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ABANDONED OBJECT DETECTION IN SURVEILLANCE VIDEOUSING GAUSSIAN MIXTURE MODEL AND KALMAN FILTER

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ABSTRACT

Abandoned Object detection is most critical 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.Object detection and tracking are important and challenging tasks in many computer vision applications such as surveillance, vehicle navigation and autonomous robot navigation etc. Different methods are used to detect and track object. In this method Gaussian Mixture Model (GMM) is used for object detection and Kalman Filter (KF) for Object tracking. By using Background Subtraction to detect foreground object in an image taken from camera.Morphological operation is use to filter out noise to get clean image.

Keywords- video surveillance, abandoned object detection, Gaussian Mixture model (GMM), Blob Analysis, Kalman Filter (KF), object detection and tracking, Background subtraction.

I.INTRODUCTION

Abandoned Object detection is most critical 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.Object detection is used different method and algorithm to detect motion, abandoned object, left luggage etc. In this method Gaussian Mixture Model (GMM) is used for object detection and Kalman Filter (KF) for Object tracking. By using Background Subtraction to detect foreground object in an image taken from camera. Morphological operation is use to filter out noise to get clean image. Fig 2 represent overall structure of system.

1.1. Object Detection

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class(such as human, buildings or cars) in digital image and videos. Fig 1 represent Flow of Object Detection and tracking.

1.2. Object Detection and Tracking

Object detection and tracking has variety of applications in computer vision such as surveillance, vehicle navigation, robot navigation, remote control vehicle, to track people in indoor environment, people and car in outdoor environment etc. Detecting abandoned object/abandoned luggage is referred to as a problem of left luggage or abandoned object detection in the visual surveillance research for public security. It is very critical task particularly for identifying suspicious stationary items. To perform this task common detection method such as training an object detector are inappropriate, because there is no object type of category that can be assumed as having been abandoned. Object detection and tracking are important and challenging tasks in many computer vision applications such as surveillance, vehicle navigation and autonomous robot navigation. Object detection involves locating objects in the frame of a video sequence. Every tracking method requires an object detection mechanism either in every frame or when the object first appears in the video. Object tracking is the process of locating an object or multiple objects over time using a camera. The high powered computers, the availability ofhigh quality and inexpensive video cameras and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms.

In this method Gaussian Mixture Model (GMM) is used for object detection and Kalman Filter (KF) for Object tracking. By using Background Subtraction to detect foreground object in an image taken from stationary camera.Morphological operation is use to filter out noise to get clean image.Fig 2 represent overall structure of system.

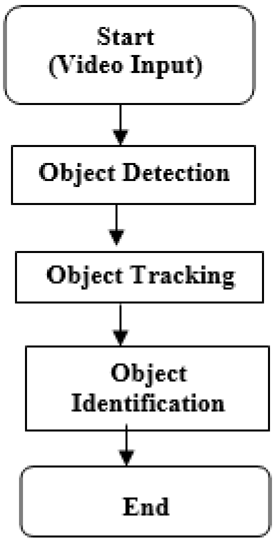

Fig1. Flow of Object Detection and tracking

II.LITERATURE SURVEY

Kevin Lin et al. [1] proposed a temporal consistency model combining a back-tracing algorithm for abandoned object detection. The temporal consistency model is described by a very simple Finite state machine (FSM). It exploits the temporal transition pattern generated by short and long-term background models, which can accurately identify static foreground objects. Their back-tracking algorithm iteratively tracks the luggage owner by using spatial-temporal windows to efficiently verify left-luggage events.

A.Singh et al. [2] proposed an 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.

Kahlil Muchtar et al. [3] 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). 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. The 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.

Q. Fan et al. [4] 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.

YingLiTian et al. [5] proposed 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.

FatihPorikli et al. [6] proposed a robust method that uses dual foregrounds to find abandoned items, stopped objects, and illegally parked vehicles in static camera setups. At every frame this method 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

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accurately outlines the boundary of items even if they are fully occluded. Since it will executes pixel wise operations, it can be implemented on parallel processors.

