Study the Effect of Threshold Value on Object Detection

Khalil Ibrahim Alsaif, PhD
Professor
Mosul University, IRAQ
Department of Computer Science

Raghad Hazim Hamid
MSc Student
Mosul University, IRAQ
Department of Computer Science

ABSTRACT
The object detection on movie based on static camera using background subtraction mainly depends on threshold value of calculating the difference between current frame and previous one.

Most of the research use fixed threshold value cause an error technique. In this research the threshold Value calculated depends on histogram gray level of the Frame.

The result for moved object detection on the movie Enhanced in addition higher detection obtained than the previous technique.

General Term
Image processing

Keywords
Object detection, Object tracking, Background subtraction, Threshold value evaluation.

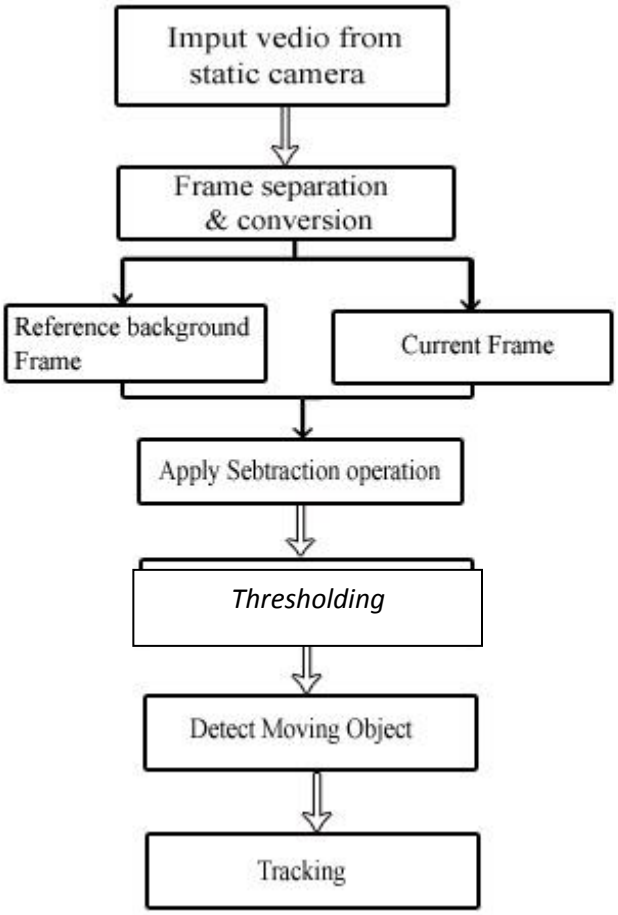
1. INTRODUCTION
It is easy for a human being to recognize images or other objects around him, but it is a very complex problem for an automated system. Nevertheless, many systems need to have information on the presence or the absence of objects in their environment. In other terms, object detection and tracking in a video sequences have been one of many important problems in computer vision and have attracted more and more researchers working on it. Furthermore, moving object detection has been used for many computer vision applications, including recognition of traffic scenarios[1], supervision traffic flow [2], collision prediction of pedestrians [3], face detection[4], human–machine interaction [5], etc. While detecting and tracking, we need to analyze video sequences to detect and track target in each frame, to achieve monitoring and to master the dynamic variation of the moving objects in order to confirm their exact position.

Segmentation involves separating an image into regions (or their contours) corresponding to objects. We usually try to segment regions by identifying common properties. Or, similarly, we identify contours by identifying *differences* between regions (edges).The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. (What you want to do with pixels at the threshold doesn't matter, as long as you're consistent.)

If g(x, y) is a thresholded version of f(x, y) at some global threshold T,

$$g(x,y) = \begin{cases} 1 & \text{if } f(x,y) \geq T \\ 0 & \text{otherwise} \end{cases}$$

2. OBJECT DETECTION
The purpose of object detection is to detect all instances of objects from a known class, such as people , cars or faces in an image. Object detection methods fall into two major categories, generative [6,7] and discriminative [8]. The first consists of a probability model for the pose variability of the objects together with an appearance model: a probability model for the image appearance conditional on a given pose, together with a model for background, i.e. non-object images. The model parameters can be estimated from training data and the decisions are based on ratios of posterior probabilities. The second typically builds a classifier that can discriminate between images (or sub-images) containing the object and those not containing the object. The parsameters of the classifier are selected to minimize mistakes on the training data, often with a regularization bias to avoid overfitting. Other distinctions among detection algorithms have to do with the computational tools used to scan the entire image or search over possible poses. Figure (1) shows allow that evaluating threshold in one of the main object.



