



International Journal of Emerging Technologies in Computational and Applied Sciences (IJETCAS)

www.iasir.net

Motion Detection and Segmentation in Dynamic Video Backgrounds

Vivek Arya
Amity University Haryana

Abstract--Nowadays roads are getting overcrowded, especially in metro cities. Hence the main aim of proposed research is to build a traffic monitoring system which replace or reduce the human monitoring system. The proposed technique is able to detect the movement of vehicles such as cars and to track the moving objects by analyzing a video. Moving object is detected using running average technique. The experimental results show that the proposed technique is adapted to monitor a road in metro cities, during cricket match to track the cricket ball and at the country's borders for monitoring.

Keywords: Detection, background subtraction, segmentation, tracking, traffic monitoring and thresholding

I. Introduction

Increase in demand for travel on highways has seen an explosive growth over the years. Vehicle detection and speed measurements and classification are very important in traffic engineering application and Intelligent Transportation Systems (ITS) [1]. Collecting traffic data manually by direct observations of human observers has a number of drawbacks also and it is also containing high cost, weather and difficulties imposed by staffing limitations[1],[2].

Data can be acquired by the sensor technology, Inductive loop detector can also be used for counts and presence detection but there installation makes traffic disruption[3]. Sensors are used can be damaged by snow. Infrared sensors have an advantage it can be used as day or night and perform better than visible wavelength sensors in fog. Ultrasonic sensors is varies change in humidity and temperature so it exhibits difficulty in detection. Its limitation in case of a critical situation in such case, motion detection and speed measurement of vehicle by live video of scene.

The camera is placed in appropriate position provide area coverage and can detect multiple vehicles simultaneously. Another advantage of video is that it provides sufficient information for vehicle tracking to be feasible, which is useful for detecting vehicles moving in the wrong direction etc.

Jiaming Zhang et al. proposed moving objects detection and segmentation in dynamic video backgrounds. This method overcomes the disadvantage of conventional Gaussian mixture model because it does not give the correct result in complex background[5]. Long Xiang et al. presented a paper on "Remaining edges linking method of motion segmentation based on edge detection". In this method of motion segmentation by edge detection because when the segmentation is occurred, boundary of the object is not clear therefore they used the algorithm in which the segmentation is done by canny operator for edge detection. The pixel that belong to boundary of object are used and pattern recognition is to classify these edge pixels into two classes—object or background. If the background is move, the pixel of the both side of the image move same way if the pixel of the foreground the move different way, so by the pattern recognition process method segment the object into the background[6]. Thanarat Horprasert et al. developed an algorithm that segment the moving object contains shading and shadows by using of colour images. That remove the illumination changes local and global such as shadow. By the color model brightness and chromaticity component are separate out. Segment the image by decomposed into brightness and chromaticity components. The pixel belongs to background whose brightness and chromaticity are same that pixel chromaticity is same but brightness is lower than the shadow. If the pixel chromaticity is different then background the pixel is foreground[7]. Matej Per̄se, et al. proposed a method for segmentation by Kalman filter and used collision avoidance algorithm. The prediction part and the measurement update part are used for error covariance estimate Kalman filter allows usage of simple motion models (constant velocity or acceleration) and at the same time it allows the knowledge of the modeling error to be built into the model[8]. Saeid Fazli, et al. proposed a method of adaptive Gaussian mixture model for background subtraction. In this approach they used Gaussian mixture model method for segment the image and background updating after that the neighborhood-based difference method are used to remove the false pixel by neighborhood information of a pixel and adaptive thresholding. Overlapping-based classification method which is used to separate the moving object from noise in the image. It can detect the foreground from the dynamic background and if the illumination change or background is moving[9]. T. Thongkamwitoon, et al. presented a paper on "Non-linear learning factor control for statistical adaptive background subtraction algorithm". By adaptive background subtraction it solve the two major problem small variation in background or illumination change. Motion segmentation using background subtraction. In this learning factor of adaptation are used for the effect of the relocation of background objects, in this research learning factor can be control in two level pixel or frame. By the control of learning rate in two level increase performance and reduces false pixel[10]. A.

