Survey on AIAOD: Advanced Intelligent Abandoned Object Detection

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Abstract— Object detection and tracking is a very challenging task in image processing. This paper discusses about various object detection and tracking methods for crowded area such as airports, railway stations, shopping malls, residential apartment . Three major steps in video surveillance analysis are detection of moving objects, track those objects from frame to frame and recognise behaviours of those track objects to find out for suspicious activity detection. This paper mainly highlights the various object detection, object representation and object tracking techniques which are performed by different researchers in the past. This survey focused on different object detection using - background subtraction, fuzzy logic, temporal logic, hadoop, via temporal consistency modelling, nonflat static objects detection, abandoned detection of object in real time environments, detection of object on the basis of 3-dimensional image information. The usage of object tracking is for public safety, for efficient traffic management on roads , to fight against crime and terrorism.

Keywords— *Abandoned Object Detection, Surveillance Systems, Fuzzy Logic, Temporal Logic, Consistency Model Etc.*

1. INTRODUCTION

Automated and intelligent security systems have become need in recent times due to an increasing demand of such systems for public and private security of human being. Abandoned detection of object is important research topic in the field of computer vision as well as Image processing with several real time applications. Processing of image is method to convert image into digital form. It is also useful to perform some operations on it in order to get enhanced image or extraction of some useful information. The input to the system will be image like video sequence or photographs and the output generated from system will be an particular image with some characteristics associated with it. Image processing operations are useful for image sharpening, image restoration, image visualization, image retrieval, pattern measurement which measures various objects in an image and recognition of image to differentiate the objects in the image. Image processing is classified into two major method like Analog and Digital. Analog method is used for the hard copies such as print outs and photo graphs while digital method helps to manipulate digital images with the help of computers for example- Adobe photoshop.

Abandoned Object Detection is nothing but detection of abandoned objects which are idle or stationary objects that remain constant for certain period of time. The time period may be adjustable, in several types of images and video sequences idle objects should be verified. for example anyone left his/her bag in the shopping mall. Basically unknown objects are those objects which can't move.

1.1 OBJECT DETECTION & TRACKING

1.1.1 OBJECT DETECTION

In a simpler way object detection is nothing but detecting a particular object in an image. Object detection can be defined as a process in the computer vision of finding as well as identifying objects in an image or video frame. This is still very challenging task for computer vision systems. There are several approaches to the object detection and tracking have been implemented over huge period of time.

Object detection is the task of finding an occurrence of something of real world objects like faces, cars, and apartments in images or videos. Object detection algorithm mostly uses extracted characteristics and learning algorithms to know instances of different object categories. The main applications of detection of object are security surveillance, cell counting in bio imaging, automated vehicle parking systems, image retrieval, video stabilization and many more. there are various models for detection of an objects.

There are lot of methods to recognize objects such as learning, matching, pattern recognition algorithm which can used appearance based / feature based techniques. Some of common techniques are gradients, histogram oriented gradients (HoG), edges, HAAR wavelets and linear binary patterns.. Firstly you have to extract the features , after that classify them with one of the classification method. One should choose a suitable method as per requirement of data.

1.1.2 OBJECT TRACKING

Next stage after object detecting is object tracking. In a simplest way object tracking is nothing but to track object or number of objects over a sequence of images. It is the

problem of determination or estimation of the positions and other equivalent information of moving objects in sequence of images. In the video sequence if object is changing its position with respect to its background then it is called as object in motion. The motion tracking of object is actually said to be the process of follow the object and keep its record in video sequence.

Object Tracking is a state of art which deals with estimation of the trajectory of an object in the image plane because it moves around a scene for
- tracking of object (car, person)
-Features Tracking
-single object tracking
-Multiple object tracking
-Tracking in moving camera
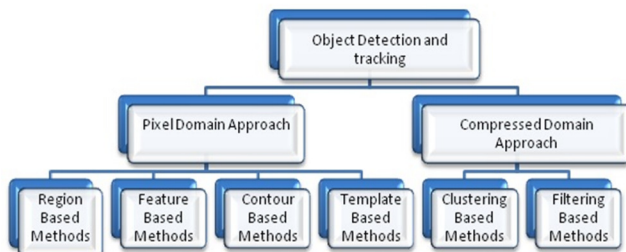
Figure[1]: Object Detection & Tracking Techniques

The two main methods of object detection & tracking are described as follows:
The two main methods of object detection & tracking are The pixel domain approach and The compressed domain approach. It is proved that pixel Domain Approach is much more accurate than the compressed domain approach, only it requires comparatively high resources. The compressed domain approach is not consume more resources because it exploits the encoded information.