Figure(1). The flow chart of moving object detection([9])

- ✓ The first step is to take input video from static cameras. For processing the video files, convert video into frames and from frames to images.
- ✓ Next step is take first frame as a Background frame and next is current frame and then apply subtraction operation. Background frame is subtracted from current frame.
- ✓ Then Threshold operation is performed and foreground object is detected.
- ✓ After object detected last step is track object in video.

3. APPLICATIONS OF OBJECT TRACKING

Some of the important applications of object tracking are[10]:

1. Automated video surveillance: In these applications computer vision system is designed to monitor the movements in an area, identify the moving objects and report any doubtful situation. The system needs to discriminate between natural entities and humans, which require a good object tracking system.
2. Robot vision: In robot navigation, the steering system needs to identify different obstacles in the path to avoid collision. If the obstacles themselves are other moving objects then it calls for a real-time object tracking system.
3. Traffic monitoring: In some countries highway traffic is continuously monitored using cameras. Any vehicle that breaks the traffic rules or is involved in other illegal act can be tracked down easily if the surveillance system is supported by an object tracking system.
4. Animation: Object tracking algorithm can also be extended for animation.

4. COMPLEXITY IN MOVING OBJECT DETECTION AND TRACKING[11]

- ✓ Loss of evidence caused by estimate of the 3D realm on a 2D image.
- ✓ Noise in an image.
- ✓ Difficult object motion.
- ✓ Imperfect and entire object occlusions.
- ✓ Complex objects structures.

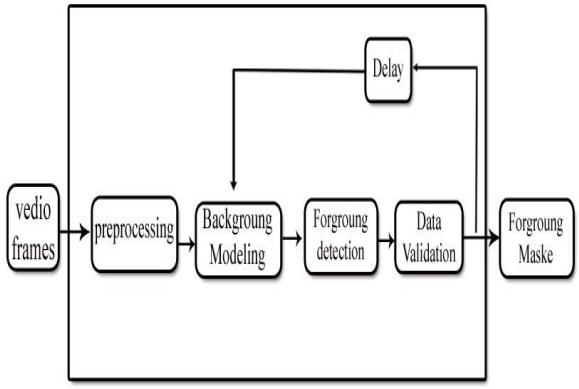
5. MORPHOLOGICAL FILTER

After the primary separation between the background and foreground is conducted secondary processing may take effect. The goals of these processes are to reduce the overall amount of noise in the image resulting in a cleaner and easier to detect targeted entity. Mathematical morphology is the branch of image processing and analysis that employs morphology as the key instrument to interpret and extract features from images . This outlines that the various different mathematical choices each have their own respective effect on the type of morphology [12].

6. OBJECT DETECTION BASED ON BACKGROUND SUBTRACTION

Background subtraction is a common method for detecting moving objects and it has been widely used in many surveillance systems. Separating foreground from background in a video sequence is one of the most fundamental tasks in many applications of computer vision. To detect moving objects, each incoming frame is compared with the background model learned from the previous frames to divide the scene into foreground and background. Therefore, background modeling has been actively investigated in the past decade [13]. Background subtraction is a widely used approach for detecting moving objects from static cameras .
The four major steps in a background subtraction Algorithm are:

- Preprocessing
- Background Modeling
- Foreground Detection
- Data validation



Figure(2).Illustration of background Subtraction

This can be summarized in the formula:

$$\chi_t(s) = \begin{cases} 1 \text{ if } d(\boldsymbol{I}_{s,t}, \boldsymbol{B}_s) > \tau \\ 0 \quad \text{otherwise,} \end{cases}$$

Where : τ is a threshold

,Xt is the motion label field at time t

,d is the distance between Is,t the color at time t and pixels,

and Bs ,the background model at pixel s.

This essentially explains that to break into the threshold there has to registration of a comparative change from the background model and the subsequent next frame . This is the central basis in which all the different algorithms are based off finding more accurate detection or quicker less computational taxing algorithms .

7. THRESHOLD METHODS

Object extraction involves extracting the foreground object from an image sequences. Among the various techniques, threshold based techniques are simple and straight forward to apply. The three types of threshold techniques, namely Maximum Entropy Threshold, Mixture Modeling Threshold, and Otsu Method are applied in present work. The object extraction is necessary to detect the foreground object in an image.

7.1 Maximum entropy threshold

Maximum Entropy (ME) method is mainly used for object extraction and object recognition. This method is used for extract the object from an image sequence by calculating gray level values for each pixel in an image sequence. Using ME for automatic image annotation, the ME-based image segmentation approach is implemented to segment a gray-scale face image [14]. This approach uses Maximum Entropy Thresholding (MET) value of 2D image. MET operations are done by the following Eqn,

$$h_{ij=P_{ij}=\frac{f_{ij}}{N}}, \qquad 0 \le i,j \le L-1$$

where i is the gray level value of a pixel; j is the average gray level value of a pixel's neighborhood; fij is the number of the pixels, of which the gray level values are i and the average gray level values of their neighborhoods are j; ME-based method yielded very good threshold value and segmented the given image very well.

