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Object Detectionand Object Classificationusing Background Subtraction Method

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Abstract: **In the video analysis, the most important part in object detection and object classification depending movement of object. The purpose is to detect the movement of object from the background image in video sequence and for the object tracking. This paper proposes a method to detect object based on background subtraction method. A reliable background updating model is established. A optimization threshold method is used to obtain behaviour of moving object and tracking. Motion of a moving object and classification in a video stream is studied and detected. The centroid of object is computed to use in the analyses of the position of the moving human body. The experimental results show that the proposed method runs quickly, accurately and fits for the real-time detection.**

Keywords: Background subtraction, Object detection, Object classification.

I. INTRODUCTION

Visual surveillance is an active research topic in computer vision that tries to detect, recognize and track objects over a sequence of images and it also makes an attempt to understand and describe object behavior by replacing the aging old traditional method of monitoring cameras by human operators [3]. A computer vision system, can monitor both immediate unauthorized behavior and long term suspicious behavior, and hence alerts the human operator for deeper investigation of the event. The video surveillance system can be manual, semi-automatic, or fully-automatic depending on the human intervention [7]. In manual video surveillance system, human operator responsible for monitoring does the entire task while watching the visual information coming from the different cameras. It's a tedious and arduous job of an operator to watch the multiple screens and at the same time to be vigilant from any unfortunate event. These systems are proving to be ineffective for busy large places as the number of cameras exceeds the capability of human experts. Such systems are in widespread across the world. The semi-automatic visual surveillance system takes the help of both human operator and computer vision. Tracking of object is being done by the computer vision algorithm and the job of classification, personal identification, and activity recognition is done by the human operator. These systems use lower level of video processing, but much of the task is done with the help of human operator intervention. In the fully-autonomous system there is no human intervention and the entire job is being done by the computer vision. These systems are intelligent enough to track, classify, and identify the object.

The main objective of this paper is to develop an algorithm that can detect object motion and classification based on background subtracion. We carry out various tasks such as motion detection, background modelling and subtraction, foreground detection, object classification. The rest of this paper is organized as follows. Section II describes the object detection using background subtraction algorithm. Object classification isperformed in Section III. Results are presented in sections IV, followed by conclusions on section V.

II.OBJECT DETECTION USING BACKGROUND SUBTRACTION

To obtain background subtraction, the background has to model first. Then, the incoming frame is obtained, and subtract out from the background model [5]. With the background model, a moving object can be detected. This algorithm is called as "Background Subtraction" [10]. The efficiency of a background subtraction technique correlates with three important steps: modelling, noise removal and data validation as shown in fig.1.

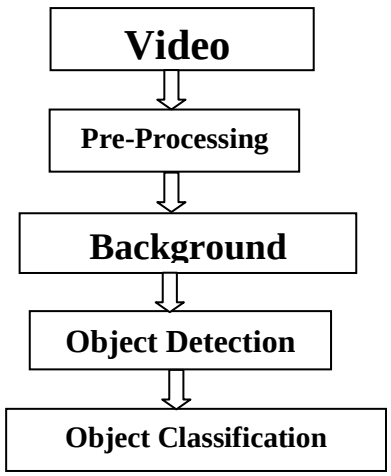


Fig1. General Flow Diagram for BGS System

A) Frame differencing

In frame differencing the number of frames are differenced with each other. Frame differencing is Frame difference (absolute) at time *t* + 1 is

$$\boldsymbol{D(t-1) = |V(x,y,t+1) - V(x,y,t)|} \ldots\ldots\ldots \quad 2.1$$

The background is assumed to be the frame at time *t*. This difference image would only show some intensity for the pixel locations which have changed in the two frames. Though we have seemingly removed the background, this approach will only work for cases where all foreground pixels are moving and all background pixels are static. A threshold "Th" is put on this difference image to improve the subtraction.

$$\boldsymbol{|V(x,y,t) - V(x,y,t+1)| > TH} \ldots\ldots\ldots \quad 2.2$$

(thismeans that the difference image's pixels' intensities are 'thresholded' or filtered on the basis of value of Th) The accuracy of this approach is dependent on speed of movement in the scene. Faster movements may require higher thresholds.

Frame differencing is a pixel-wise difference between two consecutive frames. Each current frame is subtracted from the previous frame to detect the moving object.

This is being used to detect regions corresponding to moving object such as humans and vehicles. Frame differencing is very adaptive to changing environments, but very often holes are left inside moving entities. It depends on good threshold to segment moving foreground from the background. Threshold T should be judiciously selected.

If the difference is greater than the threshold T, then the value is considered to be a part of the moving object; otherwise, it is considered to be the background. Here a threshold T is chosen based on Otsu's method. Otsu's method is optimum in the sense that it maximizes the between-class variance of the background and foreground.

It works only when there is no camera motion, the moving object is not stationary and it is not occluded.

