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Detection and Tracking of Moving Object: A Survey

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ABSTRACT
Object tracking is the process of locating moving object or multiple objects in sequence of frames. Object tracking is basically a challenging problem. Difficulties in tracking of an object may arise due to abrupt changes in environment, motion of object, noise etc. To overcome such problems different tracking algorithms have been proposed. This paper presents various techniques related to object detection and tracking..The goal of this paper is to present a survey of these techniques**.**
Keywords **-** Object tracking, Object Detection, Object Classification, Video Surveillance

I. INTRODUCTION

Detection and tracking of moving object is challenging but essential task in video surveillance system. Modern world requires fast video surveillance system. The video surveillance system is designed to be directed on detection of events of interest, classification and tracking of moving objects. Moving object detection and tracking has its application almost in every filed including military, offices, banks, school for security purpose. Automatic video surveillance is very important for the field of security. The task of reliably detecting and tracking moving object detection and tracking namely radar technology and image processing technology. In this paper image processing technology is used for detection and tracking of moving object. Detection, classification and tracking are the three important steps for any object detection and tracking system. The objects of interest are first extracted from the sequence of frames then segment them from background and track them across different frames while maintaining their identity. The object detection and tracking algorithm is not only Limited to video surveillance system but also in other application domain such as virtual reality, video compression, human machine interface, video editing and multimedia database.

II. LITERATURE SURVEY

C. Hsia et al. [1] presented an approach in which symmetric mask-based scheme (SMBS) is used for detection of moving object and symmetric mask-based discrete wavelet transform (SMDWT) for tracking of an object. A fast algorithm called 2-D SMDWT, to improve the critical issue of 2-Dlifting based DWT (LDWT) and then obtain benefit of low latency reduced complexity and low transpose memory for object detection. The SMBS approach effectively reduces noise with low computing cost in both indoor and outdoor environments.

F. Jafarian et al. [2] presented an algorithm to detect a moving target (foreground moving target) in an image with variable and complex background. In this method, canny filter and GVF active contour are used to extract the edges of all the objects in an image and then wavelet transform is used for the detection of an target. The new boundary detection method is used to extract boundary of target. As a result, background is removed and target is extracted. Neural network is used to detect type of motion and to intellectualize the algorithm.

To reduce the temporal, spatial and spectral redundancies in video frame sequence for similarity between current and the prior image K. Dinesh et al. [3] proposed a new video coding algorithm based prediction coding. This algorithm employs adaptive strategy based on normalized cross correlation and partitioning for motion detection and object tracking in frame sequence.

O. Praksh et al. [4] proposed Daubechies Complex Wavelet Transform (DaubCxWT), because of its approximate shift invariance nature use of this transform is suitable to track the object from video sequences. Tracking of object in first frame is done by computing the Daubechies complex wavelet coefficients corresponding to the object of interest and then matching energy of these coefficients to the object neighborhood, in Daubechies complex wavelet domain, to perform tracking in next consecutive frame. The advantage of this algorithm is that this method needs only complex wavelet coefficients for tracking and hence it is simple in implement at on and tracks object efficiently.

There are many problems associated with object detection and tracking such as illumination changes, fake motion, image noise, ghost image. To overcome

such problems, N. Bhandari et al. [5] proposed a system based on particle filter algorithm. For detection of moving object, edge detection and its location in frame are important. V. Satpute et al. [6] proposed discrete wavelet transform (DWT) for edge detection whereas to locate the object, variance method on to the 2-D DWT output of video frames. HAAR wavelet is used as reference for this analysis due to its ease of implementation and inherent properties.

B. Antic et al. [7] proposed a multi-resolutions frame differencing technique in which first each frame is decomposed into undecimated wavelet transform coefficients and then differencing scheme is applied on wavelet coefficient in several bands separately. N. Kasundra et al. [8] proposed an algorithm for moving object detection and tracking in presence of illumination change. He proposed Discrete Wavelet Transform (DWT) and Discrete Cosine Transform (DCT) based tracking algorithm. These methods provide the illumination invariant features.

S. Chang et al. [9] proposed a novel human body tracking system based on Discrete Wavelet Transform (DWT) for identifying target based on color and spatial information. The tracking system consists of a CCD camera which is mounted on a rotary platform for tracking moving objects. By using the position information of object in the image frame captured by the camera, rotary platform is controlled to position the tracking object around the central area of images to improve tracking efficiency.