7.2 Mixture Modeling Threshold

Maximum entropy threshold is one of the thresholding methods. This method is used to extract the object from an image sequence by calculating mean and standard deviation for each pixel in an image sequence.

In adaptive background mixture models for real-time tracking [15], each pixel is classified based on Gaussian distribution. This thresholding process is done by following Eqn,

$$h_{model(g)} = n_B e^{-(g-\mu_B)2/2\sigma_B^2} + n_O e^{-(g-\mu_O)2/2\sigma_O^2}$$

- μB and σB is mean and standard deviation of background pixels
- μO and σO is mean and standard deviation of foreground pixels

Mixture modeling threshold technique assumes two classes, one for the foreground and another one for the background. The mean and standard deviation of these two classes are calculated and added. The result is assigned as mixture modeling threshold value.

7.3 Otsu threshold

Otsu's method is used to convert gray level image to a binary image. The two clusters are obtained by Otsu method based on threshold value and the statistical measures are optimized [16]. The automatic thresholding of gray-level images via two-dimensional. This method provides good segmentation of the object in an image.

In Otsu's method, background pixels belong to one class and foreground pixels belong to another class. The weight and variance of the two classes are calculated and added. This resultant value constitutes the Otsu threshold value. It is shown in following Eqn,

$$\sigma_\omega^2(t) = \omega_1(t)\sigma_1^2(t) + \omega_2(t)\sigma_2^2(t)$$

$w_1(t)$ is weights of background pixels and $w_2(t)$ is weight of foreground pixels. $\sigma_1^2(t), \sigma_2^2(t)$ are the inter class variance of the two classes. Otsu shows that minimizing the intra-class variance is the same as maximizing inter-class variance. It is shown in following Eqn,

$$\sigma_b^2(t) = \sigma^2 - \sigma_\omega^2(t) = \omega_1(t)\omega_2(t)[\mu_1(t) - \mu_2(t)]$$

Where w_i are the class probabilities and u_i is the class mean. The class probability w1(t) is computed from:

$$\omega_1(t) = \sum_0^t p(i)$$

while, the class mean $\mu_1(t)$ is

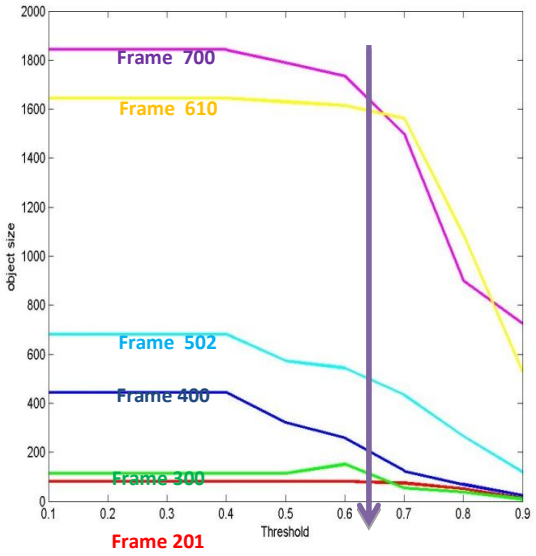
$$\mu_1^t = \frac{|\sum_1^t p(i)x(i)|}{\omega_1}$$

8. PROPOSED HISTOGRAM THRESHOLD EVALUATION

The proposed technique(as show in figure (3)) shows the threshold value on the applied example around (0.58) while the used value by suggestion from (0.4 up 0.9) give a coincidence with evaluated value . the most researcher try to guess the threshold value as [≅0.7] and others calculate it using try an error to find the best value for background subtraction projects. While with the proposed technique shows that calculated value on both the try an error and the guessed values are around to it.

9. RESULT DISCUSSION

After the analysis of the video in to a series of frames which consists it, the histogram of the gray image will be generated and the straight line between the highest and lowest value will interested the histogram in the optimal threshold value, shows in figure (3) the optimal value shows that the moved object start appear before than the starting frames adopted by the previous technique .



Figure(3): Illustration threshold effect on image

10. CONCLUSION

Several researcher study the effect of the threshold value in detecting a moved object inside a movie, to sport the study of object tracking which have many useful application.

The proposed idea for this researcher which apply gray histogram value of the object have been used to fix the background to be subtracted later from the new frames.

The proposed technique gave better detection and more clear view than the previous methods.

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