

A Critical Survey on Detection of Object and Tracking of Object With different Technique with Comparision

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Abstract: Basically object detection and object tracking are two important and challenging aspects in many computer vision applications like surveillance system, vehicle navigation, autonomous robot navigation, compression of video etc. Object detection is first low level important task for any video surveillance application. To detection of moving object is a challenging task. Tracking is required in higher level applications that required the location and shape of object. There are three key steps in video analysis: detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behavior. Object detection and tracking especially for human and vehicle is currently most active research topic. A lot of research has been undergoing ranging from applications to noble algorithms. The main objective of this paper is to review (survey) of various moving object detection and object tracking methodologies.

Keywords: Object Detection, Object Tracking, Object Classification, Video Surveillance.

I. INTRODUCTION

Video 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. Actually Videos are sequences of images, so each of this called a frame, displayed in very fast enough frequency so that human eyes can catch the continuity of its content. In image processing many techniques can be applied to each and every individual frames.

There are three key concepts in video analysis: detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behavior. A general object detection have many algorithm, which are desirable and efficient, but it is extremely very difficult to properly handle unknown objects with variations in color, shape and its texture. Therefore, various applications of computer vision systems assume a fixed and stable camera environment, which makes the object detection process much more powerful. Object tracking is to track an object either object is single or multiple over a sequence of images. Object tracking is used to locating an object or multiple objects over time using by a camera.

Here we just mention the brief idea of basic steps for object tracking, as describe in many survey.

1) Object Detection

Object Detection is a technique to identify certain objects of interest in the video sequence. Object detection is a process which deals with detecting particular objects of a certain class, such as humans, vehicles or buildings. Detection of object can be done by different methodologies such as frame differencing, Optical flow and Background subtraction.

2) Object Classification

Object can be classified in different way such as birds, vehicles, floating clouds, swaying tree and other moving objects. The approaches to classify the objects are Shape-based classification, Motion-based classification, Color based classification and texture based classification.

3) Object Tracking

Object tracking is an important task or it is perform after object detection step. Object tracking is define as a technique or methodology used to track the number objects and also direction of objects traversing a certain passage or entrance per unit time. They have different technique to track the objects are point tracking, kernel tracking and silhouette tracking.

Here the structured of paper are in following manners: Section 1 gives basic introduction to object tracking. Section 2 deals with brief explanation on several object detection methodology. Section 3 consists of detailed study on object classification methods and Section 4 describes object tracking methods. Section 5 provides conclusions.

