International Journal of Computer Science
Scholarly Peer Reviewed Research Journal - PRESS - OPEN ACCESS
ISSN: 2348-6600

http://www.ijcsjournal.com Volume 5, Issue 1, No 7, 2017 ISSN: 2348-6600
Reference ID: IJCS-189 PAGE NO: 1150-1157

Sri Vasavi College, Erode Self-Finance Wing 3rd February 2017
National Conference on Computer and Communication NCCC'17
http://www.srivasavi.ac.in/ nccc2017@gmail.com

AN EFFICIENT MOTION DETECTION AND CAPTURING SYSTEM FOR CCTV SURVEILLANCE

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ABSTRACT- Security and surveillance are important issues in today's world. Any behavior which is uncommon in occurrence and deviates from normally understood behavior can be termed as suspicious. This model aims at automatic detection of abnormal behavior in surveillance videos. We have targeted to create a system for the recognition of human activity and behavior, and extract new information of interest for end-users in highly secured indoor surveillance system. The objective of this project is to design a model for detection of abandoned objects and track abnormal human behaviors. The multi-object detection is done by background subtraction with the help of clustering techniques. Anomaly detection is done for tracking persons based on their individual appearance using Motion movement capture.

Keywords: Video Surveillance, Abnormal behaviour, Thresholding, Motion Detection.

1. INTRODUCTION

An effective video surveillance system depends on detection of suspicious activities. In recent times, detecting abnormalities in human behavior using, such systems increase more importance as it can provide clues while preventing breaches in security. Suspicious behavior detection is one of the paramount goals in surveillance systems along with abandoned object detection. However, the major constrained posed here are the result of human factors. Such constraints face challenges towards effective utilization of the systems, especially as crime-fighting tools. An important factor to be considered here is the fatigue limits of the human operations. It is significantly more while several scenes monitored by the operators for prolonged period of time. This result in a considerable degrades in the monitoring performance on surveillance areas. Another factor is that there is a limitation in the number of monitors that a human operator can manage simultaneously. This would add more complexity in large-scale surveillance systems having many cameras with a limited number of security staff. Therefore, an automatic process for detecting suspicious behavior is a necessity.

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The proposed definition aims to achieve the performance of the smart surveillance system and a different logic based skin detection system to detect the presence of human in a surveillance video. For this work various method are analyzed to improve the performance.

2. RELATED WORK

Video surveillance, which involves acquiring and processing visual data from a scene, to detect target(s) along time and space for purpose of recognizing interesting situations and perhaps generate alarms, has been a particularly hot topic. It typically begins with change detection and motion information capture for moving targets (using tracking or non-tracking methods), to enable successive high-level event analysis. Oftentimes, people pose it as a pattern-learning problem that deals with the classification of video object behavior by finding good matches either with a priori known templates of behavior or learning and forming statistical models of the behavior types from time varying feature data.

In [1], Brezeale et al. explored the video classification literature. They found that features are drawn from three modalities–texts, audio, and visual. Also combinations of these features along with classifications have been explored. While the more focused topic of understanding specific events in video data was addressed in a review by Lavee et al. [2]. In their survey the two main components of the event understanding process: Abstraction and Event modeling has been explained. Buxton [3] presented a survey on understanding dynamic scene activity using intelligent cognitive vision systems which can compute conceptual descriptions by analyzing activity in dynamic scenes from motion trajectories of moving people and the objects in particular scene. Hu et al. [4] produced a survey of automated visual surveillance which focuses on the two areas of motion detection and object tracking, offering only a short overview of behavior understanding. They reviewed recent developments, basic strategies along with possible research directions.

Teddy Ko [5] presented a survey for homeland security applications on behavior analysis in video surveillance. Also he exploited developments and a general strategy of stages involved in video surveillance, and analyzes the challenges and feasibility for combining object tracking, motion analysis, behavior analysis, and biometrics for stand-off human subject identification and behavior understanding. Dee and Hogg, in their review of real-world surveillance [6], include a section reviewing anomaly detection. In [7], Niels Haering et al. enabled the expansion of the vocabulary of video surveillance systems paving the way for more general automated video analysis. In [8], Minh et al. proposed efficient algorithm for still images, which detects various human actions by

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analyzing silhouette and the upper body of the human being. Dorin et al. in [9] proposed a robust approach using mean shift algorithm for the analysis of complex multimodal feature space and to delineate arbitrarily shaped clusters in it.

