A Low-Complexity Vehicle Classification-Based Traffic Monitoring System

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Abstract- *Automatic video analysis for traffic is a fast-emerging field which gives much importance to intelligent transport systems (ITS), which in turn provide an advanced information and telecommunication network among users, roads and vehicles with the help of an integrated application of technologies using electronics, computers, communications, sensors etc. Video detection is an efficient method for collecting parameters of urban traffic. Through video detection, this paper helps to count the number of vehicles moving across a particular scenario. The method uses background subtraction method to identify moving vehicles across a scene. The classification of vehicles is also done in this paper. The method provides accurate results even on foggy climate.*

Keywords- Visual surveillance, computer vision, background subtraction, image processing, foreground extraction, vehicle counting, classification

I. INTRODUCTION

Now-a-days, the need of recognizing vehicles going over a specific situation is expanding. This is mainly done to take necessary measures and actions to improve and control vehicle flow. At present, there are so many ways to get the traffic information such as surveillance cameras, inductive loop detector, radar detector, etc.

Surveillance cameras are essentially camcorders utilized to observe a territory. They are regularly associated with an account gadget or IP arrange and might be viewed by a security watch or law implementation officer. A portion of the principle impediments of this is: protection is an issue, it can be an expensive affair, it can be vulnerable.

Inductive loop detectors also called as vehicle discovery circles can recognize vehicles passing or landing at one point, for example moving toward an activity light or in motorway movement. One of the main disadvantages of loop detector is that, since the need to lay the loop in every path, so the street surface harm, influencing the street life. Also some makers of items don't have the rationale to recognize the line work, for cross-path driving vehicles can not accurately distinguish the handling. Need to complete the affectability of the equipment troubleshooting or programming to add rationale to recognize the capacity.

A radar detector is an electronic gadget utilized by drivers to distinguish if their speed is being observed by police or law authorization utilizing a radar weapon. Disadvantages are the need to defeat discovery relics caused by shadows, climate, and reflections from the roadway surface.

Despite the fact that there are such a large number of techniques to tally number of vehicles, these may not wind up precise in various testing circumstances, for example, low determination recordings, stormy scenes, circumstances of stop-go movement and so forth. This paper plans a minimal effort framework fit for estimating the quantity of vehicles and furthermore groups the vehicles with high exactness even in foggy atmospheres. The nearness of moving vehicles is dictated by an adaptive threshold. This paper is composed as takes after. Area 2 outlines the literature survey. Section 3 details the proposed system. At last, area 4 mentions the conclusion.

II. LITERATURE SURVEY

In the method of detecting and counting vehicles, the main process involved is background subtraction. This is also known as foreground detection since the foreground is extracted and separated from the background [1]. There are so many techniques for achieving background subtraction. One of this is frame differencing. Here each frame takes its previous one as background model [2]. But, the main problem is that, it is not possible to detect an object once it stops moving.

Another method is median filtering. Here the background value is contained in minimum half of the frames in the buffer. But, the drawback involved in this is that the algorithm needs high amount of memory to work and its performance depends on the used buffer [3].

Eventhough there are so many approaches for isolating moving object from background, they have complex algorithms and low accuracy.

III. PROPOSED SYSTEM

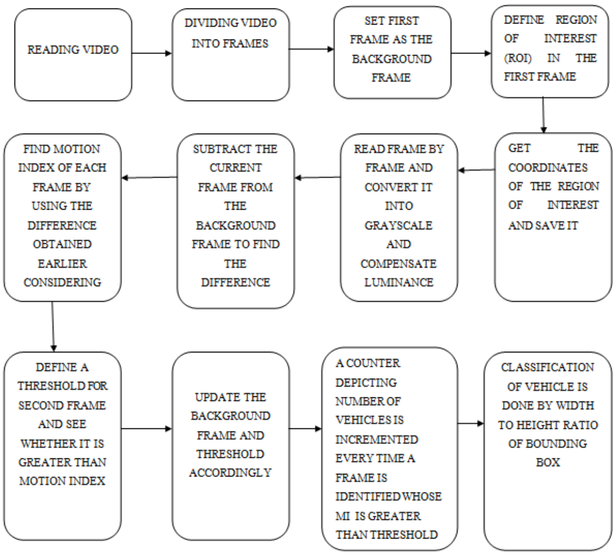

Fig.1 Block diagram of the proposed system

The fig.1 shows the block diagram of the proposed system. It helps us to understand how the system works. The premise of this paper is background subtraction, which comprises in recognizing moving vehicles from a video sequence, isolating them from the reference. Each video frame is contrasted with a reference or background display. Pixels in the present frame that stray essentially from the reference are considered be moving vehicles. There are a few systems to accomplish this objective. In this paper, the strategy utilizes a straightforward background segmentation algorithm based on approximated median filtering[4]. This is a simple method because of the fact that rather than a pixel-wise correlation, it makes utilization of a single scalar subtraction to apply the detection threshold for each region of interest of the image, consequently successfully decreasing the processing time per frame[5]. This is one of the main advantages of this paper.

First a fall, take a video to check whether it contains how many vehicles. After that convert that video into a number of frames since the processing is carried out on each frames. Initialize the first frame as background frame. Then select a polygonal region of interest (ROI). For each frame, crop across the region of interest. The input of the system is RGB image. The RGB image is converted into gray scale. The luminance (L) of a pixel with a pair of coordinates (x,y) of the frame inside the detection region is then calculated using the equation (1),

$$L(x,y)=0.299R(x,y)+0.587G(x,y)+0.114B(x,y) \quad (1)$$

After converting the image to gray scale, brightness compensation is done in order to avoid the problems caused due to the presence of large and bright vehicles. For that, luminance variation of the reference region should be calculated.

