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Survey on Abandoned Object Detection System

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Abstract— In recent years due to various kind of social activities such as theft, bomb attack and other terrorist attack preventive security measures at public places has gained lot of importance. Abandoned Object detection is most crucial task in visual surveillance system. Many Public or open areas are facilitated with cameras at the multiple angles to monitor the security of that area for keeping citizens safe. This is known as the surveillance system. In this paper a new algorithm is proposed for object tracking in video, which is based on image segmentation. With the image segmentation all objects in video can be detected whether they are moving or not by using segmentation results of successive frames.This approach definitely provides security and detects the moving object in a real time video sequence and live video streaming.

Keywords— video surveillance, left baggage detection, background subtraction.

INTRODUCTION

Recent years have seen there are rise in terrorist attacks on crowded public places such as train stations and subways,airports, market,nightclubs, shopping malls, etc. Many surveillance tools have been employed in the fight against terror. Although video surveillance systems have been in operation for the past two decades, the analysis of the CCTV footage has not often put in risk so,its out of the hands of human operators [1]. Recent studies have brought into fore the limits of human effectiveness in analyzing and processing crowded scenes, particularly in the video surveillance systems consisting of multiple cameras. The advent of smart cameras with higher processing capabilities has now made it possible to the design systems which can possibly detect suspicious behaviours and abandoned objects.

Nowadays, terrorists come to public places such as railway stations, airports, bus stations and leave the luggage bomb for explosive attacks. It is very challenging to watch over the public places with crowds by security guards and identify the abandoned objects that have been left by a terrorist.Public places are being investigated with cameras but modern technologies cannot fully prevent the such attacks[2].To prevent luggage bomb attacks, a fully automatic efficient and effective intelligent surveillance system is required. The intelligent surveillance system can detect stationary object which is alone in the public place and produce an alarm or message to alert the guards for removing such type of abandoned object.Security of public places in a considerably burning issue. Though the CCTV have installed at the laces but the footage is only used after incident had taken a place. Those CCTV cams can be used to prevent such incidents from happening. Hence we are proposing a best way in this project. We are processing the live feed of the CCTV cam with the image processing[2].If a person is dropping off some bag or any such suspicious thing and leaving then it running away , the camera will catch this activity. And if such a bag is untouched for some time span decided by analyzer after it will give notification to authority[3]. Minimum the time span probability stays 50-50, but as time span increases the robability of that thing are being abandon or hazardous increases. Hence the incident can be avoided in that case.

LITURATURE SURVEY

Kevin Smith, Pedro Quelhas, and Daniel Gatica-Perez[1],authors presented a temporal consistency model is combining a back-tracing algorithm for abandoned object detection.The temporal consistency model is described by a very simple FSM. It exploits the temporal transition pattern generated by short- and long-term background models, which can accurately identify static foreground objects. Their back-tracing algorithm iteratively tracks the luggage owner by using spatial-temporal windows to efficiently verify left-luggage events.

Fatih Porikli,Yuri Ivanov and Tetsuji Haga[2],author presented a robust method that uses dual foregrounds to find abandoned items, stopped objects, and illegally parked vehicles in static camera setups. At every frame, autor adapt the dual background models using Bayesian update, and aggregate evidence obtained from dual foregrounds to achieve temporal consistency. This method does not depend on object initialization and tracking of every single object, hence its performance is not upper bounded to these error prone tasks that is usually fail for crowded scenes. It accurately outlines the boundary of items even if they are fully occluded. Since it will executes pixelwise operations, it can be implemented on parallel processors.

Rajesh Kumar Tripathi,Anand Singh Jalal[3],authors proposed a framework for abandoned object detection in real-time from surveillance video. Author utilized running average method for background modeling which is more suitable for real-time surveillance

video. Proposed contour features are more sensitive to the changes, to distinguish the static objects and moving objects. An edge based object recognition method applied to classify human and non-human static objects either it is full or partial visible. Experimental results demonstrate that proposed approach detect abandoned object even in bad illumination, crowd scene, occlusion and effective to detect object of different size. False detection has been handled through the generated score.

