International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org Volume 2 Issue 4 ‖ April. 2013 ‖ PP.07-12

Video Superintendence System For Real Time Anomalous Activity Disclosure

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ABSTRACT: *Video surveillance systems are becoming increasingly important for crime investigation and deterrence. Video Surveillance software's are developed in order to provide the user of the software security from threats to data and other property from burglars. Nowadays, much of the video surveillance systems have fixed default motion sensitivity level to generate motion alarm. Due to the default sensitivity level, false alarms and detection failures usually exist in video surveillance systems. The proposed system model based upon setting user required motion level providing a robust detection method at various illumination changes and noise levels of image sequences. The system aims at tracking an object in motion and classifying it on the bases of motion level, which would help in subsequent motion detection analysis. The application provides functionalities to set the parameters of maximum noise and minimum noise values. So that when an activity occurs in absence of user, the application detects it and performs the required action. The application provides the graph panel to graphically represent the amount of changes occurred in the environment.*

Keywords: *Automatic video surveillance, Abnormal motion detection, Cluster Matching, Pixel Matching, Multimedia surveillance techniques, Object Tracking, Real Time Video surveillance.*

I. INTRODUCTION

Video surveillance systems are expected to be deterrence to crimes and to help in the early detection of suspicious individuals, fires, and any unusual situations. The demand for surveillance cameras is increasing, and the planning of a video surveillance system is becoming an increasingly important factor for efficiently observing a wide area. Abnormal motion detection is the key to effective video surveillance system. The detection of an abnormal motion can trigger video transmission and recording, and can be used to attract the attention of a human observer to a particular video channel. The problem is characterized by three challenges. One is the reliability requirement, meaning that irregular events should be consistently detected, while the false-alarm rate should be sufficiently low. The second is effective characterization of normal motion, allowing discrimination between normal and abnormal activity. Third, abnormal motion detected should be accomplished and recorded and stored. The goal of this paper is to learn the action categories. To realize that, we must determine:

- Video surveillance systems are attempted to incorporate content analysis processing tasks (e.g., motion detection).
- Behavior analysis,
- To understand events that happened in a site.

To detect the moving objects in an image sequence is a very important low-level task for many computer vision applications, such as video surveillance, traffic monitoring. When the camera is stationary, a class of methods usually employed is background subtraction. The principle of these methods is to build a model of the static scene (i.e. without moving objects) called background, and then to compare every frame of the sequence to this background in order to discriminate the regions of unusual motion, called foreground (the moving objects). In this paper, we are more especially interested in outdoor video surveillance systems with long autonomy. The difficulty in devising background subtraction algorithms in such context lies in the respect of several constraints. The system must keep working without or new static objects settling in the scene. This means that the background must be temporally adaptive. The system must be able to discard irrelevant motion such as waving bushes or flowing water. It should also be robust to slight oscillations of the camera. This means that there must be a *local* estimation for the confidence in the background value. The system must be real-time, compact and low power, so the algorithms must not use much resource, in terms of computing power and memory.

The two first conditions imply that statistical measures on the temporal activity must be locally available in every pixel, and constantly updated. This excludes any basic approach like using a single model such as the

previous frame or a temporal average for the background, and global threshold for decision. Some background estimation methods are based on the analysis of the histogram of the values taken by each pixel within a fixed number of past frames. The mean, the median or the mode of the histogram can be chosen to set the background value, and the foreground can be discriminated by comparing the difference between the current frame and the background with the histogram variance. Much more attractive for our requirements are the *recursive* methods that do not keep in memory a histogram for each pixel, but rather a fixed number of estimates computed recursively.
We need to achieve high detection rates and simultaneously low false alarm rates while developing the/e model of motion detection, both of these conventional methods often fail to satisfy in noisy environment.

