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Event Detection Using Background Subtraction For Surveillance Systems

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Abstract – ***In surveillance area the detecting human beings accurately in a visual surveillance system is crucial for diverse application areas including abnormal event detection. Detect an object which is in abnormal motion and classify it. Object detection could be performed using background subtraction in this system. In automated video surveillance applications, detection of suspicious human behavior is of most practical importance. However due to random nature of human movements, reliable classification of suspicious human movements can be very difficult to explain it. Defining an approach to the problem of automatically tracking people and detecting unusual or suspicious movements in CCTV videos is our primary aim. We are proposing a system that works for surveillance systems installed in indoor environments like entrances/exits of buildings, corridors, etc. Our work presents a framework that processes video data obtained from a CCTV camera fixed at a particular location. First, we obtain the foreground objects by using background subtraction. These foreground objects are then classified into people and suspicious objects . These objects are tracked using a blob matching technique. Using temporal and spatial properties of these blobs, activities are classified using semantics-based approach. The use of the gray level intensity is a common practice for most of background subtraction algorithms due to speed matters in real time applications, this algorithm could increase the efficiency of object detection thus the accuracy increases***

Key Words: *Object detection, Image processing, Background subtraction, Color histogram, Tracking.*

1. INTRODUCTION

Video Surveillance System is a collection of video, electronic and wireless components. It records videos of the various important locations for monitoring purpose. Due to the increased crime rate around the world, many organizations are deploying video surveillance systems at their locations with Closed Circuit TV (CCTV) cameras. The captured video data is useful to prevent the threats before the crime actually happens. It also becomes a good forensic evidence to identify criminals after crime. Traditionally, the video feed from CCTV cameras is monitored by human operators. These operators monitor multiple screens at a time searching for anomalous activities.

This is an expensive and inefficient way of monitoring, Expensive, because the operators are on a payroll of the organization and inefficient because humans are prone to errors. A human operator cannot monitor multiple screens simultaneously. Also, concentration of an operator will reduce drastically as time passes. One of the methods to cope with this problem is to use automated video surveillance systems (video analytics) instead of human operators. Such a system can monitor multiple screens simultaneously without the disadvantage of dropping concentration.

2. SCOPE OF WORK

Proposed system operates is in indoor surrounding like entrances or exits of buildings, corridors, etc. The lighting in these locations is usually artificial, with constant features. The location and orientation of the camera is also an important feature. An ideal position to capture the complete human shape and suspicious movements in real life scenarios.so when suspicious movement or object is captured and extracted it and classify using background estimated in proposed system. This is one of the methods to cope with this problem is to use automated video surveillance systems. Background subtraction for suspicious movement detection the time consuming is more for detected event. the proposed approach less reliable.

3. LITERATURE REVIEW

Sandesh Patil, Kiran Talele [1], in automated video surveillance applications, detection suspicious human behavior is of great practical importance. However due to random nature of human movements, reliable classification of suspicious human movements can be very difficult. Defining an approach to the problem of automatically tracking people and detecting unusual or suspicious movements in Closed Circuit TV (CCTV) videos is our primary aim.

Mohamed Bachir Boubekeur, Tarek Benlefki, SenLin Luo, and Hocine Labidi [2], a non-parametric method for background subtraction and moving object detection

based on adaptive threshold using successive squared differences and including frame differencing process is proposed. the presented scheme focused on the case of adaptive threshold and dependent distance calculation using a weighted estimation procedure. An intuitive update policy to the background model based on associated decreasing weights. The presented algorithm succeeds on extracting the moving foreground with efficiency and overpasses the problematic of ghost situations.
The proposed framework provides robustness to noise.