A.Singh, S. Sawan, M. Hanmandlu[4],author presented an abandoned object detection system based on a dual background segmentation scheme. The background segmentation is adaptive in the nature and based on the Approximate Median Model. It is consists of two types of the reference backgrounds, Current and Buffered background, each with the different time interval.Blob analysis is done on the segmented background and a dynamic tracking algorithm is devised for tracking the blobs even under the occlusion. Detection results show that the system is robust to variations in lighting conditions and the number of people are in the scene. In addition, the system is simple and computationally less intensive as it is avoid the use of expensive filters while achieving better detection results.

YingLi Tian, Rogerio Schmidt Feris, Haowei Liu, Arun Hampapur, and Ming-Ting Sun[5],authors presented a new framework to robustly and efficiently detect the abandoned and removed objects in complex environments for real-time video surveillance. The mixture of Gaussians background subtraction method is employed to detect both background and static foregrounds by using the same Gaussian mixture model. Then static foregrounds were classified into abandoned or removed objects by segmenting and comparing the surrounding area of the background model and the foreground image. Method can handle occlusions in the complex environments with crowds.Furthermore, in order to reduce false alarms, author have employed tracking information in to a small temporal window to provide an additional cue to filter out the impact of spurious and noisy trajectories for abandoned object detection.

Q. Fan, P. Gabbur, and S. Pankanti[6],In this paper authors proposed a novel approach to the abandoned object detection using the framework of relative attributes. Specifically, they design three physically interpretable attributes (staticness, foregroundness and abandonment) to characterize different kinds of alerts raised by various objects in the scene. They learn ranking functions for each of the attributes to rank order the alerts based on their strengths on the corresponding attributes. The attributes are used as input to an alert prioritization method which performs a ranking using alert importance.

H.-H. Liao, J.-Y. Chang, and L.-G. Chen[7],authors have proposed a novel approach to left-luggage detection in surveillance video. Through the use of foreground-mask sampling, authors are able to emulate the human vision capability of limiting and focusing on solely the object of interest to them, while filtering out all of other irrelevant, interfering agents. They are therefore able to apply tracking in a selective, more localized manner. Authors have also proposed an improved implementation of the Hough Transform for detecting the human upper-body contour from the video frames. And they have incorporated a probabilistic framework and employed the MAP principle in their modeling of the luggage-abandonment event and subsequent reasoning.

Kahlil Muchtar, Chih-Yang Lin, Li-Wei Kang , and Chia-Hung Yeh[8],authors proposed an automatic system for abandoned object detection. The main contribution of the method is to provide a comprehensive solution, which can identify the status of an object, abandoned, removed,or partially occluded. He employ the combination of background modeling based on mixture of Gaussians (GMM) and Markov Random Field (MRF) [8]. Furthermore, he employ a cast-shadow approach to enhance the shape of abandoned object. By combining these two approaches the abandoned object detection can perform well and obtain accurate results. The Gaussian Mixture Model (GMM) was proposed by Grimson and Stauffer [8]. The authors presented pixel-based method to the model each pixel (regarded as background) into a mixture of Gaussians. In addition, each Gaussian has its own weight to represent its portion of the data accounted for from corresponding distribution.

ABANDONED OBJECT DETECTION

In [1] Kevin Smith, Pedro Quelhas, and Daniel Gatica-Perez ,proposed a temporal dual-rate foreground integration method for static-foreground estimation for singlecamera video images. Their approach involves constructing both short- and long-term background models learned from an input surveillance video on-line. Subsequently, they introduce a simple pixel-based finite-state machine (PFSM) model that uses temporal transition information to identify the static foreground based on the sequence pattern of each object pixel. Because the proposed approach involves using temporal transition information, they can reduce the influence of imperfect foreground extractions in the double-background models, thereby improving the accuracy of the constructed static foreground inference. An owner-tracking procedure is also employed in their method to semantically verify the abandoned object event. Contributoins of the proposed method over previous methods are summarized as follows. 1) They introduce a dual-rate background modeling framework with temporal consistency. It performs considerably better than the single-image-based double background models . 2) They develop a simple spatial-temporal tracking method for back-tracing verification. Compared to the frame-by-frame

tracking approaches such as the KF- or UKF employed in [1], our approach is superior in handling temporary occlusions and is still highly efficient to implement.