A] Pixel Domain Approach-
This method of object detection and tracking implement original pixel data. data are perfectly decoded from compressed bit-streams like MPEG videos. The desired object detection can be performed precisely by defining various pixel domain models for example visual attention and object detection models, face detection and skin detection models.

The classifications of pixel domain detection are:

a)   Region Based Methods:
"The object detection is done according to features like motion distribution and colour histogram. The information with regard to the object colours can be useful when these colours are distinguishable from the image backgrounds or from other objects within the image."

b)Feature Based Methods:
"According to these methods, various motion parameters of feature points are calculated".

c)   Contour based methods:
"According to these methods, the shape and position of objects are detected by modelling and contour data".

d)   Template-based methods:
"In these methods, the objects such as faces are detected by using predetermined templates."

B] Compressed Domain Approach-
This approach of object detection and tracking exploits the encoded information like motion vectors which are extracted in a compressed bit stream. These algorithms are classified as; the clustering based and the filtering based methods.

a)   The clustering based methods:
The methods used to perform grouping and then merging all blocks into number of regions based on their spatial / temporal similarity. After that these regions are clubbed with each other and then classified as background /foreground region. Example- region growing approach

b)   The filtering based methods:
According to these methods foreground regions are extracted by filtering of blocks, which may be found in background or by classifying all blocks into foreground and background. Then by clustering procedure the foreground region is divided into different object parts.

Demerits:
The compressed domain approach results in a poor performance due to unreliability of encoded information, sparse assignment of the block-based data etc. It is applicable to simple scenario and poorly applicable for abrupt appearance changes and occlusions.

Merits:
-Fast processing time
-Adaptive to compressed videos.

2. DIFFERENT TECHNIQUES USED FOR OBJECT DETECTION AND TRACKING

2.1. A Simple approach
 To detect unknown and stolen things, the main focus is to determine static regions which recently changed in the scene by performing background subtraction[1]. The time and presence of static objects, which may be either abandoned or stolen, are marked on the video feed and may be used to alert security personnel. Our system can detect abandoned objects and is capable of performing this in real-time. No

special sensors are required and the results are shown to be satisfactory.

Advantages:
-It is a low-cost solution
-static regions are determined first

2.2 Based on dual background segmentation
By using benchmark datasets the unknown object detection system [2] is presented & evaluated . It works efficiently at QVGA resolution where number of CCTV operates. The preprocessing involves a dual time background subtraction algorithm in detail.
Advantages:
-A simple mathematical model
-Updates two sets of background dynamically

2.3. Integrated approach using background subtraction and morphological filtering
Unknown objects are determined by applying background subtraction and morphological filtering [3]. Hundreds of video streams are multiplexed in real time to recognize suspicious activities. The tracking module get input from camera tracking. Identify results and fuses these into object estimation.

Advantages:
-Automatic suspicious activity detection
-Improves safety and security

2.4. Using Background segmentation
This paper [4] represents the measures and algorithms for abandoned object detection system. Terrorist activities have threaten the life's of common people and has given a
flame for lack of security or the threat about losing their life's in such activities. In this paper, the main emphasis is given on tracking, alert system wide ranging which can be used for the detections of the explosive objects that may cause any harm.

2.5. Using Fuzzy Logic
This paper [5] represent three different features are extracted from the contour lines of the detected objects. These features are gathered using fuzzy inference system. After that by using template matching, human contour is identified. There are four main steps in the proposed method listed below:
1. Moving Object Detection.
2. Feature Extraction.
3. Feature Aggregation.
4. Human Contour Detection.