Jorge Garcia, Alfredo Gardel, Ignacio Bravo, Jose Luis Lazaro, Miguel Martinez, and David Rodriguez [3],the system for counting people through a single fixed camera. This system performs the count distinction between input and output of people moving through the supervised area. The counter requires two steps, first detection and then tracking. The detection is based on finding peoples heads through preprocessed image correlation with several circular patterns. Tracking is made through the application of a Kalman filter to determine the trajectory of the candidates. Finally, the system updates the counters based on the direction of the trajectories.
Mohannad Elhamod, and Martin D. Levine [4], Detection of suspicious activities in public transporter as using video surveillance has attracted an increasing level of attention. Introduce a framework that processes raw video data received from a fixed color camera installed at a particular location, which makes real time inferences about the observed activities .First, the proposed framework obtains 3-D object-level information by detecting and tracking people and luggage in the scene using a real-time blob matching technique. Based on the temporal properties of these blobs, behaviors and events are semantically recognized by employing object and inter object motion features. A number of types of behavior that are relevant to security in public transport areas have been selected to demonstrate the capabilities of this approach. Examples of, these are abandoned and stolen objects, fighting, fainting, and loitering.
Mohamed Bachir Boubekeur, Tarek Benlefki, SenLin Luo, and Hocine Labidi [5], People counting systems are widely used in surveillance applications. Here present a solution to bidirectional people counting based on information provided by an overhead stereo system. Four fundamental aspects can be identified: the detection and tracking of human motion using an extended particle filter, the use of 3-D measurements in order to increase the system's robustness and a modified K-means algorithm to provide the number of hypotheses at each time, and, finally, trajectory generation to facilitate people counting in different directions. The proposed algorithm is designed to solve problems of occlusion, without counting objects such as shopping trolleys or bags. A processing ratio of around 30 frames/s is necessary in order to capture the real-time trajectory of people and obtain robust tracking results. We validated various test videos, achieving a bit rate between 95 percent and 99 percent, depending on the number of people crossing the counting area. Different tests using a set, of real video sequences taken from different indoor areas give results ranging between 87 percent and 98 percent ac curacies depending on the volume of flow of people crossing the counting zone. Problematic situations, such as occlusions, people grouped in different ways, scene luminance changes, etc., were used to validate the performance of the system.
Mohamed Bachir Boubekeur, Tarek Benlefki, SenLin Luo, and Hocine Labidi [6], Behavior recognition and video understanding are core components of video surveillance and its real life applications. main approach is that detects semantic behaviors based on object and inter-object motion features. A number of interesting types of behaviour have been selected to demonstrate the capabilities of this approach. These types of behaviour are relevant to and most commonly encountered in public transportation systems such as abandoned and stolen luggage, fighting, fainting, and loitering. Using standard public datasets, the experimental results here demonstrate the effectiveness and low computational complexity of this approach, and its superiority to approaches described in some other work.
Jong Sun Kim, Dong Hae Yeom, and Young Hoon Joo [7], This paper deals with an intelligent image processing method for the video surveillance systems. In this technique propose a technology detecting and tracking multiple moving objects, which can be applied to consumer electronics such as home and business surveillance systems consisting of an internet protocol (IP) camera and a network video recorder (NVR). A real-time surveillance system needs to detect moving objects robustly against noises and environment. So the proposed method uses the red-green-blue (RGB) color background modeling with a sensitivity parameter to extract moving regions, the morphology to eliminate noises, and the blob-labeling to group moving objects. To track moving objects fast, this method predicts the velocity and the direction of the groups formed by moving objects. Finally, the experiments show that the proposed method has the robustness against the environmental influences and the speed, which are suitable for the real- time surveillance system.

4. PROPOSED SYSTEM ON BACKGROUND SUBSTATION AND TRACKING OF STOLEN OBJECT

Stolen Objects: Stolen object can be defined as a luggage item picked up by a person who is not the owner of the objects.

A. Proposed model

The figure shows the proposed system of the tracking person when any person touch unknown object who not owner of that object.

1) Background Model: The background image is dynamically updated by the background model. This allows us to slowly capture small changes in illumination and to introduce new static objects. This model is sensitive to sudden illumination changes.
2) Low-level Preprocessing:: To detect foreground objects, background subtraction is employed. The background image is subtracted from the selected frame image to obtain objects present in the foreground image. This method also introduces some noise due to change in light conditions, minor movements of background objects, etc. To eliminate differences due to color components in the foreground image, threshold of the output image is taken. Next, we perform morphological operations open to shrink areas of small noise to 0 followed by the morphological operation close to rebuild the area of surviving components that was lost in opening.
3) Object Detection:: Objects are detected from the foreground image obtained in the previous stage. These objects are classified into people and inanimate objects (luggage). This stage gives us candidates, that are to be tracked in the next stage.

