Challenges and issues in intelligent video surveillance system

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Abstract

Image processing is the analysis and manipulation of a digitized image in order to improve its quality and extract some information from image raw data. For that, Object detection is one of the principal tasks for surveillance application. Most important and typical task in intelligent surveillance application is to detect an object which is based on very important parameter which is type of camera, image quality, fixed object or moving object, and object position with shadow including different lighting condition and its behavior in natural or mock environment etc. In this paper author discuss major issues & challenges in video surveillance.

Keywords:- Image Processing, object detection, video surveillance, PTZ, motion, tracking

I. Introduction

Surveillance is the monitoring of the behavior, activities or other changing information for specified area. It's usually of people or other object for the purpose of influencing, managing, directing, or protecting valuable assets.

Surveillance cameras are video cameras used for the purpose of observing an area. It has been observed by particular bureau, whole activity is known as video surveillance.

Object detection for video surveillance is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class in digital images and videos. To detect and handle any unauthorized activity, object detection is principle & most important task for any video surveillance activity.

In Image processing for surveillance system an essential requirement is it desires good quality of image for accurate detection [1, 2, 3]. Because noise in image is really trouble in any image processing application here it requires approach that remove noise [47] to improved object detection activity. Another common parameter is Camera type weather it can be fixed or movable; if camera is movable then it is very challenge task to detect any object with different moving position [4, 5, 6, 7]. As in movable camera at every moment some objects appear and some objects removed [24]. Also in PTZ camera same object can looks smaller or larger [8, 38]. Depend on area observed camera could be selected; it could be indoor or outdoor camera for surveillance [17, 18]. In observation of different object, mainly it would be fixed object [9] or movable object [10]. If the object is movable then will have to observe object in its movable situation with different direction or in different shape. Also it is very critical when object will occlude or overlapped by other object [11]. In such situation fixed object can also be moved in accident, bomb blast, cyclone or any other natural [12] or manmade activity [13, 15]. In fixed object or in movable object, it always has their shadow with different lighting condition [16]. Shadow also critical parameter in both indoor and outdoor cameras with different lighting condition either sunlight or artificial or both [17, 18, 19, 20].In outdoor camera an additional parameter is environment change like rain, dew, fire, cyclone, wind, moisture or humidity [21, 22]. Sometimes combination of

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rain and wind where fixed object like tree will move a lot and search object occlude by it [23]. Here object overlapping is forever very challenging issue, particular in crowd area or if there are large numbers of moving object in a scene [24]. Color is also very important parameter when foreground objects color and background color is a bit similar [25, 26]. Object reflection in mirror or other type glass will create ambiguity and require more effort to maintain object integrity [27]. During indoor camera surveillance, where there is possibility of violates the privacy of the individuals, because the system may record their activities in the living room, bed room or bathrooms [28, 29].

The main aim of intelligent video surveillance is to track numerous objects using multiple cameras that synchronously and track object more reliably. Very clear purpose of synchronized object detection is to observe single object from different angle to check object integrity.

II. Major issues in intelligent video surveillance system

Object category for detection purpose most of approaches has been developed which detect human, vehicle, digits, character in different language etc. For human, it detects and identifies male, female and children [30]. From clothes and other gesture information it identifies other human attributes like age, religion etc. In vehicle detection [31] it identify object is cycle, bicycle, car, truck or any other vehicle object. Several methods that identify car belong to sedan, hatchback or XUV category. Different tool and algorithm detect digits and text that are written in local language [32]. Detected object can be in different pose or situation but its attribute must be same [33]. For e.g. color, shape. But these approaches will not work in all the condition. In above discuss major issues of video surveillance and following are the current trends need to be consider in object detection for video surveillance.

In intelligent video surveillance system to handle or track any meticulous issue opaque approach has been developed that are effectively work in certain environment. Following are listed issues with most likely remedy.

A. Movable Object

It is not achievable to predict the direction and shape of movable object in video scene. Major issue is if movable object is occluding by another object [9]. Challenging issue is if occlude object is also non stationary object [10]. Sometimes target object is partially hidden or full hidden inside occlude object where it is very difficult to keep integrity of search or target object [13]. So tracking of movable objects in surveillance area about their activity and thereby detecting any threats about any anti-social behavior [14]. No standard or generalize approach is made for detect movable object. Different approach has been developed based on number of objects are there in one field of view [13, 14, 15]. Speed of object will mater with accuracy of object detection approach [24, 25]. Mainly in crowd where many objects are moving in individual direction also some object completely hidden by other objects.

Reflection adds noise in image data because sunlight or other manual light appear in mirror or other glass and due to this, original object not looking very much clear [34, 35]. The complexity increases when there are multiple objects & all of them are reflected [26, 27, 49]. If colors & surroundings of the background resembles exactly to foreground, then it is extremely difficult to segment the portion of the foreground objects [36, 37, 50].

Following are major parameters need to be consider in moving object detection.

(i) Illumination (Lighting Condition)

In video surveillance it's very difficult to detect moving object particularly when the objects have shadows and ghosts due to various lighting

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condition [16, 17]. E.g. clouds covering the sun in outdoor scenes or lights turned on or off in indoor scenes. So here in image same object seems in different position with different lighting condition [19].

(ii) Shape

By using partially overlapping blocks it is possible to extract the shape of the moving object more accurately than in the case of non-overlapping blocks [37]. So error in shape description (i.e. boundaries) is propagated and therefore these techniques are not suitable. Furthermore, as expected, the classification does not depend on object size and orientation. E.g. moving bushes and grass because of wind are correctly rejected as background clutter [36].

