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Abandoned Object Detection using SVM Classifier

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ABSTRACT

Security and surveillance are important issues in today's world. Any behaviour which is uncommon in occurrence and deviates from normally understood behaviour can be termed as suspicious. This paper presents an effective approach for detecting abandoned luggage in surveillance videos. We have targeted to create a system for recognising abandoned static objects and extract new information for end-users in highly secured indoor surveillance system. The objective for this project is to design a model for detection of abandoned objects. The object detection is done by background subtraction with the help of appropriate model. Face detection is done by extracting features and can be captured using Viola-Jones algorithm. The system uses image processing technique using MATLAB.

Keywords: Abandoned Object Detection, Background Subtraction, Face Detection, Feature Extraction, Security

I. INTRODUCTION

Recent years have seen there is rise in terrorist attacks on crowded public places such as train stations, airports, markets and shopping malls, etc. Many surveillance tools have been installed in the fight against terror. Although video surveillance systems have been in operation from the past two decades, the continuous monitoring of CCTV footage is out of the hands of human operators. The system proposed in this paper provides continuous monitoring of CCTV footage.

Nowadays, terrorists come to crowded 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 object which is left by a terrorist. To prevent luggage bomb attacks, a fully automatic efficient and effective intelligent surveillance system is required. Hence this paper presents a better way to detect left baggage or object. In this paper, live streaming of video from CCTV is processed by image processing. If a person is dropping off some bag or any 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. Minimum the time span probability stays 50-50, but as time span increases the probability of that thing being abandon or hazardous increases. Hence the incident can be avoided in that case.

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II. WORKING

1. Block diagram

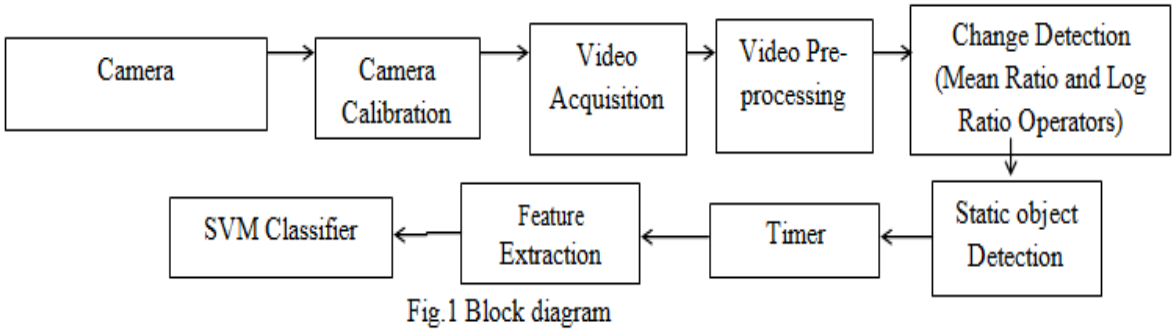

Fig.1 Block diagram

2. Block diagram description

2.1 Camera and calibration

Here, we are using face to face web-cam i-ball k20 having 20 MP still image resolution and 2 MP video resolution. We are fetching video from this camera and camera brightness, intensity, etc. are calibrated according to requirements.

2.2 Video acquisition

In video acquisition, we are capturing video frames from camera. The first frame is taken as background image by taking snapshot which consisting of already existing things like chairs, tables, etc.

2.3 Video Pre-processing

a) Gray Scale Conversion

b) Filtering and noise removal

a) Gray Scale Conversion

In this technique, the given true colour RGB video frames are converted into the gray scale intensity frames. Gray scale image carries only intensity information. It eliminates the Hue and Saturation information while retaining the luminance. Hue is the colour in the image and Saturation is the intensity or richness of that colour.

b) Filtering and noise removal

Filter is used to remove noise from the gray scale image. Median filter is used to remove unwanted information, somewhat like mean filter. However it often does a better job than mean filter. This class of filter belongs to the class of edge preserving smoothing filters which are non linear filters. These filters smoothes the data while keeping the small and sharp details. Consequently median filtering is very effective at removing various kinds of noise.