III. IMPLEMENTATION AND RESULT

Abandoned objectdetection is a crucial task in surveillance video. In this method Gaussian Mixture Model (GMM) is used for object detection and Kalman Filter (KF) for Object tracking. By using Background Subtraction to detect foreground object in an image taken from stationary camera. Morphological operation is use to filter out noise to get clean image, exact output.Fig 2 represent overall structure of system.

3.1 Gaussian Mixture Model

Gaussian mixture model based on background model todetect the moving objects. For detecting moving objects in video surveillance system the use the Gaussian mixture model, is essential this model has the color values of a particular pixel as a mixture of Gaussians. But the pixel values that don't fit the background distributions are considered as foreground. Gaussian mixture model is probabilistic model for representing normally distributed subpopulation within an overall population.

If a random variable X is Gaussian, it has the following PDF:

(1)

Where μ is the mean
σ2is the variance (σ is called the standard deviation).

3.2. Kalman Filter

A Kalman filter is used to estimate the state of a linear system where the state isassumed to the distributed by a Gaussian. The Kalman filter is a recursive predictive filter that is based on the use of state space techniques and recursive algorithms. It is estimated the state of a dynamic system. This dynamic system can be disturbed by some noise, mostly assumed as white noise. To improve the estimated state the Kalman filter uses measurements that are related to the state but disturbed as well.

Kalman filtering is composed of two steps. Thus the Kalman filter consists of two steps:

1) Prediction
2) Correction

3.3. Background Subtraction

In background subtraction an absolute difference is taken between every current image It(x,y) and the reference background image B(x,y) to find out the motion detection mask D(x,y). The reference background image is generally the first frame of a video, without containing foreground object.

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D(x,y)= (2)

Where τ is a threshold, which decides whether the pixel is foreground or background. If the absolute difference is greater than or equal to τ, the pixel is classified as foreground, otherwise the pixel is classified as background.

3.4. Morphological image processing

Binary images may contain numerous imperfections. In particular, the binary regions produced by simple thresholding are distorted by noise and texture. Morphological image processing pursues the goals of removing these imperfections by accounting for the form and structure of the image. These techniques can be extended to greyscale images. A morphological operation on a binary image creates a new binary image in which the pixel has a non-zero value only if the test is successful at that location in the input image.

Morphological image processing operation can be performed

3.4.1. Erosion- Erosion of a binary image f by structuring element s produce new binary image. Erosion removes small scale details from a binary image.

$$g = f\theta s \quad (3)$$

With ones in all locations (*x*, *y*) of a structuring element's origin at which that structuring element *s* fits the input image *f*.

$$g(x,y) = \begin{cases} 1 \text{ is } s \text{ fits } f \\ 0 \quad \text{otherwise} \end{cases} \quad (4)$$

3.4.2. Dilation- Dilation of an image f by a structuring element s produce a new binary image. Dilation adds a layer of both inner and outer boundaries of region.

$$g = f\oplus s \quad (5)$$

With ones in all locations (*x*,*y*) of a structuring element's orogin at which that structuring element *s*hitsthe the input image *f*.

$$g(x,y) = \begin{cases} 1 & \text{if } s \text{ hits } f \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

3.4.3. Closing- The closing of an image *f* by a structuring element *s* (denoted by *f* • *s*) is a dilation followed by an erosion.