B)Frame differencing in real time

In real time frame differencing we are capturing the frames from the camera in real time. The 300 number of frames captured from camera. Pixel size of the frame is 1280×780. In real time processing frames are coming in sequence. In the frame differncing we are differencing the current frame with the previous frame.

C) Background Subtraction

Background subtraction is a commonly used class of techniques for segmenting out objects of interest in a scene for applications such as surveillance. It compares an observed image with an estimate of the image if it contained no objects of interest. The areas of the image plane where there is a significant difference between the observed and estimated images indicate the location of the objects of interest. The name "background subtraction" comes from the simple technique of subtracting the observed image from the estimated image and thresholding the result to generate the objects of interest.

Algorithm Used

A pixel is marked as foreground if

$$\boldsymbol{|I_t - B_t| > \tau} \quad \ldots. \; 2.3$$

where is a "predefined" value threshold. The process thresholding is followed by closing with a 3 X 3 kernel and the discarding of small regions. The background is updated as

$$\boldsymbol{B_{t+1} = \alpha I_t + (1-\alpha) B_t} \quad .. \; 2.4$$

where the value is kept small to prevent the detection of artificial "tails" forming behind moving objects.

Two background corrections are applied:

1. If a pixel is marked as foreground for more than m of the last M frames, then the background is updated as. This correction is designed to compensate for sudden illumination changes and the appearance of static new objects.

2. If a pixel change is frequent that it changes its state from foreground to background frequently, it can be masked out due to inclusion in the foreground.

III. OBJECT CLASSIFICATION

Object classification in a video sequence is challenge because in a video sequence if the object is not moving then it is difficult to detect object and extract it from the background. In this, we are classifying objet in two ways. In motion based object classification object classified as a background or moving object. In shape based object classification the object is getting classified into the shapes like triangle, square, circle.

A) Object Classification based on Motion

Object classification is a task where we are classifying object in different classes. In motion based object classification method. We are classifying the object in two classes. One is moving object and second is background object which are stationary. The background is a one object which is common in all frames of sequence. Here if the

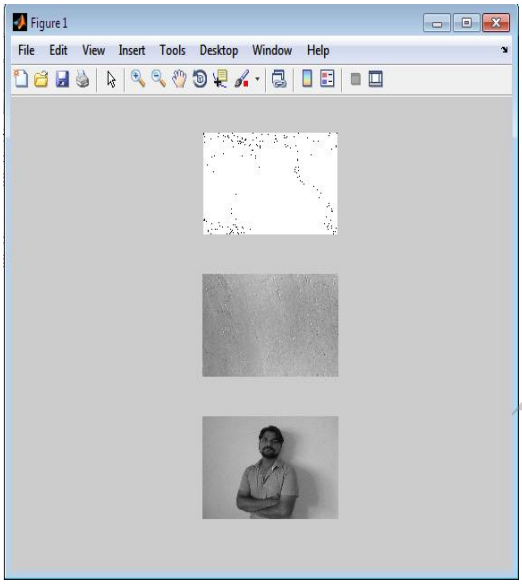
object is stationary for long time then it is not getting into difference in background or moving object.

B) Object Classification based on shape

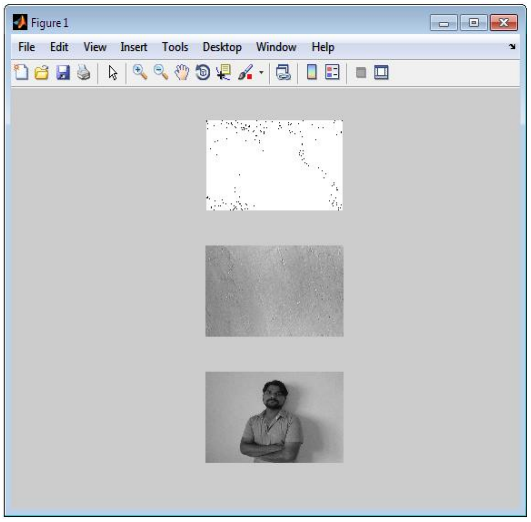
Object classification based on the shape of the object. Shape based object classification is classifying the object into the class like circle, rectangular square or unknown if not matching any class from this. Classification of the object is done in four classes. The object is best suited in which class is counted in that class and the area is calculated for each object.

IV. RESULTS

The proposed work has been developed using MATLAB on Intel dual core processor, 4GB RAM and Windows XP SP2. The real time video sequences are acquired at the rate of 30 frames/second with the frame size of 640×360 pixels resolution.