Video Pre-processing is shown in the Fig.2

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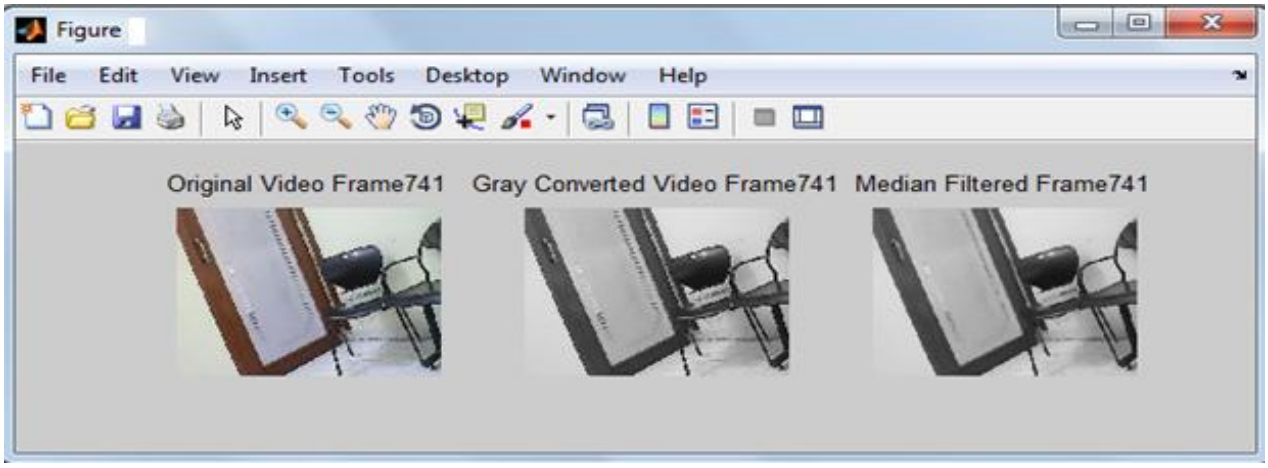

Fig.2 Video Pre-processing

2.4 Change Detection

The captured video is to be processed for detecting any change with the reference frame taken. The Image Acquisition Toolbox available within Matlab is used, for camera controlling, which is connected to the personal computer. By using these functions camera can be operated to capture desired snapshots and even a sequence of frames which forms a part of the video. In this stage, we separate forefront images from background images. For change detection Mean-ratio operators are used.

Suppose 'A' is the background reference image and 'B' is the current new frame image. By using mean ration background image subtraction, new forefront images are detected by calculating mean as follows:

$$\mu_1 = \frac{\sum_{i=1}^{R}\sum_{j=1}^{C} A_{(i,j)}}{R*C} \quad , \quad \mu_2 = \frac{\sum_{i=1}^{R}\sum_{j=1}^{C} B_{(i,j)}}{R*C}$$ where R, C are the tolerance range of pixels of images A and B

$$I_1 = \frac{A}{\mu_1}, \qquad I_2 = \frac{B}{\mu_2}$$

$$I_{diff.} = I_1 - I_2$$

The detailed algorithm of background model construction and change detection is summarized as follows:

i. The probability that the same value of pixel is present in the background image is taken into account when a new pixel in the new image is observed.
ii. If the pixel value is greater than the tolerance range i.e. threshold, then the pixel is recorded and marked it as a part of the foreground image. This is done as a background image pixel is expected to repeat its value for a long time. At least it is expected to be within a tolerance range. A very productive change marks the pixel as a part of the change. That has to be tracked and segmented out.
iii. If the observed pixel lies within the threshold value, it is considered as a part of the background and is replaced with a zero. At the same time if any significant change in the pixel value is observed the pixel particular value is retained as it is assumed to be the part of the change at the foreground.

This probability algorithm allows us to reconstruct an image which retains the pixel values of the pixels which is the part of the foreground change and removing the pixels which is a part of the background image.

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2.5 Static Object detection

In case an object is detected, the timer is initiated and continuously incremented until it is found that the object is static. The incremented timer is consistently compared against a pre-defined Threshold timer value. Once the incremented timer value equals or exceeds the threshold value, it is considered that the object is abandoned. The next action would be to raise an alarm and notify about the abandoned object found. Additionally, the system highlights the object by adding a rectangle around it on the screen that helps in identifying it in the monitored area.

