Abandoned and Removed Object Detection in a Video – An Overview

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Abstract—The proposed work focuses on design and implementation of a general framework for detecting abandoned and removed objects in videos. The major steps in the proposed work involve foreground pixel detection based on suitable background modeling, foreground object formation and detecting abandoned and removed foreground objects based on suitable features. The proposed work will be simulated using MATLAB and Tool Boxes and will be validated using standard videos available on internet.

Key words: Portable, Label Reading, Text Detection, Text Extraction, Raspberry Pi

I. INTRODUCTION

Detecting static objects in video sequences has several applications in surveillance systems such as the detection of illegally parked vehicles in traffic monitoring or the detection of abandoned objects in public safety systems and has attracted the attention of a vast research in the field of video surveillance. Many methods have been recently proposed to automatically detect abandoned objects (parked vehicles and left-luggage) in video surveillance for different applications such as traffic monitoring, public safety, retail, etc. At train/subway stations, airports, big cities, and other public spaces with high traffic flows, it becomes very challenging for security officials as well as video surveillance solutions to quickly detect objects that have been left behind.

Detection of objects as abandoned and removed plays an important role in surveillance system. In the video surveillance domain, the automatic detection of abandoned and removed objects in real-time has recently become a topic of great interest especially in crowded environments [1]. The detection of suspicious (dangerous) items is one of the most important applications. These items can be grouped into two main classes, dynamic suspicious behaviors (e.g., a person attempting to attack others) and static dangerous objects (e.g., luggage or bomb abandoned in public places).

The scope of this paper falls into the latter category. Specifically, we investigate how to detect objects in a video as abandoned and removed. To improve the quality and the effectiveness of system various algorithms and techniques are suggested and implemented by researchers in various ways. But due to their complexity and probability issues, the implementation was not so fruitful. For security concerns it has become vital to have in place efficient threat detection systems that can detect and recognize potentially dangerous situations, and alert the authorities to take appropriate action by raising alarm on right time.

We define an abandoned object to be a stationary object that has not been in the scene before, and a removed object to be a stationary object that has been in the scene before but is not there anymore. To detect abandoned and removed objects, we focus on how to detect static regions that have recently changed in the scene and how to determine whether they correspond to abandoned or removed objects.

In general, the abandoned and removed detection is achieved by developing a system with the following analysis stages: foreground segmentation, stationary region detection, blob classification and abandoned and moved object discrimination [1]. The last stage of this pipeline determines the system ability to discriminate stationary foreground objects between abandoned and removed. For its implementation, the common approach is to study the similarities between features extracted from the current and background frames of the video sequence. The security officials are alerted of the situation to take the necessary action. This makes it easy for the security officials to bring the situation to notice thus preventing any security threat from occurring. The system captures the videos using static cameras.

II. RELATED WORK

Stationary objects in multiple object tracking [2], detects the foreground objects with several moving objects and is inspired by human’s visual cognition processes. It relies on tracking information to detect drop-off events. This system produced larger errors under bright lighting conditions.

Magno et al [4] employs an unobtrusive embedded platform. This method uses a wireless video sensor to detect the abandoned object. The system employs multimodal sensor integration which saves power consumption. The objective is to develop a multimodal video sensor with low power and low cost to detect abandoned objects. This uses new algorithms for energy efficient image processing without giving up the flexibility of in-field configuration. In spite of using a video sensor, the number of false positives is 13% of the total detected objects.

Singh et al [1] uses a dual-time background subtraction algorithm to dynamically update two sets of background. This method is dynamic, adaptive, non-probabilistic and intuitive in nature. It uses pixel color/intensity information for background processing. The binary image is divided into a number of legitimate blobs. Once the blobs are generated, the system applies an algorithm for tracking of the abandoned objects. The system is robust to variations in lighting conditions and the number of people in the scene. The system does not classify stable objects as unattended and removed objects.

Kong et al [3], detects nonflat abandoned objects by comparing a reference and target video sequences. The system uses GPS information to align the videos to find the frame pairs. The camera is mounted on a moving platform to scan along a specified trajectory for nonflat abandoned objects. The difficulty of the system is to cope with moving objects, presence of shadows, lighting conditions.

In robust detection of abandoned and removed objects in complex surveillance videos [7], the method detects abandoned and removed objects using GMM.
algorithm. The type of static regions is determined by a method that exploits context information. A matching method is used to detect the abandoned and removed object and it outperforms the edge-based techniques. A person-detection process is integrated to differentiate static objects from stationary people. The system is robust to quick-lighting changes and occlusions. The accuracy of the detection is influenced by the size of the object, light conditions, and contrast situations.

III. PROPOSED WORK

In this section, we provide a solution for detecting abandoned and removed object in videos. Figure 1 shows the proposed system diagram. The system includes the following modules. (i) Dividing video into frames, (ii) Background Modeling, (iii) Background Subtraction, (iv) Foreground Object Formation, (v) Feature Calculation, (vi) Detecting and discriminating the objects as abandoned and removed.

![Fig. 1: Block diagram of proposed detection system.](Image)

A. Input Video

For this system we are considering the recorded video as an input to the proposed system. The video stream is initially segmented into individual frames which are converted to 2-D array (height * width). Once the frame is grabbed, the frame has to go through the chain of the pre-processing. The first process is gray scaling. The grayscale image simplifies computation drastically, compared to a color RGB image. The next process done is called as contrast enhancement which improves the perceptibility of objects in the scene by enhancing the brightness difference between objects and their backgrounds. The next step is to filter the image, for the purpose of noise. After noise filtering the next step is to convert the gray scale image into binary images.

B. Background Subtraction and Modelling

Background subtraction is a commonly used class of techniques for segmenting out objects of interest in a scene. Basically, the background subtraction technique compares the current frame not with the previous one but with the first frame in the video sequence. So, if there were no objects in the initial frame, comparison of the current frame with the first one will give us the whole moving objects independently of its motion. But as the initial frame is continuously adapted, after a few seconds it gives us the buffered background. We also use pixel colour/intensity information for background processing. But instead of having one reference frame, we maintain two different reference frames for self-adaptability resulting in less computation due to non-inclusion of any complex mathematics.

C. Blob Analysis

In the next step, Morphological operations are performed on the binary images of the candidate foreground pixels. After connecting the foreground pixels by connectivity analysis it forms foreground blobs. Each blob represents an Object. The abandoned object is difference between current background and buffered background.

D. Abandoned and Removed Object Discrimination

After calculating various features of a blob it is determined if it is a potential abandoned object or removed object. After further analysis if the features cross the pre-determined thresholds then these are classified as abandoned or removed, and suitable visual alert is indicated on the input video.

IV. CONCLUSION

The proposed work aims at developing a general framework for the detection of abandoned and removed object from video. This framework will be validated using standard video streams available on internet.

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