SMART VIDEO SURVEILLANCE SYSTEM FOR HUMAN ACTIVITY RECOGNITION

[1]POONAM SONI, [2]DR. SURENDRA YADAV, [3]MANISH MATHURIA

[1]M.Tech Student, [2]Professor, [3]Asst. Prof.
Department of Computer Science Engineering, MACERC, Jaipur.

Soni.poonam0310@gmail.com

ABSTRACT : *A sequential collection of frames (images) with constant time interval makes a video. Real world objects can be better understood in videos because videos provide more information about objects where the surrounding scenes change according to time. Sometimes monitoring of such videos is necessary to detect any malicious activity in the scene. For such detections and tracking many algorithms have already been developed. In this paper, a novel approach for multiple objects' tracking using background subtraction based on Gaussian Mixture Model (GMM) is discussed. The overall result of the work can be seen through the values like PSNR (Peak Signal to Noise Ratio), BCR (Bit Control Rate) and CCV (Correlation Coefficient Value).*

KEY WORDS *: Smart video surveillance, background subtraction model, Guassian mixture model, human activity recognition, real time monitoring.*

1. INTRODUCTION

The main aim of this paper is to present the current threats to the ATMs and how to deal with such activities in the real time. The present ATM customers are facing many problems while using ATMs like, victim of getting robbed, card skimming, etc. So to track all such frauds and crimes Smart Video Surveillance System can be used, which can generate an alarm at the time the malicious activity is going on, which is known as real time detection [1]. For object detection in ATMs, an efficient algorithm is proposed which works on the concept of image processing. This all is done with the use of an Ariel camera. This algorithm works in four phases i.e. extracting foreground from background using Gaussian Mixture Model, use of morphological operations for noise elimination, person detection and tracking using Kalman Filter and lastly object counting. Experiments are carried out over a wide range ATM visitors, light intensities and camera heights [2].

In this paper, the main task is to evaluate the efficiency of the tracking algorithm which is proposed to track the video objects. The main step of this tracking procedure is to segment the captured objects in motion, keeping a track of them and then analyze their tracks to assess their behaviour. There might be some challenges while detecting the doubtful objects like, if there are objects which change their shape, objects having messy structure, change in location and orientation over subsequent frames [3].

1.1 Overview of Object Detection and Tracking Model

In moving object detection various background subtraction techniques available in the literature are simulated. Background subtraction involves the absolute difference between the current image and the reference updated background over a period of time. It's hard to get all these problems solved in one background subtraction technique. So the idea was to simulate and evaluate their performance on various video data taken in complex situations. On developing a framework to detect moving objects and generate reliable tracks from surveillance video, the requirement is setting up a basic system that can serve as a platform for further automatic tracking research. It gives more focus towards the investigation of detection and tracking of objects in video surveillance. Most of the surveillance system includes static camera and fixed background which gives a clue for the object detection in videos by background subtraction technique.

1.2 Background Subtraction for Object Detection

For segmenting the motion in static scenes this technique is optimal [4]. This technique mainly emphasize on the subtraction of current frame from the background frame which is sometimes also known as frame differencing. And this subtraction is done by taking difference of the pixels of both the images. In the literature, this background subtraction process is divided into four major steps. These four steps are as follows:-

1) **Preliminary Processing:-** When the actual work on the system starts, before that there might be some data which needs to be pre-processed, and used in further steps as a format.

2) **Background Modeling:-**The reference background image is created with a process called background modeling. In this modeling few initial frames of the video as taken as sample, and then averaging those frames (based on the pixel distribution [5]) this background image is made the reference.

3) **Foreground Detection:-** A maximum value is also set for this method. Where ever the difference between the pixels is more than that value, the pixels are considered as to be that of the foreground image

4) **Data Updating:-**Periodically, the reference image can be updated over time to adapt any changes to the dynamic scene [6].