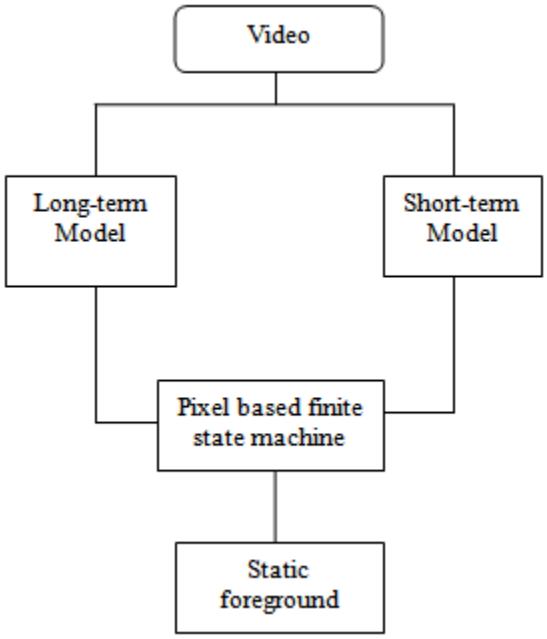

Figure 1.Flowchart of Static Foreground Detection[1]

Figure 1 shows an overview of the integrated background modeling method proposed in this study. First, they describe the long- and short-term models built in their approach for static foreground detection. A small learning rate updates the background model at a faster speed. The model that learns at this small rate is called the short-term background model. By contrast, a large learning rate yields the model that is updated at a slower speed. Similarly, the model that learns at this rate is referred to as the long-term background model.Instead of recognizing the status of each pixel based on only a single frame, they use temporal transition information to identify the stationary objects based on the sequential pattern of each pixel. A pixel is associated with only one state at a time. Based on long- and short-term background models, the state of pixel i can be changed from one state at time t to another state at time t + 1. Accordingly, they construct a simple FSM model to describe the behavior of each pixel. Authors detect the static foreground by identifying a specific pattern of transitions.

In [3] Rajesh Kumar Tripathi,Anand Singh Jalal ,proposed framework consists of three main steps as shown in Figure.1. First,foreground object is detected in two consecutive frames using the running average method.Then contours are drawn for each object into both frames. In second step, contour features are applied to detect the stationary objects from both consecutive frames. In third step, detected static objects are classified into human or nonhuman objects by using edge based object recognition method. The proposed approach is able to recognize object even it is partially visible. The edge based object recognition process includes the template generation of detected static objects and then matches it with predefined human edge template to generate a score to decide whether the static object is human or non-human objects. It also generates the partial matching score if object is partial visible due to shadow, partial occlusion or other reasons.

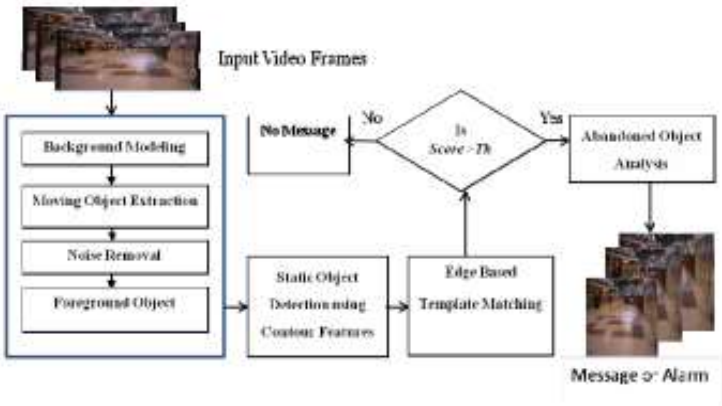

Figure 2. Framework for abandoned object detection[3]

Author have proposed a framework for abandoned object detection in real-time from surveillance video.They have utilized running average method for background modeling which is more suitable for real-time surveillance video. Proposed contour features are more sensitive to the changes, to distinguish the static objects and moving objects. An edge based object recognition method applied to classify human and non-human static objects either it is full or partial visible.

In [4] A.Singh, S. Sawan, M. Hanmandlu ,presented an abandoned object detection system based on the simplistic and intuitive mathematical model which works efficiently at QVGA resolution which is the industry standard for most of CCTV cameras. The proposed system consists of a novel selfadaptive dual background subtraction technique is based on the Approximate Median model framework.Algorithms for tracking abandoned objects with or without occlusion are also included.