Advantages:
-It's a robust background to detect object

2.6. Using Moving camera
Abandoned object tracking is done with the help of matching reference and target video sequences[6]. That reference video was taken by a moving camera where there was no suspicious object in that scene. The target video was taken by a camera, the same route is followed for that. It may contain extra objects. The main objective was to find these objects.

Advantages:
-Uses moving camera for abandoned object detection

2.7. Percentage Reduction Approach
Recently the use of CCTV cameras for security purpose is increased .All the public places are now under the CCTV. Now state government has also made it compulsory to use CCTV for cooperative housing societies. This work is done to give the good quality abandoned object detection to enhance the security system[7].

Advantages:
- Gives the improved quality by changing image intensity

2.8. Background subtraction and foreground analysis
This paper [8] represent Tracking based approaches for unknown object detection which is unreliable in complex surveillance videos because of occlusions and lighting changes. It present a new framework which works efficiently to detect abandoned and removed objects. This is combination of background subtraction and foreground analysis. In this several improvements are added for quick lighting change adaptation, fragment reduction, shadow removal, and keeps a constant updates for video streams with different frame rates.

Advantages:
-The background is modeled by three Gaussian mixtures
-It handle complex situations

2.9. Three-dimensional image information
This paper [9] implements idea of an abandoned object detection system for road traffic surveillance
systems to reduced traffic accident which is mainly depend on 3D image information. They have implemented BIRR algorithm for implementation of new idea.

Advantages:
-prevent traffic accidents

2.10. Using Temporal consistency modeling
This is the useful method for detecting unattended luggage in video surveillance[10]. It club shortterm and longterm background models to extract foreground objects. In this method each pixel is treated as an input image and it is classified as a two bit code. Subsequently, static foreground

regions are identified using temporal transition of code patterns and to know whether the candidate regions contain abandoned objects by examining the back traced path of luggage owners.

Advantages:
    -It is simple spatial temporal tracking method
    -It performs considerably better than the single-image-based double background models
    - back-tracing verification

2.11. Using Hadoop

This paper [11] used a system for video surveillance which may improve the performance and efficiency in terms of process speed by using Hadoop Horton works Data platform 2.0. On the basis of literature survey , the system has been tried to solve the issues of existing system and achieved results considerable results if not commendable.

Advantages:
- Classify, Identify and update the unknown objects.

2.12 Using Temporal Logic

In this paper framework has described for "smart threat detection system" .In this system computer has used to capture, exploit & interpret the temporal flow of events related to the abandonment of an object. This method[12] uses related information and causal progression of events analysis to decide buzzer should raised or not.

Advantages:
-When unknown object is identify, then the system traces that unknown thing back in time to record and determine the probability of correct owner.

2.13 Periodic concept based framework

There is very much need of this system in important places. This system has vital role for detection of robbery,threads, burglary recording, monitoring of school area, crowd places and much more .so this can be useful for people safety whether they are in home or somewhere else [13].

Advantages:
-Multifunctional suspicious objects can be detected.

3. ISSUES AND CHALLENGES

Following are some issues that can be faced by Object detection techniques.

- Reducing the false alarm rate in abandoned object detection

Rapid detection of unattended packages left in public places is important to prevent security threats to people and property. The real thing is that it is most challenging for regular surveillance of public and laborintensive. So, know days the innovative automated unknown object detection systems has very much popular. An ongoing challenge in computer-aided detection is interference of benign stationary things, for example people sitting on benches being flagged as suspicious. The reason for this is that 'abandoned items' are usually defined as objects latest updated into the scene that have been stationary for a pre defined time period. As a result, any immobile object can be flagged as suspicious and it has chance to give false alarm number of time.

- Less Image Quality

The quality of images are poor due to these digital images undergo different forms of processing during capture of image, storage & transmission of the same and finally display to the consumer. There are chances to alter the appearance of an images, there exists a demand to assess the impacts of processing steps on final visual quality.

4. CONCLUSION

This research paper have been addressed the major aspects of object detection and tracking with different approaches. Various methods have been explained in detail and merits of each method were mentioned. This comparative study of different object detection and tracking techniques helps researchers to choose one of the best method which suites to their own application needs. Basically, this paper reviews the various aspects of moving objects to deal with security purpose.

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