3. SYSTEM WORK

Video Input

While the application is loaded, as part of the initialization process we scan for the video input devices attached to the system. Further these devices are made available for selection by the user; so that the most appropriate area to be captured for a given instance of time can be chosen.

Background Image Acquisition

This section basically consists of capturing a frame as the reference image or the desired ideal background condition which thus considered as the reference for any further processing. Once the background is set, camera is then programmed for capturing live video footage of the monitored area.

Image pre-processing

Pre-processing is performed on the acquired images for enhancing the quality of the frames. The video frames have a lot of noise due to camera, illumination and reflections etc. This can be removed and quality of images can be enhanced with the help of preprocessing stages. The suitable steps are carried out in this stage. Now-a-days, video pre-processing is performed in the digital domain, which is carried out after the digital video capture, giving full play to the convenience of the digital signal, efficient, flexible and consistent superiority.

Change Detection

The captured video is to be processed for detecting any change with the reference frame taken and processed in the previous step, as the reference condition. 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 foreground images from background images. For change detection Mean-ratio operators are used.

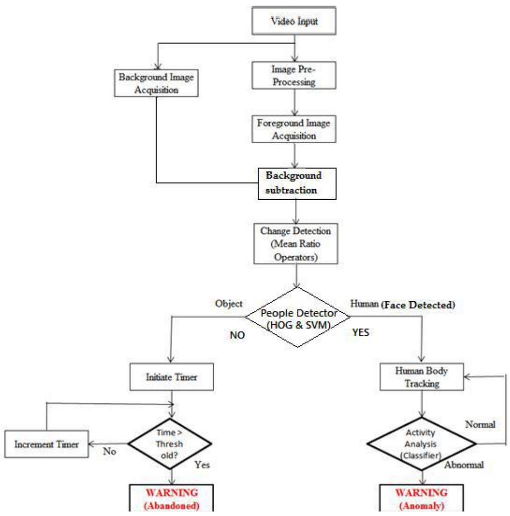

Fig.3.1 System Model

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i. Foreground Extraction

The Foreground Extraction is one of the significant sections of this project. Here the foreground object is reconstructed by removing the background elements. To accomplish this, the background image obtained previously is taken as a perfect reference image for the processing of image segmentation. Before proceeding to identify the foreground section of the image with reference to the background image, the enlisted challenges needs to be considered:

- It is always very difficult to construct a robust system which will suit various light conditions.
- The noise in the images needs to be removed.
- The comparison among the background and acquired images must be performed as quickly as possible, so that the system works in a real time manner.

To address these challenges, each image frame is initially converted to grayscale image. This makes the task easier because when a pixel to pixel comparison is made for identifying the foreground image, a 2-D unit that is grey scale image of data will be faster and easier to process upon when compared to a RGB image which is 3-D unit.

In our algorithm, we performed morphological operations to remove further noise and then binary image is dilated using the structuring element, which returns the dilated image. So that maximum information can be gathered in the smallest span of time. This results in decreased amount of the processing time along with an increase in the accuracy level of the image processing which is very much required.

ii. Algorithm for Motion movement capture.

The detailed algorithm of background model construction and Motion movement capture is summarized as follows:

- 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.
- 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.
- 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.

The 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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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 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 a dormant 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.

Classification and Tracking of Object

Object tracking is the method of detecting moving objects of interest and plotting its route by analyzing them. Object detection in a video sequence, is the method of detecting the moving objects in the frame sequence using digital image processing techniques. Background subtraction is the most commonly used technique for object detection.

Background subtraction techniques for object detection from video sequence use the concept of subtracting the background model or a reference model from the current image. The methods considered in tracking of objects use various techniques for building the background model. It has been found that the methods require different time for execution and their performance differs in speed and memory requirements. The techniques involved in these algorithms are based on the intensity values of the pixels constituting the image. The background and illumination changes of the image influence the intensity values to a great extent, ultimately affecting the overall performance.