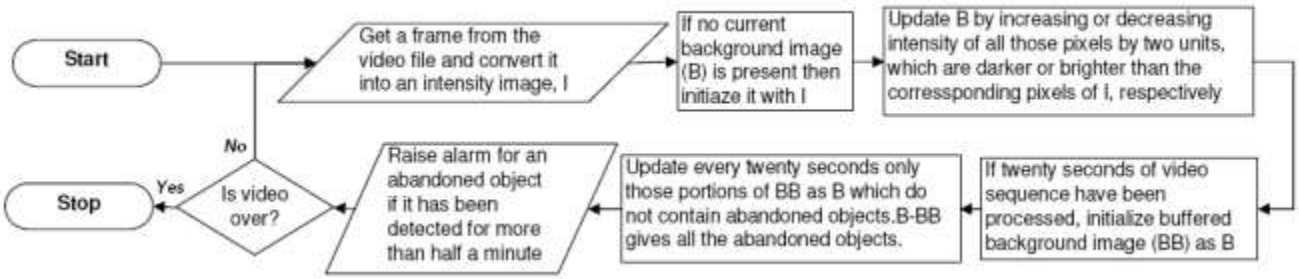

Figure 3: Flowchart of abandoned object detection system[4]

The overall system is modular in the nature and consists of four disparate blocks with each block acting as a discreet processing unit making it is easy to modify any block, provided the input and output data types remain compatible with the connecting blocks. The 4 blocks are: Data extraction and conversion unit; Background subtraction module; Still object tracking and occlusion detection block and Alarm raising .display of result unit A live video stream is initially segmented into individual images from which the region of interest is extracted and converted to 3D intensity matrices (height * width * intensity value of each pixel). These matrices are then fed as input to the Background Subtraction module.

In [5] YingLi Tian, Rogerio Schmidt Feris, Haowei Liu, Arun Hampapur, and Ming-Ting Sun ,proposed a novel solution to detect abandoned and removed objects. Compared to their previous work, there are four major extensions that are merit being highlighted:

1) The previous work did not keep a history of the background objects on scene. The extended method is provide more accurate results to classify static regions into abandoned and removed objects;

2) The previous work was not able to the distinguish stationary human from nonhuman objects. In this paper, they integrate human detection in near-field, mid-field, and far-field scenarios into the framework;

3) The previous work did not use any tracking information. In order to lessen the false positives in complex videos, we employ the tracking trajectories as the complementary information;

4) They add more quantitative experimental results in complex city scenarios and demonstrate the efficiency and robustness of the

proposed work. In addition, the mathematical framework behind the technique are described in this paper. Figure 4 shows their system diagram. The system includes four main components: 1) BGS and static-region detection; 2) object type detection (abandoned or removed); 3) abandoned/removed object alert detection; and 4) integration with human detection and tracking information for abandoned and removed object alert detection.

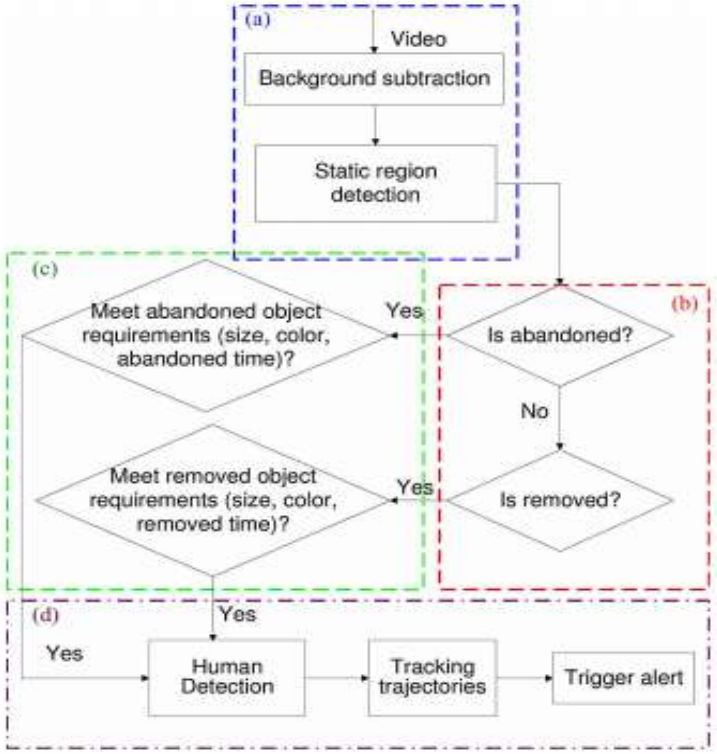

Figure 4.System Architecture[5]