II. CONCEPT OF THE SYSTEM

We presented a computationally efficient and reliable method for abnormal motion detection in compressed video streams. The input to the algorithm is the set of macro block motion vectors(as well as intra-frame and intra-block flags) that are produced anyway by the compression process an essential part of many modern video surveillance systems.
In the context of video analysis, 'normal' and 'abnormal' are fundamentally hard to define. The best current way to evaluate an abnormal motion detector is by learning the patterns of normal activity.
From a practical point of view, since the algorithm is used mainly for triggering video recording for later human analysis, or for triggering transmission to a human observer, detecting the 'object' that generated the abnormal motion is much less important than the detection of the abnormality itself. Fundamentally, the algorithm can detect abnormal motion that cannot be associated with any specific object.
The algorithm is modular, in the sense that different feature vectors can be suggested and alternative probability density estimation or modeling methods can be used. Further extension given long training sequences would be to learn normal pattern of activity from short frame sequences.

III. LITERATURE SURVEY

3.1 Comparison with existing system (CCTV):

Closed-Circuit television is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. CCTV system operates continuously or only as required to monitor a particular event. CCTV video used for security purposes pursuant to this policy must always be restricted to a secure private network which may only be accessed by authorized persons. CCTV is more effective at combating property offenses than violence or public order crime. The individual context of each area and the way the system is used appear to be important. Achieving statistically significant reductions in crime is difficult (i.e., crime reductions that clearly go beyond the level that might occur due to the normal fluctuations in the crime rate are difficult to prove). CCTV appears to work best in small, well-defined areas (such as public car parks).

3.2 Literature survey of algorithm:

The goal of pixel matching in realistic rendering applications is to obtain a perceptual match between a real scene and a displayed image even though the display device is not able to reproduce the full range of luminance values. Various pixels matching algorithm related to Video Surveillance System are as follows:

- Agglomerative Clustering Algorithm,
- Reciprocal nearest Neighbor Pair Algorithm,
- Sub Pixel Mapping Algorithm,
- Dense Corresponding Algorithm,
- Tone Mapping Algorithm,
- Pixel based identity check

Pixel matching algorithm is not suitable if actual images used to have shifts or distortion.

Image matching functionality uses distinct pixel features to analyze visual content and identify matching images between a query image and a reference database. Image matching algorithms related to Video Surveillance System are as follows:

- Classic image check,
- Block based identity check.

This algorithm has drawback like less runtime efficiency, more complex. This Image based check is suitable for only exact image match with minimal tolerances or any deviations. Whenever application renders the component not fully deterministically, this algorithm is not suitable.
The algorithms which are chosen for implementation are as follows:

- Cluster matching Algorithm

- K-means Algorithm,
- Histogram check

and are briefly described in the later sections.

IV. PROPOSED SYSTEM

The proposed motion detection video surveillance system model based upon setting user wished motion level providing a strong and robust detection method at various illumination changes and noise levels of various sequences of image. A Real Time application of Abnormal Automated Video Surveillance system, the system aims at tracking an object in motion and classifying it on the bases of motion level, which would help in subsequent motion detection analysis. Motion features are derived from the motion vectors.

4.1 Architecture

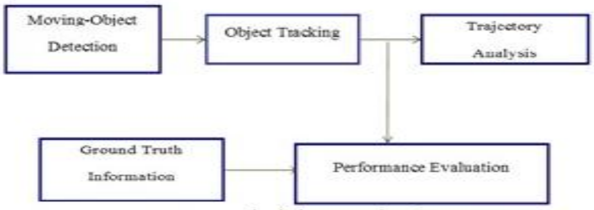

Fig 1: Basic block diagram of Video Surveillance System

The Figure above depicts the basic system architecture of the surveillance system. The system begins with a motion detection module, which is responsible for detection and segmentation of the moving objects from the stationary background. This module is also responsible for initializing the tracking process for the detected objects. The tracking module estimates the location of the object at each new frame and tags the object in order to be used for high level processing modules. The trajectory characterization module is used to test the moving object trajectory in order to detect any unusual motion pattern. The performance evaluation module is used to evaluate the performance of the system using the available ground truth data. In system the temporal variance is used as a parameter to detect moving areas in stationary scenes. The idea is to calculate the mean and variance of the intensity value at each pixel over a window of few past frames and recursively update these values for each new frame. This value of the variance is used directly afterward for the detection of moving area.