(a)



(b)

Figure 1:Frame differencing with threshold values (a) 50 (b) 150

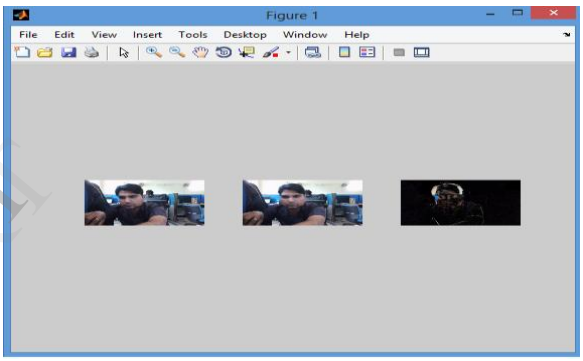


Figure2: Real time frame differencing

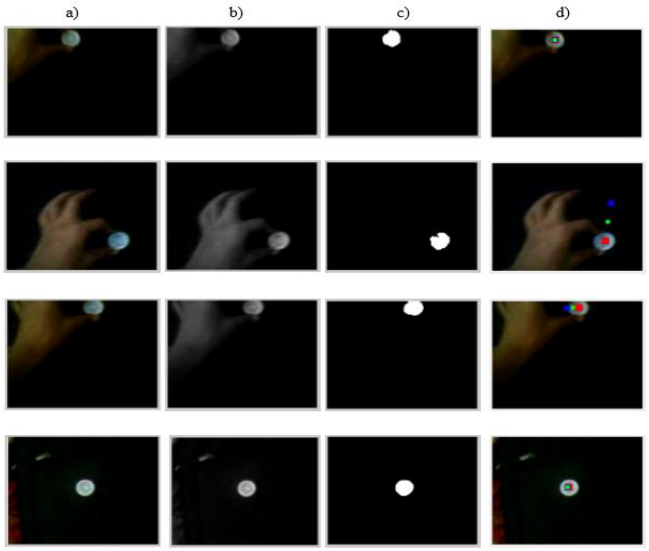
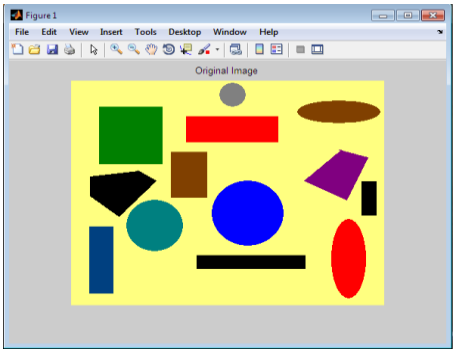
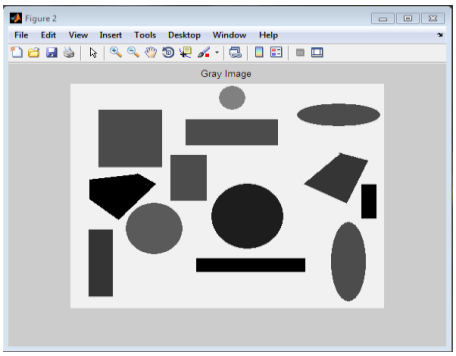


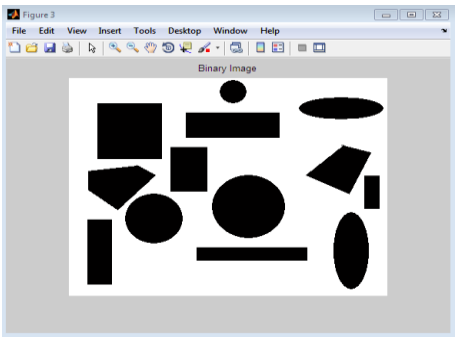
Figure 3: Output of Background Subtraction Method (Centroid Detection) a) Actual Image, b) Gray scale Image, c) Binary Image after Background Subtraction, d) Final Output with Centroid detection.



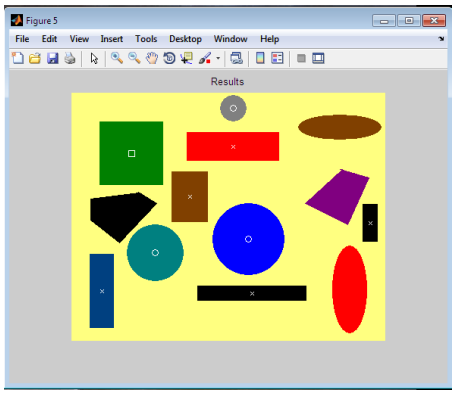
(a)



(b)



(c)



(d)

Figure 8: Object Classification (a) original image (b) gray image (c) binary image (d) result

Object Class	Square	Rectangular	Circle	Unknown
No. of object classif-ied in class	1	5	3	4

Table 1: Result Object Classification

V. CONCLUSIONS

In this paper, a real-time video of moving object detection and classification is proposed, based on background subtraction. We propose reliable background subtraction method which usesthresholdingmethod to detect moving object and update the background in real time. This method is effective in real time, and it works well for small numbers of moving objects. Target detection and process is realized on the video image. In video we detect motion of object by square the area in image current frame.

For object classification we propose two methods, one is shape based object detection and second is motion based. In shape based we classify object in some shape based classes and in motion based fore ground object or background object.

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