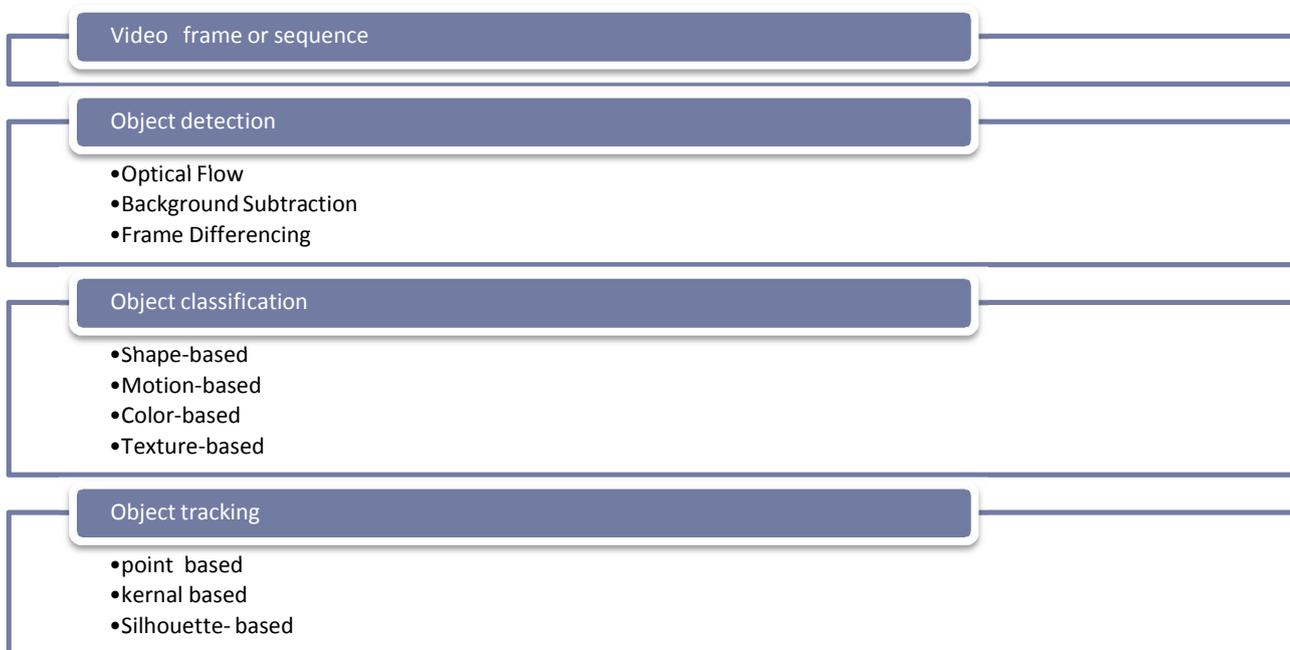


Fig 1: different object tracking steps [8]

II. OBJECT DETECTION METHODS

In process of object tracking first step is to identify objects of interest in the video sequence. Most method are focus on the detection of such objects. Detailed of object detections methods are given below.

A. Frame differencing

The presence of moving objects is determined by calculating the difference between two consecutive images. The calculation of this method are very simple and easy to implement. there are lots of dynamic environments, that is much harder to detect object but it has a strong enough to detect the object, but it is generally difficult to obtain complete outline of moving object. by using this method result is not enough accurate.

B. Optical Flow

Optical flow method [1] is to calculate the optical flow field of particular images. by using this method we can get the complete movement information of that object and to detect the moving object from the background better, in this method there are many disadvantages are over there large calculation, time -consuming ,sensitivity to noise, poor anti- noise performance, it not suitable for real-time application.

C. Background subtraction

Background subtraction method is the efficient method for tracking the objects in real time. Because this method is able to track all the moving objects in the video frames. In this method, the background is kept as stable. This method works on outside or inside both background. Comparing to the other methods, this is the most efficient and easiest way to track all the moving objects in the video frames.

Recently for moving object the background subtraction method is to use the difference methodology of the current image and background image to detect moving objects, with simple and easiest algorithm, but very sensitive to the changes in the external environment and has poor anti- interference ability. However, it can gives the complete information of the object in the case background is known.

Table 1. Comparative study of object detection methods [8]

	<i>frame differencing</i>	<i>optical flow</i>	background subtraction
Accuracy	High	Moderate	Moderate
Calculation Time	Low to Moderate	High	Moderate
Advantage	Easiest Method Perform well for static background	It can produce the complete information.	Low memory requirement
Disadvantage	It requires a background without moving objects	Require Large amount of calculation	Low memory requirement

III. OBJECT CLASSIFICATION METHODS

After detection of object, the next step is to perform classification of object. As per different survey; approaches to classify the objects are as follows:

A. Shape-based classification:

In this type different shape descriptions of information of motion regions such as representations of points, box and blob are available for classifying moving objects. this method is Simple pattern matching approach. It does not work well in dynamic situations and is unable to determine internal movements well.

B. Motion-based classification:

Object motion shows a periodic property for Non-rigid object, so this method is used as a strongly used for moving object classification. This method does not require any type of predefined pattern templates but it has been struggles to identify a non-moving human.

C. Texture-based classification

Texture based technique [8] counts the occurrences of gradient orientation in localized portions of an image, is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy

D. Color-based classification

Unlike many other image features (e.g. shape) color is relatively constant under viewpoint changes and it is easy to be acquired. Although color is not always appropriate as the sole means of detecting and tracking objects, but the low computational cost of the algorithms proposed makes color a desirable feature to exploit when appropriate.

According to paper [8], table 2 describes comparative study of classification methods using accuracy and computational time. Advantages and limitations of various techniques are also described in table 2.