2. SMART VIDEO SURVEILLANCE SYSTEMS (SVSS)

The main objective of the paper is object detection and tracking. Detecting a moving object in the frame and then keeping a track of that object throughout the video is gaining importance because of the day by day increasing suspicious, criminal, and harmful activities around us [7]. To accomplish the above task, the below given approach was followed:-

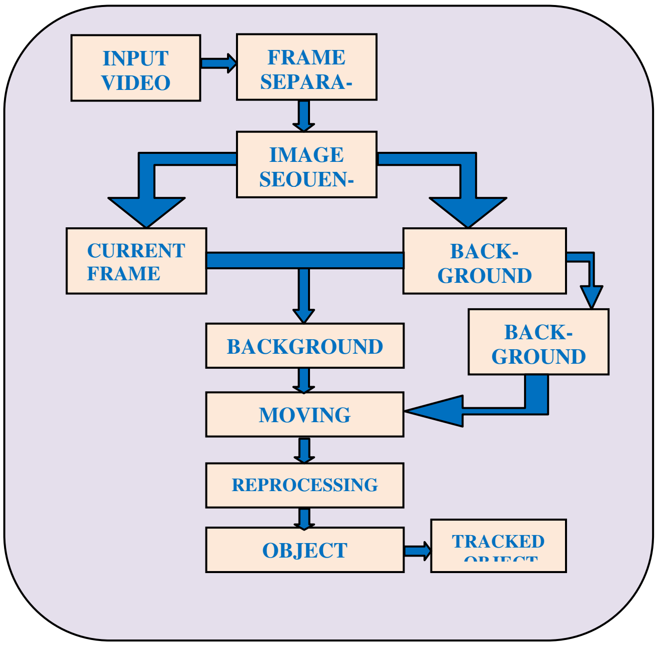

Fig. 2.1 Flow chart for Smart Video Surveillance System

3. VARIOUS SCENARIOS

There can be various types of settings in which this algorithm can be tested for its correctness. For example,

- Whether the video is captured in room light or outside room in the day light.
- Whether there is a single object is to detect or there are multiple objects in the scene.

Based on the above given situations, there can be the following four scenarios:-

1) Day Light-Single Object Detection
2) Day Light-Multiple Object Detection
3) Room Light-Single Object Detection
4) Room Light-Multiple Object Detection

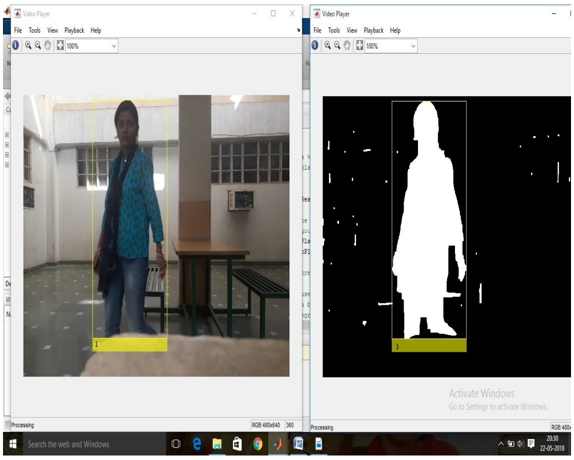

Fig. 3.1 Object Detection and Noise Removal

4. IMAGE QUALITY EVALUATIONS

TABLE 4.1
FRAME QUALITY EVALUATION

S. No.	Case	I Frame	II Frame	BCR	PSNR	CCV
1.	*Day Light - Single Object*	Frame 1	Frame 366	.3012	20.9447	.7668
2.	*Day Light - Multiple Objects*	Frame 1	Frame 206	.3197	26.7072	.9283
3.	*Room Light - Single Object*	Frame 34	Frame 354	.5469	26.7981	.9442
4.	*Room Light - Multiple Objects*	Frame 15	Frame 243	.5407	27.7779	.9355
5.	*Good Light Intensity*	Frame 1	Frame 506	.9024	22.3268	.9245
6.	*Poor Light Intensity*	Frame 11	Frame 338	.6536	25.2657	.8917
7.	*Overlapping Objects*	Frame 1	Frame 261	.2304	24.5663	.8753
8.	*Camera in Motion*	Frame 1	Frame 174	.4950	23.4525	.9141
9.	*Vibrating Camera*	Frame 1	Frame 299	.4981	19.7113	.4523
10.	*Presence of Shadow*	Frame 1	Frame 167	.4863	23.6842	.9217