Categories	Representative Work
Point Detectors	Moraves detector [Moravec 1979] Harris detector[Harris&Stephens 1988] Scale Invariant Features [Lowe 2004]
Segmentation	Mean-Shirt [Comaniciu & Meer 1999] Graph-Cut [Shi and Malik 2000]
Background Modeling	Eigenbackground [Oliver al.2000] Dynamic texture background [Monnet et al.2003]
Supervised Classifiers	Support Vector Machines [Papageorgiou et al.1998] Neural Networks [Rowley et al.1998] Adaptive Boosting [Viola et al.2003]

Table 3.1: Object detection Methods

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Any tracking method requires an object detection mechanism in each frame or in the first appearance of the object in the video. An ordinary approach for object detection is to use information in a single frame. But, some object detection methods utilize the chronological information computed from a sequence of frames to the number of false detections. This temporal information is usually in the form of frame differencing, which highlights changing regions in consecutive frames. Given the object regions in the image, it is then the tracker's task to perform object correspondence from one frame to the next to generate the tracks. We tabulate several common object detection methods in above Table

4. CLUSTERING ALGORITHM

Ones the method extract the motion feature and location features of the frames, it can able to generate the total motion matrix and average motion matrix and then apply the hill climbing clustering algorithm in order to group the similar activity. The stepwise details of the algorithm are as given below.

Algorithm: clustering based segmentation

1 Compute the Average Motion Matrix of the Segment.

2 Start at a non-zero bin of the Average Motion Matrix and make uphill moves until reaching a peak as follows:

2.1 Compare the number of pixels of the current Average Motion Matrix bin with the number of pixels of the neighboring (left and right) bins.

2.2 If the neighboring bins have different numbers of pixels, the algorithm makes an uphill move towards the neighboring bin with larger number of pixels.

2.3 If the immediate neighboring bins have the same numbers of pixels, the algorithm checks the next neighboring bins, and so on, until two neighboring bins with different numbers of pixels are found. Then, an uphill move is made towards the bin with larger number of pixels.

2.4 The uphill climbing is continued (repeat steps 2.1-2.3) until reaching a bin from where there is no possible uphill movement. That is the case when the neighboring bins have smaller numbers of pixels than the current bin. Hence, the current bin is identified as a peak (local maximum).

2.5 If no uphill move is done, the stopping bin is identified as a peak of a hill, and all bins leading to this peak are associated with it.

3. Select another unclimbed bin as a starting bin and perform step 2 to find another peak.

This step is continued until all non-zero bins of the Average Motion Matrix are climbed (associated with a peak).

4. The identified peaks represent the initial number of clusters of the input Segment and thus these peaks are saved.

5. Neighboring pixels that lead to the same peak are grouped together. Although, it used a global Average Motion Matrix to find the peaks, step 5 takes into account the spatial information of the pixels when forming the segments, i.e. only spatially close (neighboring) pixels that lead to the same peak are grouped into one segment. Finally, neighboring pixels that lead to the same peak are grouped together, that is associating every pixel with one of the identified peaks.

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5. APPLICATIONS

The significance of the video data is that they are used in many different areas such as sports, medicine, traffic and education programs. The potential applications of video mining include annotation, search, mining of traffic information, event detection / anomaly detection in a surveillance video, pattern or trend analysis and detection. There are four types of videos in our daily life, namely, (a) produced video, (b) raw video, (c) medical video, and (d) broadcast or pre-recorded video.

6. CONCLUSION AND FUTURE WORK

There has been a tremendous development and application activities in the video data-mining domain. There are many challenging research problems facing video mining such as discovering knowledge from spatial temporal data, inferring high-level semantic concepts from the low-level features extracted from videos and making use of unlabeled data. The detection of unusual and abnormal video events is indispensable for consumer video applications such as sports highlights extraction and commercial message detection as well as surveillance applications. To improve the results of the video data mining, the new features can be constructed by analyzing the heterogeneous data like video text, audio, and videos. In our proposed algorithm motion movement capture are increase the efficeney of anomy detection and collect the images for future reference. It's applied to all the real time detection of video surveillance system.

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ISSN: 2348-6600
SKRGC Since 2012

http://www.ijcsjournal.com Volume 5, Issue 1, No 7, 2017 ISSN: 2348-6600
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