4.2 Algorithm Used

In our system we use the temporal variance as a parameter to detect moving areas in stationary scenes. The idea is to calculate the mean and variance of the intensity value at each pixel over a window of few past frames and recursively update these values for each new frame. This value of the variance is used directly afterward for the detection of moving area. The use of temporal variance as a measure for motion has the following nice properties:

1. The variance of intensity at a certain pixel depends on both the amplitude of changes and the duration of this change as shown, which makes it more robust to noise coming from moving texture that usually lasts only for a short duration.
2. There is no need for background training period as this method can build the model even when moving objects are present in the scene.

4.2.1 Cluster matching algorithm

Each time the Motion Detector receives a frame as input from the Web cam it compares each pixel of that frame with the corresponding pixel in the previous frame. If the difference between the pixels is greater than some level i.e. Noise Threshold then a counter is incremented. Once the whole image has been processed this counter represents the degree of motion which has occurred. It is scaled so that it lies between 0 and some value i.e. Maximum Motion and it is passed to application. The application graphs values between o and the Maximum motion level. Point the camera at motionless scene and set the Noise Threshold. Now expose the scene to maximum degree of motion expected to be detected. Once the motion has been detected in the video frame the considerable action has to be taken by providing the user of this application with desired effect.

4.2.2 K-Means algorithm

It is a Partitioned clustering approach. Each cluster is associated with a centroid (center point). Initial centroids are often chosen randomly. Clusters produced vary from one run to another. The centroid is (typically) the mean of the points in the cluster. K-means will converge for common distance functions. Each point is assigned to the cluster with the closest centroid. Most of the convergence happens in the first few iterations.

Often the stopping condition is changed to 'Until relatively few points change clusters'. Number of clusters, K must be specified. The basic algorithm is very simple. K-means can handling empty clusters.

Mathematical module:

An algorithm for partitioning (or clustering) *N* data points into *K* disjoint subsets *Sj* containing *Nj* data points so as to minimize the sum-of-squares criterion ;

$$J = \sum_{j=1}^{K} \sum_{n \in S} | x_n - \mu_j |^2$$

Where

- x_n is a vector representing the *nth* data point and
- m_j is the geometric centroid of the data points in S_j

Complexity is O(n * K * I * d)

n = number of points, K = number of clusters,
I = number of iterations, d = number of attributes

Diagrammatic Example of K-Means:

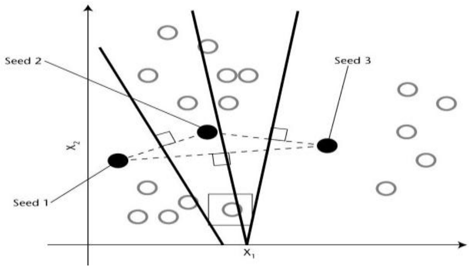

Fig: 1

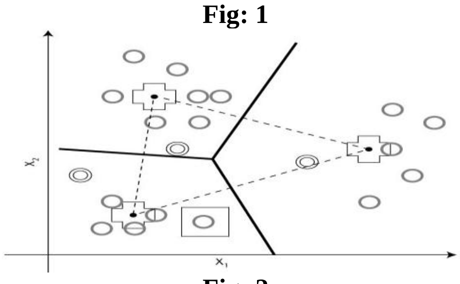

Fig: 2

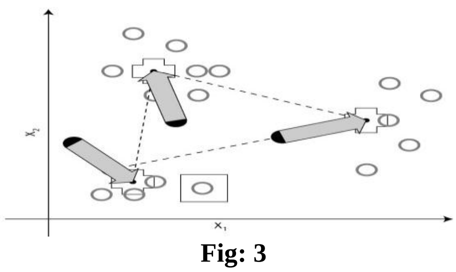

Fig: 3

4.3 Histogram Check

An image is first broken into its three base colors red, green and blue, to create a histogram. Then the color values for each pixel are analyzed to partition them into a definable amount of categories (known as buckets when talking about histograms). The actual fill level of each bucket is compared to the expected level. Comparison of the relative frequencies of color categories is the result of the algorithm. Histograms are used for many scenarios.