For all the above given cases, whether they are different scenarios in which objects are detected and tracked or whether they are different challenges to our system, here its tried to evaluate the quality of the frames using BCR (Bit Control Rate), Peak Signal to Noise Ratio (PSNR) and Correlation Coefficient Value (CCV) [8]. A brief description of all these values is given below:-

Bit Control Rate- BCR is actually the measurement of number of bit errors and bit error rate. Here one frame is compared (bit-wise) with the other.
Peak Signal to Noise Ratio- PSNR is generally used for measuring the loss occurred in any image due to compression. But here, we used this for measuring the amount of noise occurred in the frame when object entered the current frame as compared to a frame without object.
Correlation Coefficient Value- Whenever we want to recognize any image in relevance to another image, we can use CCV. Its value basically tells us about the similarity ratio between two relevant images [9].

5. CHALLENGES

There are various challenges that were faced while using this algorithm for different setups. Here we are showing the results of using the algorithm in these challenging situations.
1) Varying Light Intensity
2) Occlusion
3) Motion of Camera
4) Vibrating Camera
5) Object Detection in Presence of Shadow [10]

6. CONCLUSION

In this paper, SVSS is implemented over a wide variety of videos taken from static camera like, videos captures in day light or room light, with single or multiple objects, and many other situations, and we can see that this system is efficiently working in almost all situations except some exceptions. There are few challenges while implementing the system. These challenges can be worked upon, and the efficiency of system can be improved in near future. Table 4.1 represents the frame quality evaluation of different scenarios and challenges, where the values of various parameters like BCR, PSNR and CCV can be easily compared.

7. REFERENCES

[1] Sujith B, “Crime Detection and Avoidance in ATM: A New Framework”, International Journal of Computer Science and Information Technologies, Vol. 5 (5), 2014.

[2] K. Trinayani and Mrs. B. L. Sirisha, “Moving Vehicle Detection and Tracking using GMM and Kalman Filter on Highway Traffic”, International Journal of Engineering Technology, Management and Applied Sciences, Volume 3, Issue 5.

[3] Hammad Naeem, Jawad Ahmad and Muhammad Tayyab, “Real Time Object Detection and Tracking”, 978-1-4799-3043-2/13/ copyright 2013 IEEE.

[4] S. H. Shaikh et al., “Moving Object Detection Approaches, Challenges and Object Tracking”, SpringerBriefs in Computer Science, DOI 10.1007/978-3-319-07386-6_2.

[5] Rohini Chavan and Sachin R. Gengaje, “Multiple Object Detection using GMM Technique and Tracking using Kalman Filter”, International Journal of Computer Applications (0975 – 8887) Volume 172 – No.3, August 2017

[6] Weiyao Lin, Ming-Ting Sun, Radha Poovandran, and Zhengyou Zhang, “Human Activity Recognition for Video Surveillance”, 978-1-4244-1684-4/08/$25.00 ©2008 IEEE.

[7] Jubil T Sunny and Sonia Mary George, “Applications and Challenges of Human Activity Recognition using Sensors in a Smart Environment”, IJIRST –International Journal for Innovative Research in Science & Technology, Volume 2, Issue 04, September 2015.

[8] Gaurav Verma, Swati Gautam, Rohan Agarwal, Sarthak Saxena and Deval Verma, “Implementation of Smart Video Surveillance System Using Motion Detection Technique ”, Sensors and Image Processing, Advances in Intelligent Systems and Computing 651, © Springer Nature Singapore Pte Ltd. 2018.

[9] Sanjay Singh, Srinivasa Murali Dunga, A.S. Mandal, Chandra Shekhar, and Anil Vohra, “Moving Object Tracking Using Object Segmentation”, ICT 2010, CCIS 101, pp. 691–694, 2010. © Springer-Verlag Berlin Heidelberg 2010.

[10] Fatih Porikli and Alper Yilmaz, “Object Detection and Tracking”, Video Analytics for Business Intelligence, SCI 409, pp. 3–41, Springer-Verlag Berlin Heidelberg, 2012.