Table 2. Comparative study of object classification methods [8]

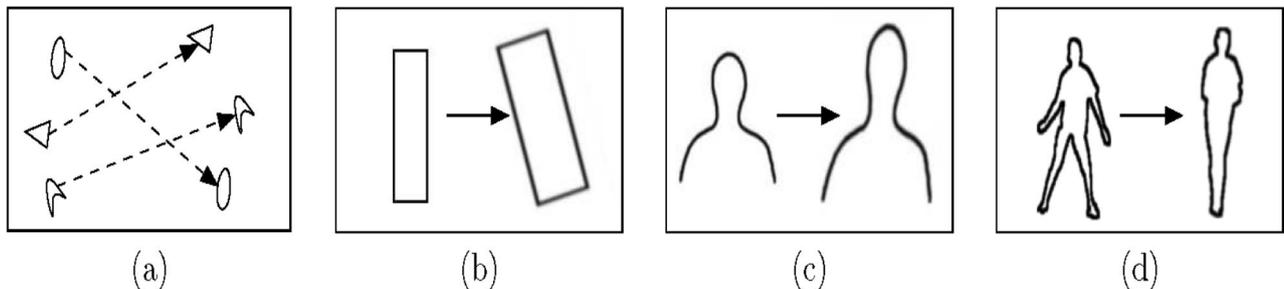
	<i>Shape-based</i>	Texture-based	Motion-based	Color-based
Accuracy	Moderate	High	Moderate	High
Calculation Time	Low	High	High	High
Comments	Simple patternmatching approach. It does not work well in dynamic situations and is unable to determine internal movements well.	Provides improved quality with the expense of additional computation time.	Does not require predefined pattern templates but struggles to identify a non-moving human	It creates a Gaussian Mixture Model to describe the color distribution and to segment the image into background and objects

IV.OBJECT TRACKING METHODS

After classification of object, the object tracking is performed. Object tracking is define as a technique or methodology used to track the number objects and also direction of objects traversing a certain passage or entrance per unit time. The main purpose of an object tracking is to generate the route for an object above time by finding its position in every single frame of the video [5]. According to paper [10], Object tracking can be classified as point tracking, kernel based tracking and silhouette based tracking. Tracking methods can be divided into following categories:

A. Point Tracking

In this approach object can be represented as a point in fig (a). This approach requires an external mechanism to detect the objects in every frame. In an structure of image, moving objects are represented by their feature points during their tracking. Point tracking [10] is a complex or quit difficult problem particularly in the incidence of occlusions, false detections of object. Recognition can be done relatively simple, by thresholding, at of identification of these points. in this approach the point tracking is done by different technique like Kalaman filter , Particle filter etc.



B. Kernel Based Tracking

Kernel always refers to the object shape and appearance in fig (b). for example, the kernel can be a either rectangular template or an elliptical shape with an associated histogram. Kernel tracking [9] is usually performed by computing the moving object, which is represented by a embryonic object region, from one frame to the next. These algorithms diverge in terms of the presence representation used, the number of objects tracked, and the method used for approximation the object motion. In real-time, illustration of object using geometric shape is very common. But one of the limitation over here is that parts of the objects may be left outside of the defined shape while portions of the background may exist inside. This can be also detected in rigid and non-rigid objects .They are large tracking techniques based on representation of object, object features ,appearance and shape of the object. in this approach the kernel based tracking is done by different technique like *Simple Template Matching, Mean Shift Method, Support Vector Machine (SVM)*etc.

C. Silhouette Based Tracking Approach

While tracking some object will have complex shape like hand, fingers, shoulders that cannot be well defined by simple geometric shapes. Silhouette based methods [9] deals with an accurate shape description for the objects. The goal of a method is to find the object region in every frame by means of an object model generated by the previous frames. Capable of dealing with variety of object shapes, Occlusion and object split and merge in this approach the kernel based tracking is done by different technique like Contour tracking, Shape matching etc.

V. CONCLUSION

In this paper we survey the extensive survey of object tracking methods like object detection, object classification and object tracking has been studied methods for these phases have been explain over here and a give a comparison of each and every methods were highlighted in this paper. By using frame difference, optical flow and background subtraction we can perform object detection. Same as object tracking can be performed by using different methodologies point tracking, kernel tracking and Silhouette tracking. Object tracking method have further classified in different technique like kalman filter, particle filter ,SVM ,mean median etc. summarized that for detection of object, background subtraction is a simplest method providing complete information about object

compared to optical flow and frame difference for detecting objects. providing complete information about object compared to optical flow and frame difference for detecting objects.

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