

Study of Abandoned Object Detection Implementation using Matlab

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Abstract: In this paper we come up with Abandoned object detection which is used for the surveillance cameras in the crowded places like airport, railway station and bus stations etc. Object detection is the most crucial step of video analytics. Abandoned object detection is one of the trending technologies and most useful area of computer vision. This algorithm takes video as an input from surveillance cameras and detect suspicious objects. If a new object is found without no apparent human presence for a certain period of time. Then it is declared as abandoned object and then an alarm is raised. In this way, we can recognize abandoned object using Background modelling and subtraction. This paper illustrates the implementation of object detection and tracking using MATLAB. We use the basic block diagram of Churned object detection and explains various predefined functions and object from various toolboxes. Some of the useful toolboxes include image acquisition, image processing and computer vision. Experimental results show that this system implements fast detection of abandoned objects.

KEYWORDS: Abandoned Object, Background Subtraction, Blob Analysis



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INTRODUCTION

In the previous decades we had been observing the rise in terrorist attacks. Mostly this incidence can take place in the crowded areas like airports, railway stations and bus stations etc. Now a days, colour video cameras are being affordable and this is the main reason that they were used for security related monitoring activities. It is unfortunate that it is not possible to have someone watching all the cameras at the same time as their attention is distributed between several cameras. This will not serve the main purpose of installing the cameras of detecting unusual events and hazardous incidents before anything bad happens. In this paper we present an algorithm for automated abandoned object detection which works effectively in complex environment like heavy traffic, crowd areas, shadows of people. Detecting such objects is crucial because bombs are usually placed in such abandoned luggage. This idea of bale to detect such weapons make this research more valuable.

In abandoned object detection we have to find out the objects that are being left alone by some person intended to make harm to the society. We define abandoned object as the stationary object that has not been touching a person that has not been touched by a person for some time threshold. There are some requirements for this type of system to satisfy. Those requirements are that the selected method must work online in real time, it should work relentlessly all the time and it must be able to detect abandoned objects even if they are obstructed by a moving crowd of people. In addition to these there are some other difficulties such as change in lightning condition and shadows. These make abandoned object detection more complex.

Installing video cameras for surveillance system in public places like railway stations, airports, multiplexes, etc. is needed to detect suspicious behaviour of humans and also for different objects that are being carried around. Abandoned objects are considered as potential threat and measures are taken to both detecting and also avoiding them. Automatic systems will help to identify objects and also useful to track the owner of abandoned object.

Various platforms can be used for design and implementation of object detection and tracking algorithm. These platforms include MATLAB, C

programming, Open CV, Python, etc. In real time usage the object detection must be executable in short time and must effectively use memory. It is hard for a beginner in research to develop such effective code for real time use. Considering all these facts, the MATLAB is found as a better platform for design and implementation of algorithm. It contains number of toolboxes covering majority of the fields in technology. Every individual toolbox has predefined functions, system objects and Simulink blocks. These features help us to write short code and saves time in logic development. MATLAB coding is simple than others and can be easily learned by a new researcher. In this paper we used various toolboxes and functions that are used at different levels in object detection and tracking. Toolboxes including computer vision, image processing and image acquisition. MATLAB 2016a version is used for this study.

METHADODOLOGY

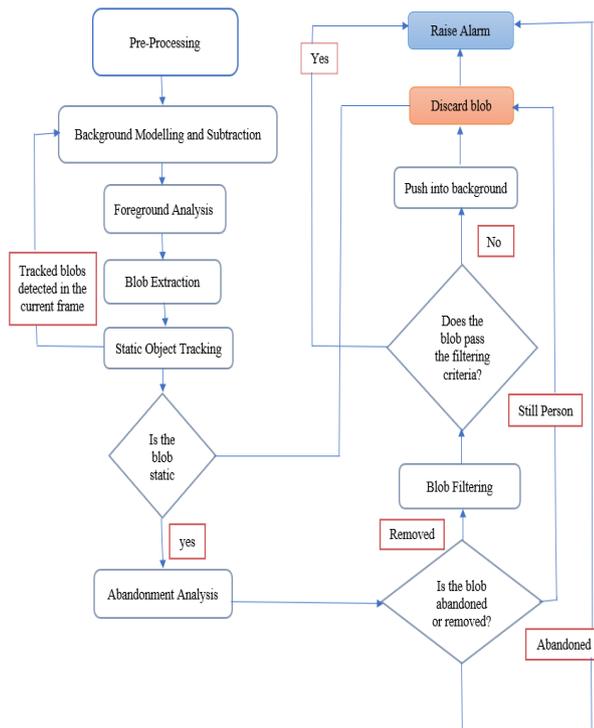
We are aiming to differentiate between object belonging to foreground or background in video. The basic idea of implementation is to process foreground and find out object which are not part of background in a given video input. If the detected object remains still for a certain threshold amount of time. Then the system raises the alarm. The above algorithm is showed in the flowchart in fig.1.