In [9], E. Auvinet, E. Grossmann, C. Rougier, M. Dahmane, and J. Meunier, presented an algorithm to detect abandoned luggage in the real world public environment. This is a typical challenge of nowadays surveillance systems. They present a planar homography constraint to the resolve occlusions and detect the locations of people on the ground plane corresponding to their feet. Their video surveillance process is described in Figure 5.

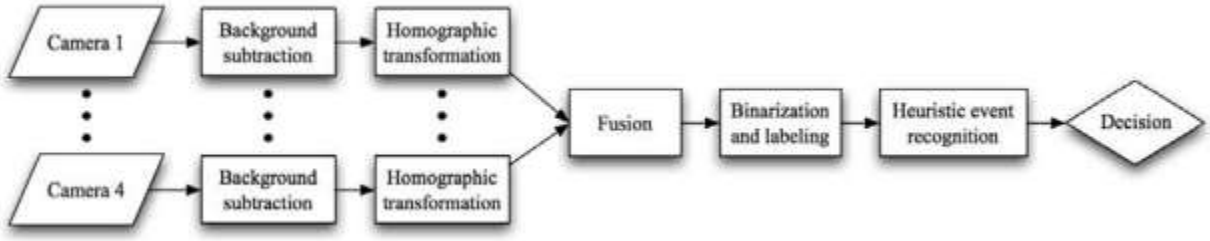

Figure 5. video surveillance process[9]

First, they perform a background subtraction in the image plane of each camera.Then, a homographic transformation is performed to merge information from all cameras in the scene floor homographic image. Finally, they work in the homographic image to track people using a heuristic method to detect suspect events. Their main contribution is to present results obtained by a simple modular system. Its principal merit is that it has a few parameters, most of them being easily identified physical quantities.

Table 1.Abandoned Object detection Methods/Technique.

Authors	**Methods**	**Description**
Kevin Lin, Shen-Chi Chen,[1]	Dual Background Subtraction, PFSM	Dual subtraction is used to identify current and background image.Then a Pixel based finite state machine method is applied to that image and the static object can be detected.
F. Porikli, Y. Ivanov, and T. Haga,[2]	Dual Foreground, Bayesian Update	Each pixel as layers of 3D multivariate Gaussians. Each layer corresponds to a different appearance of the pixel. Using Bayesian approach, they are not estimating the mean and variance of the layer, but the probability distributions of mean and variance.
Rajesh Kumar Tripathi, Anand Singh Jalal[3]	Contour feature, Edge based object recognition	Extract two consecutive binary foreground frames and find the contours of both the frames. The area and length of a contour from both frames are calculated and then, area ratio, length ratio and center position of the contour is calculated to determine static object into the frame. Identification of human and non-human static objects is performed by using edge-based object recognition, which is robust in similarity measure when the object is partially visible due to the occlusion. Edge-based object recognition algorithm uses edge information of an object into a human edge based template.
A. Singh, S. Sawan, M. Hanmandlu[4]	Dual background segmentation, Blob detection	Technique requires two reference background images, namely, 'Current Background' and 'Buffered Background'. This technique of storing two backgrounds can be considered as a dual background method. The blob analysis takes as an input a binary image, applies an algorithm and returns various properties of the detected blobs like bounding box, area, centroid position etc.
Y. Tian, R. S. Feris, H. Liu,[5]	Background subtraction with Gaussian Mixture Model	The mixture of Gaussians BGS method is employed to detect both background and static foregrounds by using the same Gaussian mixture model. Then, the static foregrounds were classified into abandoned or removed objects by segmenting and comparing the surrounding areas of the background model and the foreground image.

CONCLUSION

This paper explored related research efforts that focused on Abandoned Object Detection System. We have presented various methods such as background substraction ,dual background segmentation, mixture of Gaussians (GMM) ,contour search,blob detection etc that used to detect Suspicious/Abandoned object in different environment. Methods are categorized such as Short term and Long term,background substraction.

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