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Moving Object Counting in Video Signals

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Abstract— Object detection and tracking is important in the field of video processing. The increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms. The input video clip is analyzed in three key steps: Frame extraction, Background estimation and Detection of foreground objects. The use of object tracking and counting; basically cars; is pertinent in the tasks of traffic monitoring. Traffic monitoring is important to direct traffic flow, to count traffic density and check the rules of traffic at traffic signals. In this paper we have presented a technique to avoid human monitoring and automate the video surveillance system. This system avoids the need to have a background image of the traffic. To a given input video signals, frames are extracted. Selected frames are used to estimate the background. This background image is subtracted from each input video frame and foreground object is obtained. After post processing technique, counting is done.

Keywords— Background estimation, Background subtraction, Car tracking, Frame difference, Object counting, Object detection

1. INTRODUCTION

The efficient counting and tracking of multiple moving objects is a challenging and important task in the area of computer vision. It has applications in video surveillance, security, traffic rules violations and human–computer interaction. Recently, a significant number of tracking systems have been proposed. The major hurdles in monitoring algorithms are changing light intensities especially at late evenings and at night, weather changes like foggy atmospheres. Vehicle counting is important in computing traffic congestion and to keep track of vehicles that use state-aid streets and highways. Even in large metropolitan areas, there is a need for data about vehicles that use a particular street. A system like the one proposed here can provide important and efficient counting mechanism to monitor vehicles (cars) density at highways

Objects are defined as vehicles moving on roads. Cars and buses can be differentiated and the different traffic components can be counted and observed for violations, such as lane crossing, vehicles parked in no parking zones and even stranded vehicles that are blocking the roads. Vision-based video monitoring systems offer many more advantages. Surveillance and video analysis provide quick and practical information resulting in increased safety and traffic flow. The algorithm does not require the background image of road for this system. The background image is estimated from randomly selected input video frames. This is the greatest advantage of this method.

The organization of the paper is as follows. Section 2 gives a brief summary of the literature survey. Section 3 describes the architecture and modeling for the current technique of background estimation. In the subsections, the details of frame extraction, background estimation, background subtraction and car detection is presented. The technique of counting is described in section 4. Section 5 gives the results obtained. Simulation software is discussed in Section 6. Section 7 gives the future work to be done in this system. Section 8 gives the conclusions.

2. LITERATURE SURVEY

A brief survey of the related work in the area of video segmentation and traffic surveillance is presented. Sikora T. [1] used this concept for intelligent signal processing and content-based video coding. Here an image scene consists of video objects and the attempt is to encode the sequence that allows separate decoding and construction of objects. Nack et al., [2] and Salembier et al., [3] have discussed Multimedia content description related to the generation of region based representation with respect to MPEG-4 and MPEG-7. detection based approach Y. Yokahama et al. in [4] discusses concept of initial segmentation as applied to the first frame of the video sequence, which performs spatial segmentation, and then partitions the first frame into homogeneous regions based on intensity. Motion estimation is then computed for determining the motion parameters for each region, and finally motion-based region merging_is performed by grouping the regions to obtain the moving objects. L, Wu et al., [5] explains how temporal tracking is performed in detail after initial segmentation. Neri et al., [6] describes a solution to eliminate the uncovered background region by applying motion estimation on regions with significant frame difference. The object in the foreground is then identified when a good match is found between two frame differences. The remaining region is then discarded as unwanted area. Stauder et al., [7] considers the effect of shadow of object in the background region which affects the output in change.

In [8] tracking and counting pedestrians using a single camera is proposed. Here the image sequences are segmented using background subtraction and the resulting regions are connected then grouped and together as pedestrians and tracked. Dailey et al., [9] presents the background subtraction and modeling technique that estimates the traffic speed using a sequence of images from an uncelebrated camera. The combination of moving cameras and lack of calibration makes the concept of speed estimation a challenging job. Vibha L, Chetana Hegde [10] has background subtraction and compared with foreground registration technique.

3. ARCHITECTURE AND MODELING

Figure 1 shows the architecture of Background estimation method. Frames are selected randomly from the input video clip and are used for background estimation. From the input video frame, the background frame is subtracted to obtain the image of foreground object. Then using some post processing like median filtering and morphological closing operation a clear foreground object image is obtained. Then object tuning for object identification is done.

3.1 Frames extraction

Frames are extracted from the input video clip. Here 6-7 video clips are examined which are of different atmospheric conditions, different light intensities and different traffic densities. These frames are converted into gray frames. The total number of frames which depend upon the size of the input video clip is also extracted.