For each frame, the luminance variation of the reference region is calculated by equation (2),

$$L_{offset} = 1/Nref \sum L(x,y) \quad (2)$$

where N_ref is the number of pixels inside it. Then subtract 〖L〗_offset from L(x,y) to get L^'. The resulting image is then compared with the background model to find the difference given in eqn (3) as,

$$D(x,y)=L'(x,y)-B(x,y) \quad (3)$$

With this difference, we can find the motion index by the eqn.(4) as,

$$M.I = 1/255N \sum D(x,y) \quad (4)$$

After calculating threshold for each frame, check whether the motion index is greater than the threshold. For every frame where M.I is found to be greater than threshold, a vehicle is detected and counted.

Next, we can also classify the vehicles that we detected and counted. For each frame, the foreground is extracted using Gaussian mixture model. This is a pixel-level approach. Here we can develop an efficient adaptive algorithm using Gaussian mixture probability density to identify a moving vehicle. After applying some morphological operations such as filling, dilation etc to the extracted foreground, the detailed objects are marked by drawing a bounding box around them using regional properties. After getting a bounding box, we have to find its width and height and take its ratio between them. With that width to height ratio, we can classify vehicles in order to check whether it is a car, truck, bus etc.

IV. RESULTS

For the effective and precise counting of vehicles, the following steps are carried out. First a frame is taken as shown in figure 2.

Fig.2 A frame of the video

Then a region of interest is defined in that image as shown in fig.3. The luminance of the pixels inside the detection region is then calculated for converting the image to gray scale.

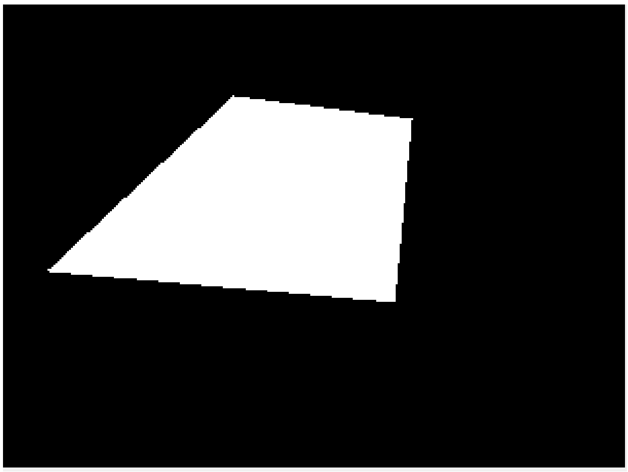

Fig.3 Region of interest in the image

Brightness compensation is then carried out after converting the image to gray scale in order to mitigate the problem caused due to the presence of large and bright vehicles. For that, a reference region is defined. Then the luminance variation of the pixels inside the reference region is evaluated. After that the background subtraction is carried out by finding the difference between this luminance variation and the luminance values of the pixels in the detection region. With this difference, the motion index is also calculated. And a threshold is manually set up. For every frame where M.I is found to be greater than threshold, a vehicle is detected and counted.

For each frame, the foreground is then extracted using Gaussian mixture model. After applying some morphological operations such as filling, dilation etc to the extracted foreground, the detailed objects are marked by drawing a bounding box around them using regional properties. After getting a bounding box, we have to find its width and height and take its ratio between them. With that width to height ratio, we can classify vehicles in order to check whether it is a car, truck, bus etc. The fig.4 shows some consecutive frames obtained in the classification of the vehicles.

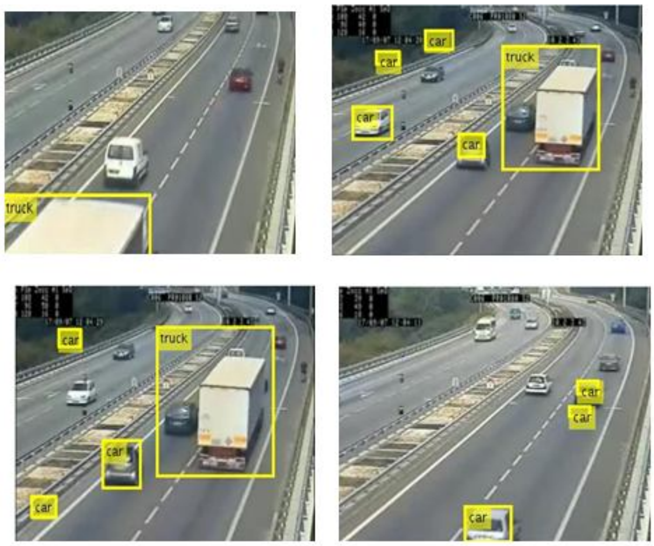

Fig.4 Some images showing the classification of vehicles

V. CONCLUSION

In this paper, a straightforward, proficient, minimal effort PC vision framework ready to recognize and count vehicles from standard determination recordings has been exhibited. In the meantime, it is additionally conceivable to order the vehicles disregarding a specific situation, regardless of whether it is an auto, car, truck, and so on relying upon its features or size. This strategy demonstrates that it has an adequate execution as far as precision even in some trying circumstances, for example, low determination recordings, stormy scenes, foggy atmospheres and so forth. This strategy has turned out to be exceptionally proficient as far as computing time since the processing is so speedier.

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