V. VIDEO SURVEILLANCE SYSTEM FUNCTIONS

5.1 Deterrence

One function of a Video Surveillance system provides deterrence to criminal activity. Deployment for deterrence might include parking or other areas where theft occurs.

5.2 Forensic
Recorded video from Video Surveillance systems is recalled to review events, support investigations and to provide evidence for criminal cases. To avoid financial waste, Care must be taken to ensure recorded video is of sufficient quality to meet forensic objectives.

5.3 Alarm assessment
Using an active control room, when an alarm is received, pan, tilt and zoom cameras are programmed to slew to a preset location providing control room personnel with the ability to assess conditions, validate threats and communicate information to responding personnel.

5.4 Supplement Protective Force Patrols
Another potential function of a Video Surveillance system is to allow assigned protective force personnel to use the Video Surveillance system to supplement roving by surveying areas of sites experiencing elevated criminal activity.

5.5 Operational Support
Often personnel are remotely admitted into a building or site. When remote admittance is required, Video Surveillance systems allow personnel to verify the presence and identity of persons prior to admitting to the building or site.

VI. RESULTS

We developed Video surveillance system using Java and Multimedia Techniques, which works in Windows Xp and higher version environment. Camera supports RGB and YUV format. The application uses JMF and JDK libraries. Camera and alarm are the only hardware required.
The main functions of the system are:

- Camera Configuration.
- Start capturing of desktop activities.
- Search for suspicious movements.
- Motion detected.
- Record suspicious movements.
- Ring the attention Alarm.

6.1 Flow of system
The flow of control is from camera configuration to ringing alarm. This is for pushing information to end-user about motion detection.

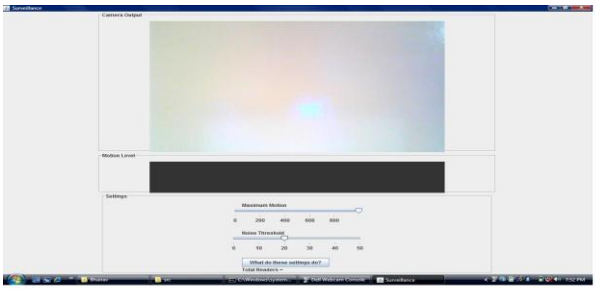

Fig 2: Initial User Interface Screen

Fig 3: Recording Completed and Resume Monitoring

Fig 4: Recording Video after Motion Is Captured

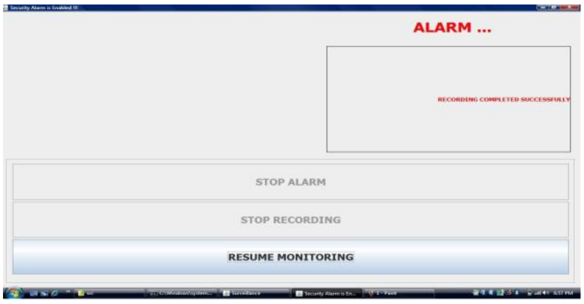

Fig 5: Recording Completed and Resume Monitoring

VII. CONCLUSION

We have proposed Video Surveillance System used in detection of any intruder. It uses Cluster matching algorithm, k-means algorithm and Histogram Check algorithm. The paper also states the advantages and disadvantages of Video Surveillance System. It has come to our vicinity that Video Surveillance System has advantages and applications like: provides evidence of a crime, security in banks.

Video Surveillance System is a good security tool. It helps in detection of any intruder. Manual surveillance is not required hence it reduces the effort of manning the area. If there is any sort of intrusion and the motion crosses the threshold value, it captures that particular movement and stores. At the same time alarm is sounded. It is cost effective and advanced technology.

ACKNOWLEDGMENTS

We are thankful to the staff and students of our college for the support and encouragement they gave.

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