Here, the threshold value is of significant importance and hence needs to be determined carefully. It forms a basis for deciding whether the object is in an inactive state or not. The lower value may lead to false alarms, while the greater value may result in the object going undetected for a considerably larger amount of time. In case of surveillance systems this may prove fatal, since the abandoned object might contain a timed bomb.

2.6 Feature extraction

Extracted features are geometry and human shape. These features are taken with the help of harr features. Further extracted parameters are width to height ratio and eccentricity.

For human face detection we are using Viola-Jones algorithm which consists of three stages namely: Harr features, Ada-boosting and cascading. Because of all these three stages human face can detect very accurately.

2.7 SVM Classifier

The Support Vector Machine classifier is a binary classifier which looks for an optimal hyper plane as a decision function. Once trained on images containing some particular object, the SVM classifier can make decisions. SVM has better accuracy. Extracted features are geometry and human shape. These two classes are applied to SVM classifier. SVM is trained for geometry and human shape.

2.8 Abandoned object detection

In case an object is detected, the timer is initiated and continuously incremented until it is found that the object is static. The incremented timer is consistently compared against a pre-defined Threshold timer value. Once the incremented timer value equals or exceeds the threshold value, it is considered that the object is abandoned.

The system highlights the object by adding a rectangle around it on the screen that helps in identifying it in the monitored area and it is displayed that abandoned object is detected on the screen. Also, if human is detected then also system highlights the human by adding a rectangle around it on the screen and it is displayed that human is detected on the screen.

III. RESULT

The proposed work has been developed using MATLAB 8.1(R2013a) on Intel dual core processor, 2GB RAM and Windows 7 operating system.

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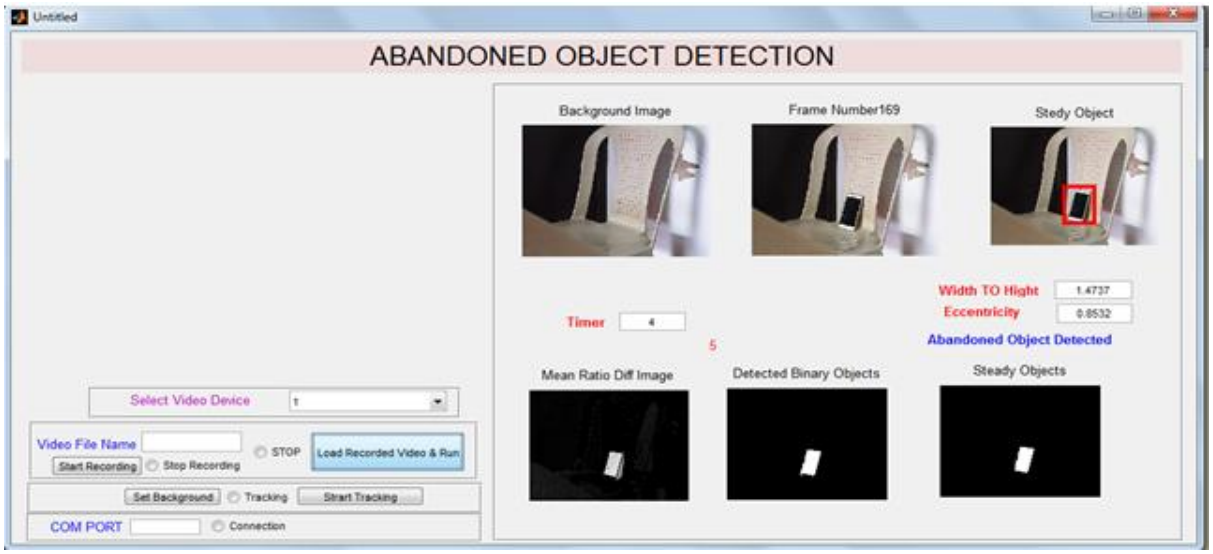

Fig.3 Output GUI Window

IV. CONCLUSION

For abandoned object detection, we use threshold method to detect object based on the background captured when the application is started. A benefit of this method is that it is time efficient, and it works well in artificial light environment as well. The results of our method, indicates that the method is effective in detection of abandoned object.

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