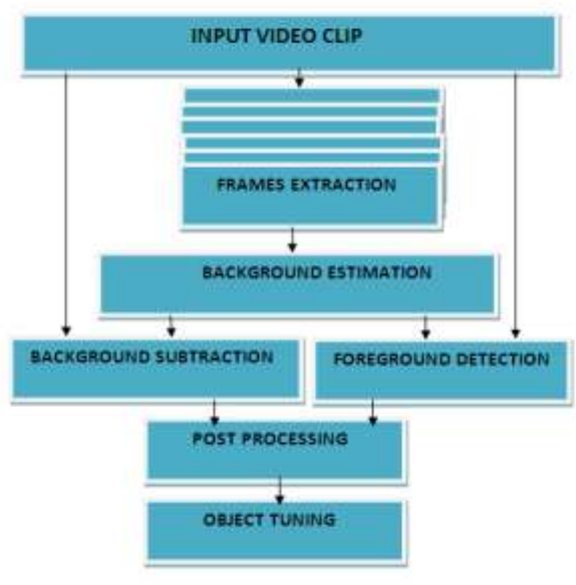

Fig 1: Architecture diagram of Background estimation technique

3.2 Background estimation

Frames are selected randomly from the input video clip. The number may vary according to traffic density. For higher densities of traffic this number may be larger than that required lower densities of traffic. Then all these frames are averaged out by averaging filter. The resulting image formed is that of background since the objects are averaged out. This method is called background estimation. By using this method, object tracking can be done on any video clip, even if background image of the clip is not available. Figure 7 below shows the background image obtained by averaging out 6-7 input video frames.

Fig 7 Background Image by background estimation

3.3 Background subtraction

The background these frames are gray images. The result of background subtraction is a foreground object image. Fig 2 shows the result of background subtraction.

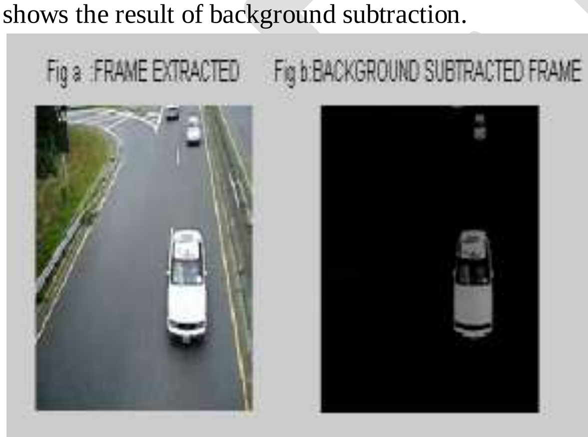

Figure 2 Background Subtraction

Figure 3: Post Processing Technique

3.4 Post processing

The post processing steps are applied to remove some noise in the camera images. These include filtering techniques such as median filtering. The image boundaries are smoothened and any noise is removed. This filter replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel. The formula used is f (x, y) = median {g (s, t)} (1)

3.5 Object tuning

This post processing step is applicable in traffic monitoring and traffic surveillances systems. The output of this processing is a binary and a clearer image of the object. To get a clearer image of the foreground object a morphological closing operation is required to be done on the binary image. Fig 5 shows the binary image obtained by object tuning

Figure 5: Object Tuning

4. Object counting

The tracked binary image forms the input image for counting. An imaginary or hypothetical line is assumed to be present across the Y-AXIS of the image frame. When any moving object (vehicle) crosses the line, it is registered and count is incremented. One variable is maintained i.e., count that keeps track of the number of vehicles and. When a new object is encountered, as soon as it crosses the line, Count is incremented, else it is treated as a part of an already existing object and the presence of the object is neglected. This concept is applied for the entire image and the final count of objects is present in variable count. A very good accuracy of count is achieved. Sometimes due to occlusions two objects are merged together and treated as a single entity.

5. Simulation software

Simulation is performed using Matlab Software This is an interactive system whose basic data element is an array that does not require dimensioning. It is a tool used for formulating solutions to many technical computing problems, especially those involving matrix representation. It provides environment in the solution of digital image processing. Matlab is a very efficient tool for image processing.

6. Results

The algorithm for moving objects counting is implemented on video 'trafficcctv.avi' series 01 to 05and the results obtained are shown in fig 6. There are traffic videos of all conditions of light, foggy atmosphere, and traffic density. Fig 6a and 6c shows result of high traffic density in dim light. Fig 6b shows results of very low traffic density and brighter light. Fig 6d and 6e shows the result of our algorithm in moderate traffic. The algorithm is successful in counting moving objects when frames are displayed consecutively in series. Table 1 gives count values for different traffic counts

TABLE 1 Count Values

Sr. No.	Traffic Video	Count Value Obtd (CO)	Actual Count (CA)
1	cctv01.avi	9	8
2	cctv02.avi	5	5
3	cctv03.avi	12	12
4	cctv04.avi	7	7
5	trafficcctv.avi	13	13

Fig 6a. trafficcctv.avi

Fig 6b) cctv04.avi

Fig 6c) cctv03.avi

Fig 6d) cctv02.avi

Fig6e) cctv01.avi

7. Future work

The future work consists of comparing real time implementation of this project and display of the number of moving objects simultaneously. His will be very helpful in weight sensitive bridges and to control traffic congestion or traffic jam.

8. Conclusion

In this paper, we propose an efficient algorithm for counting moving object using background elimination technique. Initially we compute the frame differences (FD) between frames Fi and background frame. The moving object is then isolated from the background. In the post processing step, the noise and shadow regions present in the moving object are eliminated using a morphological gradient operation that uses median filter without disturbing the object shape. This could be used in real time applications involving multimedia communication systems. It is to be proved in further work that the clarity of the image obtained using background elimination technique is much better than using background registration technique. Good segmentation quality is achieved efficiently. This paper also discusses an application system of traffic surveillance.

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