Colombari et al. presented a paper on “Segmentation and tracking of multiple video objects”. It is a image differencing model in which each pixel belongs to moving object morphological filtering (Erosion and Dilation) applying on them. Erosion process will allow to get skinny and detect the hole inside the object and dilated that are very lightly drawn get thick the object. The average percentage before and after morphological filtering are respectively 1.3416% and .2893% .Then the blob matching between one layer to the next identified moving object. This algorithm deals with noise and small camera movement[4]. Makito Seki et al. proposed a method who handles the change in background in terms of distributions of image vectors. In the real world every time the background change due to change in illumination, background change due to small camera moment, or blowing of air so remove this type of noise chronological updating are applied on the background image. This method removes the chronological change in image. The method evaluates the Mahalanobis between the new images. To clarify the locally changing texture elements by removing the uniform changes in the overall intensity, the method uses normalized image vectors. By the average method or covariance method Mahalanobis distance are find out. The method segment the image by comparing the new image by the background image[11]. Chris Stauffer Gaussians presented a paper on “Adaptive background mixture models for real-time tracking”. This technique may correspond to background colours. Pixel values that do not fit the background distributions are considered foreground until there is a Gaussian that includes them with sufficient, consistent evidence supporting it. The approach is deals with light change, small camera movement, shadows, and slow moving objects also with the small moving elements like swaying tree[12]. Priti P. Kuralkar, et al. proposed a technique for background subtraction and shadow removal. In which the reference image used as a background image and the next frame is subtracted from the reference image, RGB colour value is subtracted from the reference image RGB colour value and convert into gray value if it greater than the threshold then foreground object is detected, but when the shadow merge with the foreground object it does not give the good result so shadow is removed by the used of morphological operation[13]. Donovan H. Parks et al. proposed a post processing technique by which they remove the environmental effects[14].

The entire paper is organized in the following sequence. In section -1 describe the introduction and various existing methods of objet tracking and detection are explained, In section-2 the proposed technique is discussed. The algorithm developed and the results obtained are discussed in section 3 and 4 followed by conclusion and future work.

II. Proposed Technique

Our proposed algorithm for motion segmentation. Background subtraction technique is used for motion segmentation. It is a technique using image processing its extract the foreground object into the video (or sequence of images). The application of background subtraction comes from its computational efficiency, which allows applications such as human-computer interaction, video surveillance and traffic monitoring. There are many challenges in developing a good background subtraction.

- It is efficient against changes in illumination.
- It should avoid detecting non-stationary background objects such as moving leaves, rain, snow and shadows cast by moving objects.
- A good background model should also react quickly to changes in background such as starting and stopping of vehicles.

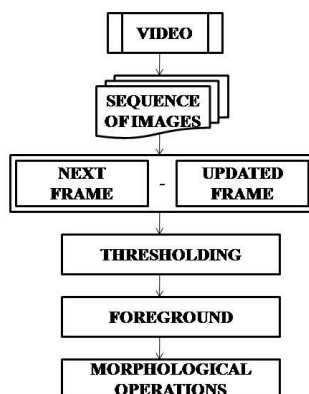
A. Input:

The input is term of video taken from the CCD camera. The camera is stationary mounted on a pole. It is a RGB video. For further process, It is converted into gray scale. After it video is splits up into frames or we can say that sequences of images. The input video frames are shown in figure 1.



Figure 1 Images of input video

These two images which we have extracted from a real time video are used for motion detection and segmentation. Our purposed work is foreground segmentation and second is foreground quality enhancement. The various steps of moving object detection is shown in given below flowchart.



Flowchart for motion detection and segmentation

B. Foreground segmentation:

We have used the background subtraction technique for foreground segmentation. Before subtraction background frame into next frame, we compute the background. The background model evolves because of the existence of background dynamics. Hence a background model must be updated every frame in order to accommodate for background dynamics. The background is computed with help of reference frame and background frame. There are two technique for compute the background, first is non recursive technique and second is recursive technique. Due to high memory requirement and long processing time we have used the recursive technique to compute the background, that is called running average background modeling technique. Running average technique are used for background modeling. It is very simple and fast background modeling algorithm because every time only newest current frame is used. So it does not need high memory requirements. Background update [15] can be done by using equation 1.

$$B_{t+1} = \alpha I_t + (1 - \alpha B_t) \text{ -----(1)}$$

- a) α is a constant learning rate
- b) I_t is current image
- c) B_t is background frame
- d) B_{t+1} is computed frame

Learning rate: Learning rate is defined the speed of background model adaptation. Its value varies from 0 to 1 if the learning rate value selected is large. Object update quickly, but same time true background model is lost as well as the moving foreground object become stationary for some period of time, so we have to reduced the speed of adaptation so that pixel show the high activity of foreground object[16].