$$f.s = (f \oplus Srot) \ominus \text{Srot} \quad (7)$$

Where Srot- Structuring element rotated by 180

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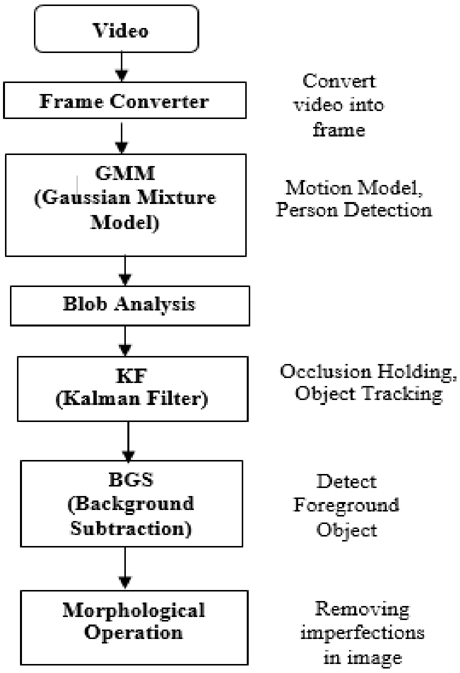
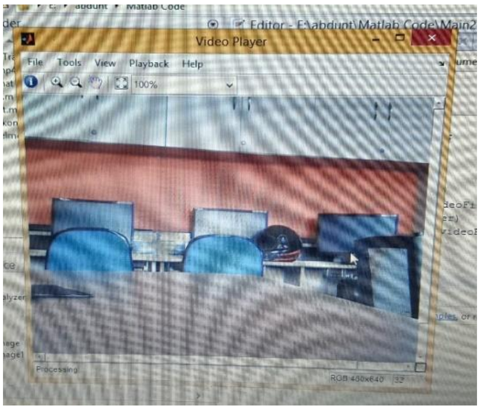
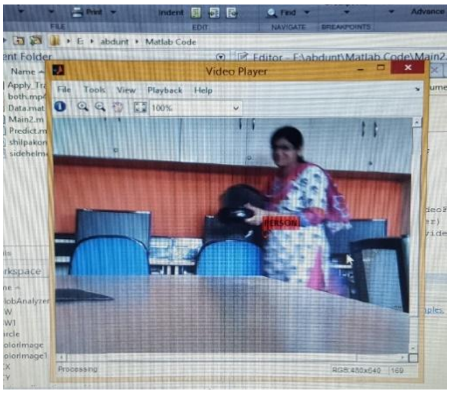


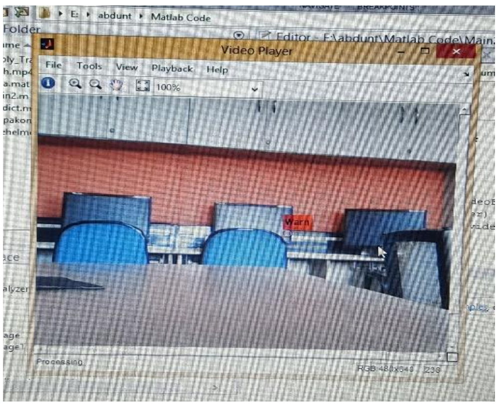
Fig 2. System Overview



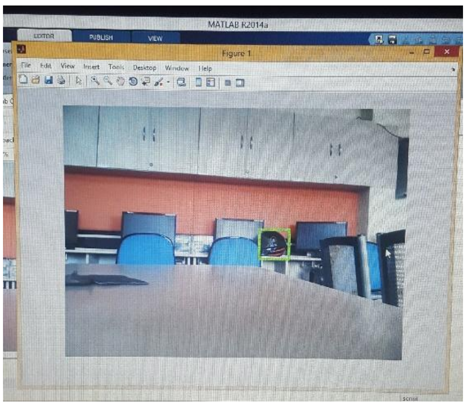
(a)



(b)



(c)



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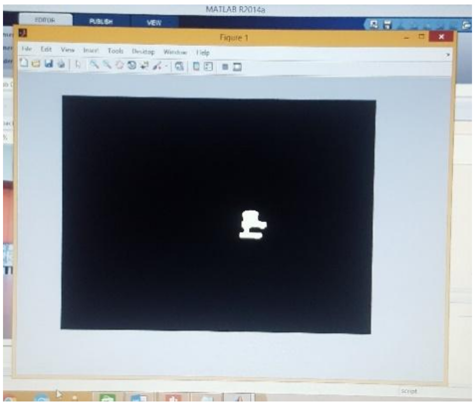

(e)

Fig 3. a) Reading Video b) Person collecting object c)left object place detecting in frame d) object tracking in frame and draw green color bounding box around that object e) Background Subtraction to detect foreground object.

IV.CONCLUSION

This is successfully carried out using GMM (Gaussian mixture model), KF (Kalman Filter) and Background subtraction. Giving video input to the system then framing is carried out to convert video into image then GMM use for person detection in that frame. Blob analysis is used to draw bounding box around the detected object. Kalman Filter is used for Object tracking to easily track the object in that frame that's why the security of surveillance video is increased. By using Background Subtraction to detect foreground object in an image taken from stationary camera. Morphological image processing is used to filter out noise and remove imperfections.

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