(iii) Texture (SURFACE)

Texture is extracted along the edge region to identify moving edge segment using most recent frame [24]. This fusion of texture and edge segment information helps to obtain the geometric information of edge in the case of edge matching. Detected moving edges are utilized extracting video object plane with more accurate boundary [25].

(iv) Dynamic Background Model

It is likely that objects may modify their status from stationary to non-stationary or vice versa [5, 6]. The reason of this drawback is that initially a static background is assumed, and suppose the objects of background comes into motion and hence needs to be switched to foreground area and removed from background model. So a background model needs to be updated that is adapted to changes and become dynamic model [7]. The major challenges in making the background model dynamic are how to update the background model, and how to determine the threshold for classification of foreground and background pixels [8].

(v) Speed Estimation

Speed of movable object is very critical parameter in moving object detection. If the object is appearing very speedily in several frames then it seems to be a difficult job to detect due to occlusion [37] with other object. So before the object can be tracked after its movement is detected, it disappears from the vision due to its extreme speed [10, 13].

(vi)False Detection

The detection accuracy can be measured in terms of correctly and incorrectly classified pixels during normal conditions of the object's motion (i.e. the "stationary background"). The second problem is that the background model should immediately reflect sudden scene changes such as the start or stop of objects [18], so as to allow detection of only the actual moving objects with high reactivity (the "transient background" case). If the background model is neither accurate nor reactive, background subtraction causes detection of false objects [16, 20] referred as "ghosts".

B. Lighting and Environment Issue

Each object can have its own shadow but it is depend on sun light for outdoor surveillance and for indoor consider both manual light and sometimes sunlight [14]. Problematic situation is when object can have multiple shadows in different direction. Movement of object causes shadow movement, and shadow is based on various lighting condition [16, 17]. During night, vision shadow depends on intensity of electric multiple lightings [18] with slightly different light shadow. In indoor surveillance sunlight does not affect, so object can have same shadow in all situation based on manual light [19, 20].Success rate if fine for outdoor surveillance where will have to consider only sunlight and its shadow [16]. But in manual lights including sunlight is with object shadow where its success rate going down [48].

In surveillance area for image quality get scare when image includes snowfall, rainfall, storm or fog [21] and in result image is not seem very accurate for object detection. The changes due to above factors introduce difficulty in monitoring

as the object can't be viewed clearly as it seems like image smudge [22]. Also it becomes difficult to recognize the identity of detected object due to poor vision [23].In day condition to remove noise from image such approach has been developed that work with neighbor pixel measuring method [22]. Still its experiment result goes down in night vision [23].

Following are major parameters need to be consider in object detection with lighting and shadow with environment issue.

(i) Quick lighting changes with shadow
In indoor video surveillance due to manual lights of different type which can suddenly on or off. So in neighbor frame same object seems different including same object's shadows affect of light on-off situation [16, 42].

(ii) Same object in different in multiple cameras
In same field of view if there are multiple cameras so it's quite possible that same object shown in different camera. Here issue is if object shown clearly from one camera but it occlude by another object [38, 43] in different camera view. So issue is very difficult to check object integrity [6] and lost object track.

(iii) Malfunction of sensor
In case of fog, smoke or fire kind of situation sensor produce wrong output and result is false alarm [44]. That produces unnecessary confusion.

(iv) Effect of Rain, Snow, Fog and Smoke or Fire
In image if there is rain, snow, fog, smoke or fire effect, where it is very difficult to clear this image for object detection and identification [22]. Various approaches like reference of previous frame are developed still its success rate is not more than 60%.

(v) Fire and rain with lighting condition
It is challenging task to detect object from image if it has some issue of fire, rain etc. It is more challenging if has this issue including various lighting condition change as well [45,

46]. Like in night scene with raining it is very challenging to search or detect an object.

(vi) Combination of manual light and sunlight
Sometimes the detection area includes sunlight and artificial light both that causes abrupt changes in illumination [16]. So in this case, it is difficult to detect or identify the object in video surveillance.

C. Multi Camera View
Object detection is very important and critical task for prevention any illegal activity. Sometimes it is not possible to detect integrity of particular object from one dimension [39]. So for checking integrity of that object, cameras need to maintain track of its earlier activities or same activity observed from different camera angle. Also to avoid any false detection, applications have synchronized multiple camera views to accurately track of detected object also for taking certain action.

In a multi-camera tracking method, all cameras focus at the same ground plane and establish association for tracking the same object observed in different camera views [40]. In order to track people across multiple cameras, first of all need to set relationship among cameras in same FOV (Field of view). The approach can, however find this information by observing motion in an environment [41].

III. Conclusions
This paper provides basic parameters of any object detection in video surveillance environments. These parameter like camera type fixed or movable with normal or PTZ, importance of image quality, fixed or movable objects in various situations, object with sunlight or manual lighting with their shadow, object integrity during various environment changes like rain, dew or moisture, issue of object overlapping, color of foreground and background object, object inside another object

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etc. Among that, in detail discuss stationary and moving object, various lighting and environment issues and multi camera view for adding intelligence in surveillance system.

IV. Further work (Research Gap)

To deal with large number of objects in video surveillance when multiple cameras and objects involve in the system, the processing at all cameras should be balanced to avoid camera computational overloading. Certain approached need to be developed and triumph in vital harvest situation (like snowfall, rainfall, storm or fog, dew etc) for detect movable object. As it require multiple approach worked simultaneously in video surveillance that deal with different lighting condition including day and night vision along with various climate condition. Furthermore, this approach should work in multi camera environment so object detection produces higher success rate result to check object integrity.

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