The current image (I_t) and the updated background image (B_{t+1}) is now further used to find the foreground object into the current image by equation 2.

$$F_t = | I_t - B_t | \text{ -----(2)}$$

Where, F_t is the foreground pixel

The goal of the foreground segmentation is to obtain a binary mask to each video frame. In this mask, only objects that belong to the foreground, will be visible. To detect the foreground pixel we used thresholding technique. It should be determined which pixels in the current image frame are belong to foreground. We used global thresholding means a constant value set as a reference value apply to the image. If the F_t pixel value is greater than reference pixel is set as '1' (foreground pixel) in to the frame. Otherwise pixel is set as '0' (background pixel) in to the frame. As shown in equation 3.

$$B_t = \begin{cases} 1 & ; F_t > \tau \\ 0 & ; \text{Others} \end{cases} \text{ -----(3)}$$

Now the white pixel into the image show as foreground object or moving object, or black pixel shows background. Figure 2 shows the foreground pixel. These foreground pixels are further processed for object localization and tracking, to remove the movement of small background elements post processing technique are used that explain in next section.



Figure 2. Foreground object

C. Foreground Quality Improvement:

Foreground quality improvement is done by the morphological operations. For foreground quality enhancement we have used the two technique- post processing and blob processing which are explained below.

1. **Post Processing Technique:** There are various changing in environment like changes in illumination non-stationary background objects such as moving leaves, rain, snow, and shadows due to this region the foreground object seen not clear, So the post processing technique are used to eliminate these type of changes and quality of foreground object is increased.
2. blob. So by applying morphological operation closing to fill the small gaps , erosion are used to remove the blobs that are insufficiently large the blob processing output shown in figure 3 . We have used the morphological operations to eliminate the shadow effect in a real time video.

III. DEVELOPMENT OF MOTION DETECTION & SEGMENTATION ALGORITHM

- Step 1- Read the RGB video on to the workspace of the MATLAB.
- Step 2- Divide the video into sequences of frames
- Step 3- Subtract the updated frame from next frame
- Step 4- Convert the RGB frames into gray scale.
- Step 5- Now assign the global threshold for foreground and background for segmentation
- Step 6- Extract the foreground object
- Step 7- Apply morphological operations
- Step 8- Then we obtain the foreground good quality object

IV. Results and Discussion

An algorithm has been developed for motion detection and segmentation in dynamic video backgrounds. Figure 3 shows the results. Experimental results indicate that our proposed technique decrease the false motion detection and thus improved the segment quality.

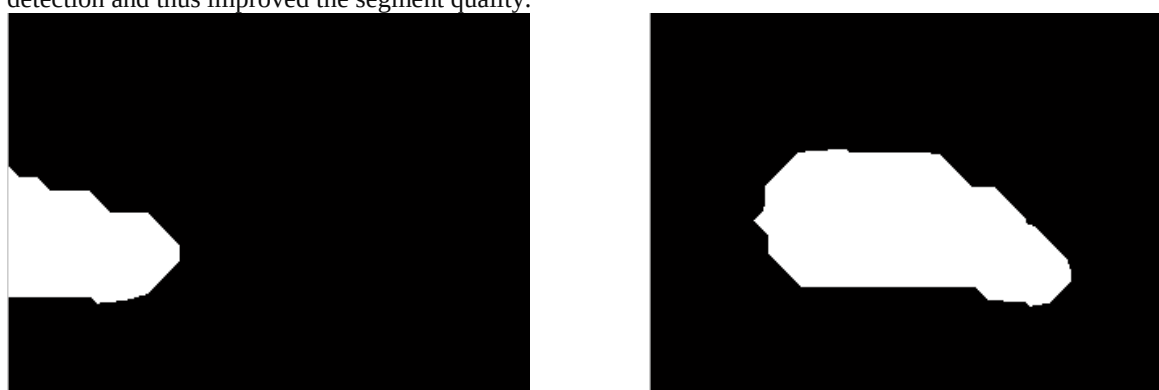


Figure 3: Output of morphological operation

We obtained the optimum result after applying the morphological operations. Our results clearly indicate the moving car in the given images which is indicated by white in the above figure.