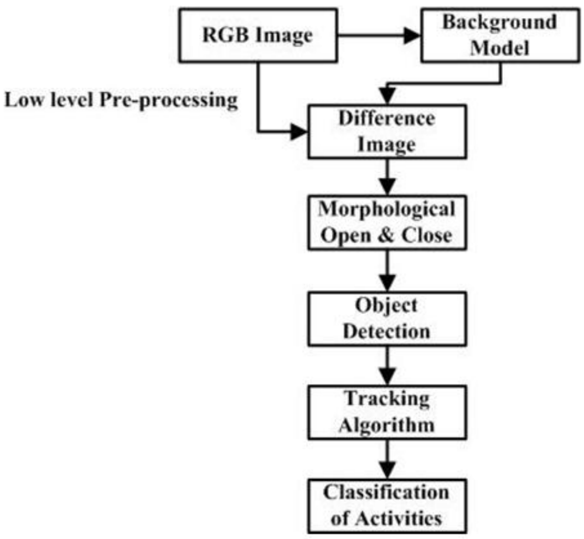

Fig -1: Proposed block diagram

4) Tracking:: This stage tracks people and inanimate objects using a proposed tracking algorithm. It uses color sample histogram information and correlation principle. We have developed an algorithm that is used for tracking in our system. This algorithm employs background subtraction and blob detection for tracking of people and luggage. The algorithm is listed below.
a) Get foreground mask from the background model.
b) Cancel out noise and fluctuations by taking threshold of the output image,

$$dst(x,y) = \begin{cases} maxval & ; if\ src(x,y) > thresh \\ 0 & ; \quad otherwise \end{cases}$$

where src(x; y) and dst(x; y) are input and output images, respectively; maxval is taken as 255; and thresh is some threshold value. We have set thresh to 50.

c) Perform morphological operation open to shrink areas of small noise to 0.

$$A \circ B = (A \theta B) \oplus B$$

This is followed by the morphological operation close to rebuild the area of surviving components that was lost in opening,

$$A \bullet B = (A \oplus B) \theta B$$

where, $\oplus$ and θ denote dilation and erosion ,respectively.
d) Draw a bounding box for each contour obtained in the resultant image. Each bounding box represents an object.
e) For all detected objects, find their color histogram (RGB).
f) Find correlation between color histograms of objects in current frame and previous frames. Correlation is given by,

$$d(H_1, H_2) = \frac{\sum_I \left(H_1(I) - \bar{H}_1\right)\left(H_2(I) - \bar{H}_2\right)}{\sqrt{\sum_I \left(H_1(I) - \bar{H}_1\right)^2 \left(H_2(I) - \bar{H}_2\right)^2}}$$

Where,

$$\bar{H}_k = \frac{1}{N} \sum_J H_k(J);$$

H_i is histogram of an image ;and N is total number of bins.
Using correlation information and distance between objects in current frame and previous frame, we uniquely identify all the objects.
Repeat step a through f for all frames in video which is suspicious video.
5) Classification of activities:: Here the total number of incoming and outgoing people is counted and saved . The activities of the people are classified into normal and suspicious.
Suspicious activities like theft, stolen object, trespassing, etc. will be detected.

Fig -2: Background picture

Fig -3: Tracking suspicious person

Fig -4: Suspicious moment

Fig -5: Object removal

5. CONCLUSIONS

In this paper, the various technologies used In this research work, a complete semantics-based behaviour recognition approach that depends on object tracking has been introduced.

Our approach begins by translating the objects obtained by background subtraction into semantic entities in the scene. These objects are tracked in 2-D and classified as being either animate (people) or inanimate (objects). Then, their motion features are calculated and recorded in the form of historical records. Finally, behaviours are semantically defined and detected by continuously checking these records against predefined rules and conditions. This approach ensures may real-time performance, adaptability, robustness against clutter and camera nonlinearities, ease of interfacing with human operators, and elimination of the training required by machine learning-based methods.

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