S. Datla et al. [10] proposed a framework which attempts to attain a light weight tracking system by reducing undesirable and redundant computation. The frames from video are passed through pre-processing stage after which only motion detected blocks are transmitted to the tracking algorithm. Further the frames with less motion in the search area of target object are detected in pre-processing stage and area of target object are detected in pre-processing stage itself are blocked from further pre-processing. S. Thorat et al. [11] proposed normalized cross correlation method for detection of moving object, the proposed algorithm has the benefit of component connected analysis for tracking of moving objects and real time video streams compression of with high reliability. After dividing the two successive video frames from sequence of video frames into four parts normalized cross correlation is applied. The sub frame with minimum value of NCC is then determined to detect the occurrence of moving object in it and then tracking is performed. First Location of moving object is important for tracking by investigating connected components and by morphological dilation operation, then after calculation of centered target is calculated for tracking of moving object.

V. Reddy et.al. [12] Presented a novel algorithm for moving object tracking based on position vectors. The position vector of an object in first frame of video has been extracted based on selection of region of interest (ROI). In this algorithm, object motion has shown in nine directions based on position vector in first frame. Nine position vectors for nine different directions are extracted

To differentiate whether the detected object is either a vehicle or a human being M. Bhajibhakare et al. [13] proposed a system which can be applied in home and business surveillance system to detect and track moving object. Colour background modeling along with sensitivity parameter (delta) is used to remove noises and to detect and track moving objects easily. Blog labeling is used for grouping of moving objects. Then morphological operations like dilation and erosion is used to remove noise under surveillance.

R. Bhambare et al. [14] proposed wavelets algorithm to track the object and show resulting improvement in tracking. This is useful for high performance real-time applications. The proposed method is suitable for indoor as well as outdoor scenes with static background and overcomes the problem of stationary objects fading into background. J. Wang et. Al. [15] proposed an object tracking algorithm based on multi feature fusion feature points tracking is used to reduce the match time and improve the real time of tracking. To overcome the inaccuracy of a single feature tracking, the object model is presented by the color and texture features. For the traditional "current" statistical model in maneuvering object tracking defects, an improved algorithm which combined with adaptive kalman filter (AKF) is proposed to improve tracking efficiency.

M. Sood et al. [16] proposed background subtraction method to detect the moving object. A reliable background updating model is established. A reliable background updating model is established. A dynamic optimization threshold method is used to obtain a more complete moving object. Morphological filtering is introduced to eliminate the noise and contour projection analysis is combined with the shape analysis to remove effect of shadow. S. Tuli et al. [17] proposed a method in which edge maps are derived from two successive frame difference and background frame difference. Then moving edges are found by computing these two edge maps and moving edge region is computed. Finally, moving object region of current frame is extracted based on the determined edge region.

S. Golzar et al. [18] proposed a method in which a moving object selected by the user is segmented and the dominant color is extracted from segmented target. Then the dominant color of moving object in HSI color space will be used as a feature to detect the

moving object in consecutive video frames. The detected result is fed back as the measurement of adaptive kalman filter and the estimate parameters of adaptive filter are adjusted by occlusion ratio adaptively.

K . Yang et al. [19] presented an algorithm in which first the average of values & the gray of the continuous multi-frame image in the dynamic image, and then get background image obtained by statistical average of the continuous image sequence, that is the continuous interception of the N-frame are summed, and find the average. In this case, weight of object information has been increasing, and also restrains the static background. Eventually the motion detection image contains both the target contour and more target information of the target contour point from the background image, so as to achieve separating the moving target from image.

III. TARGET TRACKING SYSTEM

Tracking of target is a crucial task. There are various applications that require an efficient detection as well as tracking system. Object tracking have to go through number of stages. The block diagram for tracking system is shown in Fig.1

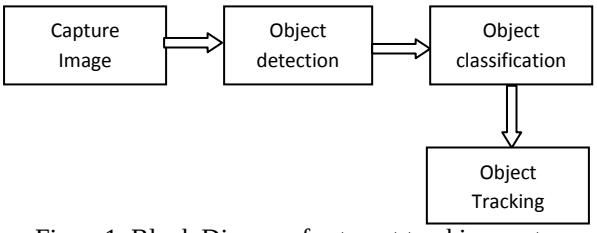

Figure1. Block Diagram for target tracking system

The main steps required for any tracking system are object detection, object classification, feature selection and object tracking. The initial stage of any target tracking system consists of object detection followed by classification and feature extraction and finally tracking. There are various methods for detection. Classification & tracking. There are various methods for detection, classification and tracking of objects. The input image can be from any CCTV camera, web camera or digital camera. The details of various methods are described in following section.