Before beginning the process, the region of interest is specified from the video. This entire mechanism will be done only in the region of interest which is specified initially. Parameters like maximum number of objects that can be detected and range of size of objects that are to be detected are specified.

As we know that frames of colour video camera are in RGB (Red Green Yellow) form. To enhance the contrast of the image we need to convert the RGB form of image frames to YCbCr. Now every frame is subtracted from the background frame. This will convert the subtracted image to binary image. Then noise is removed from the binary image by adding small balls. Now blob analysis is performed to get complete information about the blobs. Blob analysis gives some of the useful results like the area, centroid and rectangle covering the blobs. Now to check if any object is abandoned or not using detailed analysis. Then we need to make a list of all the

centroids and make a new list. Now, we need to traverse every centroid value in that list and round off those values. If the centroid already exists in the list, then its hit count is incremented. Or else due to some obstruction, then the miss count is incremented. After getting the complete data, if the hit count increases, then the alarm is raised. If object appears within 7 frames, then the hit count resets to zero.

FLOWCHART



STEPS INVOLVED

- Background modelling and subtraction
- Pre-processing
- Foreground analysis
- Blob extraction
- Static object tracking
- Abandonment analysis

Background modelling and subtraction

- First frame of the video is taken as the background.
- Both current and the current frames are converted form.

Background modelling and subtraction can be done by various algorithms, but here we are using Gaussian mixture model.

Gaussian mixture model: It considers that on the whole intensity at any pixel at each instant is produced by the combination of foreground and background process, and every such process can be geared by a single Gaussian distribution function.

Pre-Processing

Pre-Processing has 2 functions:

- Contrast Enhancement
- Noise Reduction

Contrast Enhancement: It mainly improves the quality of low light video. This can be done by normalizing the difference between the maximum and minimum intensities by using YCbCr approach. YCbCr approach includes conversion of RGB frame to YCbCr by using some inbuilt functions in MATLAB. According to the version, we were using "vision.ColorSpaceConverter" function. This conveys the colour information in an effective and smaller way than in the case of RGB. We convert both the background and current frame into YCbCr format.

NoiseReduction: This step is mainly responsible for reducing the white noise present in an input frame. This can be done by smoothening the frame. It is used for low quality videos. It is used to control the amount of noise that becomes visible in low light videos after applying contrast enhancement. This can be achieved by subjecting the image with several smoothening filters.

Foreground Analysis

BGS methods tend to produce noisy outputs that are not sufficient for extracting useful objects. This noisy output of BGS may contain false foregrounds produced due to sudden lightning changes in environment. To avoid this type of noises, this system has separate foreground analysis stage that takes the output of BGS module and removes all the noise and false foreground pixels from it.

Blob Extraction

The reinforced output from the previous step is further processed with component detection algorithm to extract required foreground objects that are smaller than a specified threshold. This provides simple, efficient but accurate algorithm used for this purpose. This algorithm also labels the internal points of each connected component.

Static Object Tracking

To keep track of all the blobs are inserted into a matrix. The Centroid is rounded off to the nearest multiple of 5. When the same Centroid is found, count is incremented.

If the Centroid position and size of the blobs are present already, then the Hit Rate of blob is incremented by 1.

Abandoned Object Analysis

- If a blob having Hit Rate above certain threshold is discarded.
- Hit count higher than threshold level, then alarm is raised.
- If any object is disc is obstructed, then Miss Rate is incremented by 1.
- If miss count is increased above certain level, then blob centroid is deleted from the list.

