing from image processing tool box Computer Vision package which is open source, capacities chiefly focused on constant computer vision.

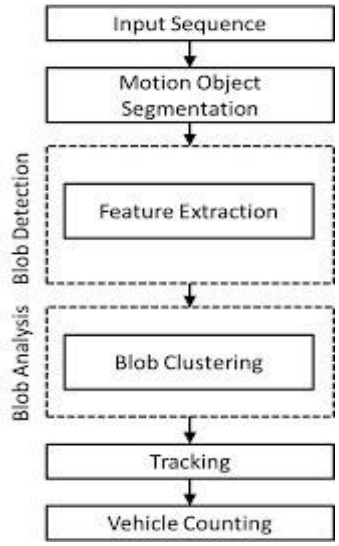

Figure 4: Blob Detection and Tracking.

There is a camcorder mount on footbridge going across a central avenue to screen three paths at the same time and keep away from incorrect including brought about with cars covering the picture. The consequences from the two distinct

methodologies with their particular exactness accuracies are recorded in the Table 1.

Figure 5: Vehicle Tracking

Precision value compasses to 96% for virtual locator strategy, and 98% for mass following technique. It can be seen that this framework can identify, track, and check most vehicles effectively from comparison in

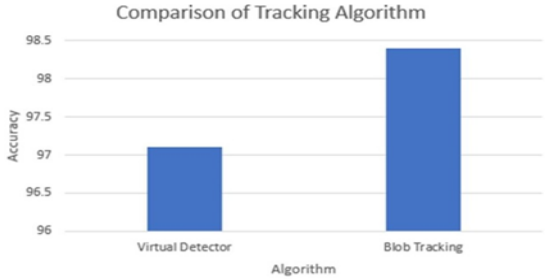

Figure 6: Comparison of tracking algorithms

Table 1: Experimental Results

No of Frames	Virtual Detector	Blob Tracking	Virtual Accuracy	Blob Accuracy
60	2	2	100%	100%
300	6	6	100%	100%

The experimentation results are given in Figure 7 depicting the frame of tracking and the comparison between Virtual accuracy and Blob accuracy has been shown in Figure 8

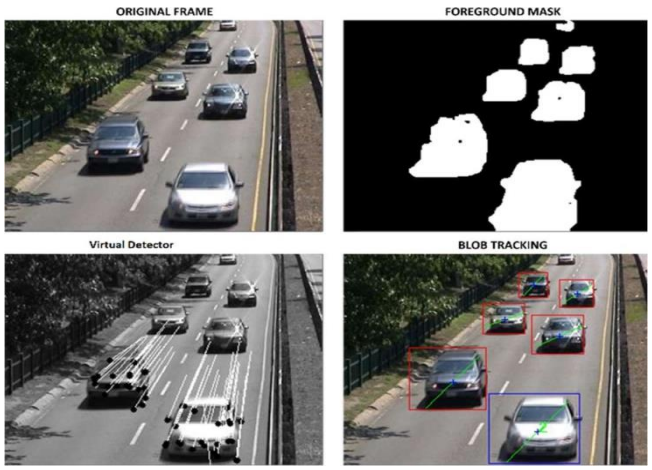

Figure 6: Tracking Frame

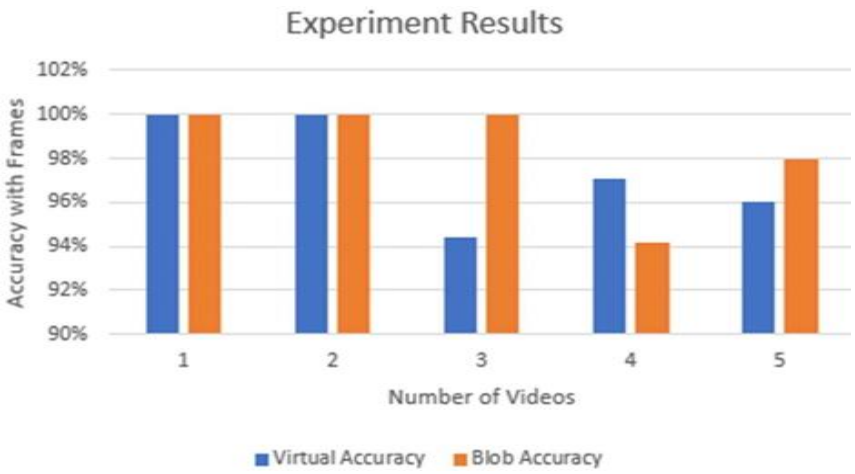

Figure 7: Experiment Results

6.Conclusion

The proposed system is actualized with python, utilizing the computer vision platform. The recordings with assortment source from traffic camcorders were taken for analyzing. All the videos can be considered as pre-recorded videos which can be obtained from the traffic department on request for research purpose. The basic method is produced to choose the locale important to be broke down and afterward picture preparing strategies are applied to figure vehicle tally.

Because of expanding requests in ITS, there is a colossal measure of likely utilizations of distinguishing, following, and checking the moving vehicles on street continuously. In our research we have proposed efficient strategies in accomplishing our objective. Moving vehicle discovery, using a strategy for precisely isolating vehicles frontal area from versatile foundation mechanism by blending the Otsu's method of

thresholding technique and flow casting shadow recognition strategy. For tracking the vehicles, we have followed two techniques to check the accuracy of the algorithms. Hence, it can be concluded that blob-based tracking gives better results than the other algorithm. The dataset collected in this work for detecting and calculating the traffic which can be later extended to giving an alert message that can help necessary action to be taken by the traffic department. Practical outcomes, executed using computer vision, demonstrate the suggested technique will be viable in recognizing, finding, and check running vehicles precisely.

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