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Object Detection and Object Tracking Using Background Subtraction for Surveillance Application

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ABSTRACT:In the video analysis, the most important part in object detection and tracking is 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. Aoptimization threshold method is used to obtain behaviour of moving object and tracking. Motion of a moving object and tracking 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 tracking.

I.INTRODUCTION

A) Introduction

The main aim of object tracking and detection is to establish a correspondence between object parts in consecutive frames and to extract information about objects such as posture. Tracking detected objects frame by frame in video is a significant and difficult task [1]. It is a crucial part of smart surveillance systems since without object tracking, the system could not extract cohesive temporal information about objects and higher level behaviour analysis steps would not be possible. Moving object detection is the first step in video analysis. Some of the applications are as follows [2]:

(i) Visual surveillance: A human action recognition system process image sequences captured by video cameras monitoring sensitive areas such as bank, departmental stores, parking lots and country border to determine whether one or more humans engaged are suspicious or under criminal activity.
(ii) Content based video retrieval: A human behavior understanding system scan an input video, and an action or event specified in high-level language as output. This application will be very much useful for sportscasters to retrieve quickly important events in particular games.
(iii) Precise analysis of athletic performance: Video analysis of athlete action is becoming an importanttool for sports training, since it has no intervention to the athletic.

In all these applications fixed cameras are used with respect to static background and a common approach of background subtraction is used to obtain an initial estimate of moving objects. First perform background modelling to yield reference model. This reference model is used in background subtraction in which each video sequence is compared against the reference model to determine possible variation. The variations between current video frames to that of the reference frame in terms of pixels signify existence of moving objects. The variation which also represents the foreground pixels are further processed for object localization and tracking. Ideally, background subtraction should detect real moving objects with high accuracy and limiting false negatives (not detected) as much as possible. At the same time, it should extract pixels of moving objects with maximum possible pixels, avoiding shadows, static objects and noise [2].

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

B) Literature Survey

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. 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 [1]t. The video surveillance system can be manual, semi-automatic, or fully-automatic depending on the human intervention. In manual video surveillance system, human operator responsible for monitoring does the entire task while watching the visual information coming from the different cameras [7]. 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

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.

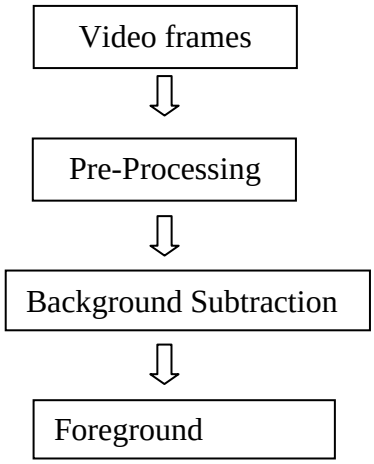

Fig1. General Flow Diagram for BGS System

Background modeling [3], is the backbone of the Background Subtraction algorithm. Background model defines the type of model selected to represent the background, and the model representation can simply be a frame at time (t-1) formula such as the median model. Model Adaption is the procedure used for adjusting the background changes that may occur in a scene. Noise removal is a procedure that eliminates noise in the scene. Data validation is involved with the collection of techniques to reduce the misclassification of pixels. In the recent papers, many background subtraction algorithms are proposed, because no single algorithm is able to cope with all the challenges in the sports applications

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[10]. There are several problems that a good background subtraction algorithm must resolve. Therefore in this paper the most commonly used, background subtraction algorithms are discussed.

A Gaussian mixture model (GMM) was proposed for the background subtraction in Friedman and Russell, [6] and efficient update equations are given in Stauffer and Grimson, [7]. In Power and Schoonees, [8] the GMM is extended with a hysteresis threshold. This method uses a Gaussian probability density function to evaluate the pixel intensity value. It finds the difference of the current pixel‟s intensity value and cumulative average of the previous values. So it keeps a cumulative average (μ) of the recent pixel values. If the difference of the current image‟s pixel value and the cumulative pixel value is greater than the product of a constant value and standard deviation then it is classified as foreground [11]. That is, at each t frame time, the Ipixel‟s value can then be classified as foreground pixel if the inequality: $|I_t - \mu_t| > k\,\sigma$ holds; otherwise, it can be considered as background, where k is a constant and σ is standard deviation. Here background is updated as the running average:

The proposed background subtraction method, we capture frames from camera. Then we model the (t-1) frame as a background model which we are referring for the object detection & extraction from the current frame.

III.OBJECT TRACKING BASED ON COLOURED OBJECT

Object tracking means identifying & following same object in sequences of video frames. Camera is used as input sensors to acquire frames to form the video. The acquired video may have some noise due to bad (light, wind, etc. or due to problems in sensors). To remove noise from captured frames noise reduction technic is used to improve the image quality, to detect moving object, based on colour of the moving object in frame. Extraction of objects from frame using the different features is known as object detection. Every object has a specific feature based on its shape.

Applying background extraction algorithm, the object in each frame can be extracted out. The camera is capturing 30fps. The implementation is initially performed on matlab and various methods for object tracking are tested. The process of indicating the moving object in sequence of frames is known as tracking. This tracking can be performed by using the feature extraction of objects and detecting the objects in sequence of frames. We are tracking the object are on basic colour RGB, to be detected object in frame we differentiate gray scale input image frame with coloured image frame to indicate coloured objet in video.

A. Rectangular Bounding Box

A rectangular coloured bounding box is plotted around the foreground objects detected from GMM based Background subtraction. By using the dimensions of rectangular bounding box, a centroid is plotted. The position of the centroid is stored & object is bounded in box.

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.

Fig 1.Background Mode

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Fig. 2 Current Frame

Fig.3Foreground objects detected

VI.CONCLUSION

In this paper, a real-time video of moving object detection and tracking is proposed, based on background subtraction. For object detection, we propose reliable background model, uses thresholding method to detect moving object and update the background in real time. At last the moving object is tracked by finding colour. This method is beneficial for time efficient, and it works well for small numbers of moving objects. Target detection and process is realized on the video image. Video image data of the human body is processed, and its geometrical centroid is obtained in different time intervals depending upon colour it are getting tracked.

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