ALGORITHM

- Maximum number of objects that can be tracked are 200.
- To read each frame individually from the video, we use vision. VideoFileReader function.
- For drawing bounded boxes in input video, we use `int32 repmat ([roi (1), roi (2), 0, 0], [maxNumObj 1]);`
- RGB Image is converted into YCbCr using `vision.ColorSpaceConverter ('Conversion', 'RGB to YCbCr');`
- Next one is Background Subtraction.
- To remove noise, we use `vision.MorphologicalClose ('Neighbourhood', strel('square',10));`
- Find the properties of the blobs in the segmented images.
- Create system objects with their locations.
- Run a loop till all the frames are completed and meanwhile storing them in the background.
- Now subtract the background using YCbCr image.
 - Fill the gaps in the detected object and create a new image.
- Now create a list using Blob analysis, storing area, centroid in a list.
- Traverse through the centroids in the list of all the blobs.
- Based on the distance between centroid of the blob in both the background frame and the current frame. If yes, increment its count by 1, if not, increase the miss count by 1.

- If the object remains stationary for more than 75 frames then it considered as an abandoned object. If the object is obstructed by some interference for more than 7 frames then it is not considered as an abandoned object.
- After detection of abandoned object, its bounded box becomes in red colour and an alarm is raised

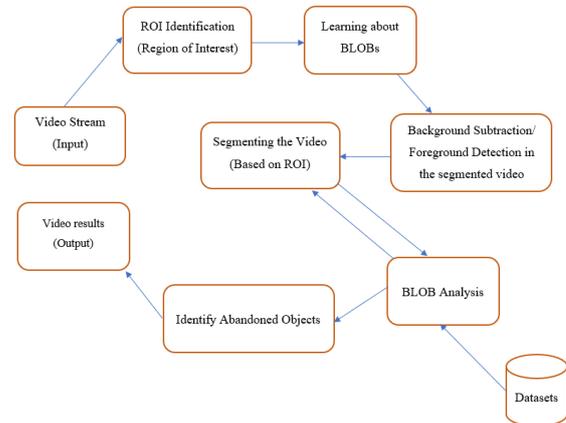


Fig 1. Algorithm of the working of the project

RESULT



Fig 2. Abandoned Object Detected Output

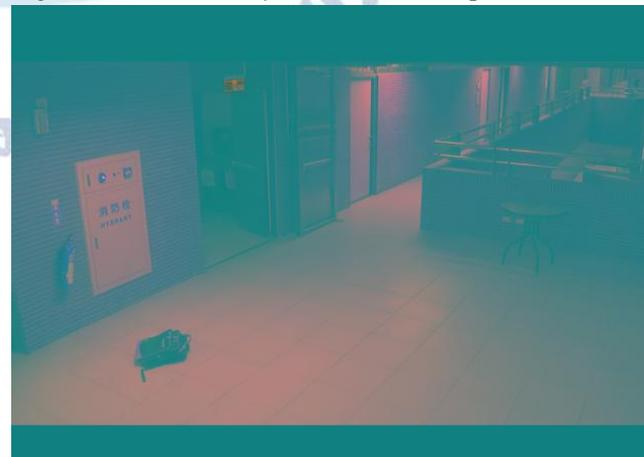


Fig 3. YCbCr form of the image

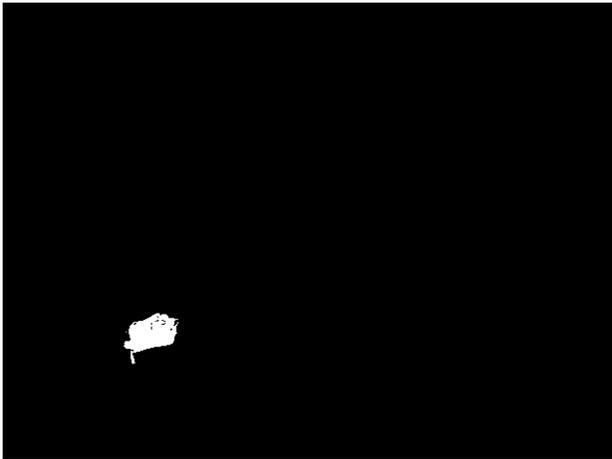


Fig 4. Binary Image after Image Subtraction from the Background (Without Removing Noise)



Fig 5. Binary image after removing noise from the Fig 4

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