V. Conclusion and Future Work

Motion segmentation is an important in video indexing, traffic monitoring security There are many challenging problems in studying real traffic scenes within a complex background. In this work, efficient image processing techniques are applied to extract high quality motion detection from a input video. This research is divided into two phases. In the first phase segment the moving object from the static background, motion segmentation is done by updating background subtraction. the model is updated using only a fixed small number of history

frames. In this way current incoming frames have a great influence on the final model: it can adapt quickly. The method requires only two parameters, α and T. These two parameters are robust to different cameras and different scenes. This method deals with slow lighting changes and shadow, to get the proper shape of foreground object and remove the shadow by post processing technique. In the second phase after segment the moving object like vehicle, the quality of extracted moving object is enhanced by morphological operations. In future work there will be a possibility of Gaussian Mixture Model and Region Based Segmentation technique for motion segmentation and moving object speed measurement.

References

- [1] Zhang Jinglei and Liu Zhengguang "A Vision-Based Road Surveillance System Using Improved Background Subtraction and Region Growing Approach", Eighth ACIS International Conference on Software Engineering, Artificial Intelligence, Networking, and Parallel/Distributed Computing.
- [2] Shung-Tsang Tseng and Kai-Tai Song "Real-Time Image Tracking for Traffic Monitoring", The IEEE 5th International Conference on Intelligent Transportation Systems 3 - 6 September 2002, Singapore.
- [3] Fu Yuan Hu, Hichem Sahli et al. "A High Efficient System For Traffic Mean Speed Estimation from MPEG Video", 2009 International Conference on Artificial Intelligence and Computational Intelligence.
- [4] A. Colombari, A. Fusiello, V. Murino, "Segmentation and Tracking of Multiple Video Objects", Dipartimento di Informatica, University of Verona Strada Le Grazie 15, 37134 Verona, Italy, 2006.
- [5] Jiaming Zhang and Chi Hau Chen, "Moving Objects Detection and Segmentation In Dynamic Video Backgrounds", Electrical and Computer Engineering Department, 2007 IEEE., pg 64 to 69
- [6] Long Xiang, Wu Xiaoqing et al, "Remaining edges linking method of motion segmentation based on edge detection" 2012 IEEE pg 1895 to 1899
- [7] Thanarat Horprasert, David Harwood et al. "A Robust Background Subtraction and Shadow Detection" Computer Vision Laboratory
- [8] Matej Peršič, Janez Peršič et al. "Physics-Based Modelling of Human Motion using Kalman Filter and Collision Avoidance Algorithm"
- [9] Saeid Fazli, Hamed Moradi Pour et al. "A Novel GMM-Based Motion Segmentation Method for Complex Background", Electrical Engineering Department,
- [10] T. Thongkamwitoon, S. Aramvith et al. "Non-Linear Learning Factor Control for Statistical Adaptive Background Subtraction Algorithm", 2005 IEEE, pg 3785 to 3788
- [11] Makoto Seki, Hideto Fujiwara et al. "A Robust Background Subtraction Method for Changing Background", 2000 IEEE pg 207 to 213
- [12] Chris Stauffer, W.E.L. Grimson, "Adaptive background mixture models for real-time tracking", 1999 IEEE pg 246 to 252.
- [13] Priti P. Kuralkar, V.T. Gaikwad, "Human Object Tracking using Background Subtraction and Shadow Removal Techniques", International Journal of Advanced Research in Computer Science and Software Engineering 2012
- [14] Donovan H. Parks, Sidney S. Fels, "Evaluation of Background Subtraction Algorithms with Post-processing",
- [15] Alan M. McIvor, "Background Subtraction Techniques",
- [16] T. Thongkamwitoon, S. Aramvith et al. "An Adaptive Real-time Background Subtraction and Moving Shadows Detection", 2004 IEEE International Conference on Multimedia and Expo, pg 1459 to 1462