IV. OBJECT DETECTION METHODS

Object detection is a task of finding and identifying object in an image or video sequence. Object can even be recognized when they are partially obstructed from view. This task is still a challenging problem for computer vision systems. Over year many methods have been developed for object detection. These method are explained as follows.

A. Background Subtraction Method.

Background Subtraction, also known as foreground detection is a technique in the field of image processing and computer vision where an image's foreground is extracted for further processing. After the stage of image preprocessing which include image denoising, post processing like morphology object localization is required this may make use of this technique. Background subtraction is widely used approach for detecting moving object in videos from static camera. Detecting the moving object from the difference between the current frame and a reference frame is background image or background model. Background subtraction method is sensitive to change in external environment and has poor anti-interference ability.

B. Optical Flow Method.

Optical flow is the distribution of the apparent velocities of object in an image. By estimating optical flow between video frames, one can measure the velocities of object in the video. In general, moving objects that are closer to the camera will display more apparent motion than distant objects that are moving at the same speed. Optical flow estimation is used in computer vision to characterize and quantity motion of object in video stream, for motion-based object detection and tracking systems.

C. Frame Differencing Method.

Frame differencing is a technique where the computer checks the difference between two video frames.

V. OBJECT CLASSIFICATION METHOD

After detecting the object of interest from sequence of frames, the object is classified by assigning each object to a class based on features.

The definition of feature varies widely. For this purpose feature describes various characteristics like shape, size, color, motion of target image. Following various feature are used for object tracking.

A. Edges:

Object boundaries usually generate strong changes in image intensities. Edge detections is used to identity this changes. An important property of edges is that they are less sensitive to illumination changes compare to color features [20].

B. Motion:

Non-rigid articulated object motion shows periodic property, so this has been used as a strong cue for moving object classification [21]. Optical flow is also used to tract the motion of object.

C. Color:

All video frame formats are based on different color spaces model. The data of different frame can be stored in dissimilar color spaces ranging from gray scale, RGB, YCbCr and HSB color spaces. Color images are denoted as read (R), green (G), Blue (B), or RGB.

D. Texture:

For identifying the target or object of interest texture is used. It is a measurement of intensity variation of a surface which quantifies properties such as smoothness and regularity [20].

VI. OBJECT TRACKING METHODS

The purpose of target tracking is to generate the root for an object above time by finding its position in every single frame of video. Object tracking can be classified as point tracking, kernel tracking and silhouette based tracking.

A. Point Tracking Method

Point tracking is reliable, robust and accurate tracking method developed by Veenman. Moving object are represented by their feature points. Point tracking is further divided into two categories namely deterministic and statistical methods. Object tracking is based on point which is represented in detected object in consecutive frame and association of points is based on previous object state [20] . An external mechanism is required to detect object in every frame.

B. Kernel Tracking:

Kernel refers to the object representation of rectangular or ellipsoidal shape and object appearance. The motion of the object is computed from frame to frame. The motion of the object is in the form of parametric motion or dence flow field computing in subsequent frames. Kernel tracking is further classified as simple template matching, mean shift method support vector machine and layering based tracking. In simple template matching a reference image is verified with the frame that is separated from the video, tracking can be done for single object in video [21]. Translation and scaling is used to track the motion of the object, then rectangular frame is used to define object of interest. Then tracked object is separated from background. Training set of values are used by simple vector machine. These are contained by positive value whereas target which are not tracked are contained by negative values. Multiple objects can track in layering based tracking [22].

C. Silhouette Tracking:

When complete object region is required silhouette tracking is used. There are various objects which have complex shapes like hand, human body, head these shapes can be accurately described by silhouette based method. The goal of silhouette tracker is to find the object region in each frame by means of an object model generated using the previous frames. Silhouette tracking can be classified into two categories namely Shape matching and Contour tracking.

VII. CONCLUSION

In this paper, literature survey on object tracking approaches have been presented also a brief review of the related topic is presented. The tracking approaches are divided into three categories, object detection, object classification and object tracking. Various methods are used for object detection, object classification and object tracking. Various methods are used for object detection and tracking. In this a survey related to object detection and tracking has been describe. Advance study may be carried out of find efficient algorithm to reduce computational cost and to decrease the time required for tracking the object for variety of videos.

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