The International Journal of Engineering And Science (IJES)
||Volume|| 2 ||Issue|| 01 ||Pages|| 240-242 ||2013||
ISSN: 2319 – 1813 ISBN: 2319 – 1805

Performance Comparison of Moving Object Detection Techniques in Video Surveillance System

[1]Dr. Dheeraj Agrawal, Nitin Meena,
[1]*Assistant Professor, Dept of ECE MANIT, Bhopal, India*
[2]*Research Scholar, Dept of ECE MANIT, Bhopal, India*

Abstract

Real time object tracking is considered as a critical application. Object tracking is one of the most necessary steps for surveillance, augmented reality, smart rooms and perceptual user interfaces, video compression based on object and driver assistance. While traditional methods of Segmentation using Thresholding, Background subtraction and Background estimation provide satisfactory results to detect single objects, noise is produced in case of multiple objects and in poor lighting conditions. Hence, a method called correlation is used which gives the relation between two consecutive frames which have sufficient difference to be used as current and previous frame. This gives a way better result in poor light condition and multiple moving objects.

Keywords— *Video Surveillance system; Moving object detection; Tracking; Background Subtraction algorithm; Adaptive Contrast Detection Method*

Date of Submission: 14th December, 2012 ⟺ Date of Publication: Date 20th January 2013

I. Introduction

It is the system, used to monitor security sensitive areas such as bank, departmental stores, highway, borders etc. It is computer based system where without much human efforts we can detect any object. Availability of large capacity storage devices and high speed network made this research effective and possible. Many researches and work have been done in this field. Now we can track smallest thing from either static or dynamic cameras. We can recognize shape, color, size, speed, velocity, direction, distance, pattern of motion etc of moving object in a given premises. To make video surveillance system smart we should be able to implement fast, reliable and robust algorithms for object detection, classification, tracking and activity analysis. Security is main concern in today automated world where maximum thing is governed by machines like computers. Scenarios where security is concerned: Public places like shopping malls, banks etc. In collecting information like measuring traffic flow.Law enforcement like measuring speed of vehicle in traffic. In military areas like measuring flow of refugees etc.

II. Proposed Algorithm

Background subtraction and Background estimation provide satisfactory results to detect single objects, noise is produced in case of multiple objects and in poor lighting conditions. Using the segmentation technique we can locate a target in the current frame. By minimizing the distance or maximizing the similarity coefficient we can find out the exact location of the target in the current frame. Target localization in current frame was computationally much complex in the conventional algorithms. Searching an object in the current frame using these algorithms starts from its location of the previous frame in the basis of attraction probably the square of the target area, calculating weighted average for all iteration then comparing similarity coefficients for each new location.

To overcome these difficulties, a new method is proposed for detecting and tracking multiple moving objects on night-time lighting conditions. The method is performed by integrating both the wavelet-based contrast change detector and locally adaptive thresholding scheme. In the initial stage, to detect the potential moving objects contrast in local change over time is used. To suppress false alarms motion prediction and spatial nearest neighbour data association are used. A latest change detector mechanism is implemented to detect the changes in a video sequence and divide the sequence into scenes to be encoded independently. Using the change detector algorithm (CD), it was efficient enough to detect abrupt cuts and help divide the video file into sequences. With this we get a sufficiently good output with less noise. But in some cases noise becomes prominent. Hence, a method called correlation is used which gives the relation between two consecutive frames which have sufficient difference to be used as current and previous frame. This gives a way better result in poor light condition and multiple moving objects.

Background

Proper threshold values have to be chosen for background, standard deviation and area of the moving objects. The statistical parameter standard deviation is used in the processing of removing the shadow of the moving object. In this algorithm threshold value of background chosen as 250 pixels, standard deviation is 0.25 and area of the moving object is 8 pixels.8*8 pixel is taken as one block in this algorithm.

Foreground

The input video format is avi. Avi stands for audio video interleave. An AVI file actually stores audio and video data under the RIFF (Resource Interchange File Format) container format. In AVI files, audio data and video data are stored next to each other to allow synchronous audio-with-video playback. Audio data is usually stored in AVI files in uncompressed PCM (Pulse-Code Modulation) format with various parameters. Video data is usually stored in AVI files in compressed format with various codecs and parameters. The aviread, aviinfo matlab functions which are are used to read the input video avi format. This Algorithm is tested with input video file having 120 frames.

Background Subtraction

This proposed algorithm dynamically extracting the background from incoming all video frames, it is subtracted from every subsequent frame and compared with the background threshold. If is greater than the background threshold, it assumed as foreground otherwise it is background. The background is updated in each and every frame.

Shadow removal

Performing the operation using a function on each frame by 8*8 block wise and result is compared with the variance threshold. If the result is less than the variance threshold,it assumes as shadow and it takes logic 0 otherwise it takes logic 1.

- **Background Subtraction Algorithm**
- **Background Estimation**
- **Adaptive Contrast Change Detection**

Background Subtraction Algorithm

Background subtraction is a commonly used class of techniques for segmenting out objects of interest in a scene for applications such as surveillance. It compares an observed image with an estimate of the image if it contained no objects of interest. The areas of the image plane where there is a significant difference between the observed and estimated images indicate the location of the objects of interest. The name “background subtraction" comes from the simple technique of subtracting the observed image from the estimated image and thresholding the result to generate the objects of interest. Here we survey several techniques which are representative of this class, and compare three important attributes of them: how the object areas are distinguished from the background; how the background is maintained over time; and, how the segmented object areas are post-processed to reject false positives, etc. Several algorithms were implemented to evaluate their relative performance under a variety of different operating conditions. With this, some conclusions can be drawn about what features are important in an algorithm of this class. In our algorithm, we have used successive I-frames for tracking and thereafter we have interpolated the motion of the object in the intermediate frames. Initially we acquire a DCT image of an I-frame representing the background, which is used as the reference image. Then, all the DCT images are compared with the reference image subsequently to segment the foreground object. Based on the model of the application the background image is created and is updated from time to time whenever there is a permanent change in the background.

A pixel is marked as foreground if

$$| I_t - B_t | > \zeta$$

Where τ is a “predefined" value threshold. The process thresholding is followed by closing with a 3 X 3 kernel and the discarding of small regions. The background is updated as

$$B_{t+1} = \alpha I_t + (1- \alpha) B_t$$

Where the value α is kept small to prevent the detection of artificial “tails" forming behind moving objects.

Two background corrections are applied:

1. If a pixel is marked as foreground for more than m of the last M frames, then the background is updated as $B_{t+1} = I_t$. This correction is designed to compensate for sudden illumination changes and the appearance of static new objects.

2. If a pixel change is frequent that it changes its state from foreground to background frequently, it can be masked out due to inclusion in the foreground. This is designed to compensate for fluctuating illumination, such as swinging branches of trees.

Background Estimation

Initially this algorithm identifies the moving objects in the first few image frames and then labels the corresponding pixels as foreground pixels. Next, the algorithm identifies those pixels that do not belong to the foreground pixels as the incomplete background. The algorithm estimates more and more of the background pixels as the foreground objects move. Once the background estimation is completed by the program, the background is subtracted from each video frame to produce foreground images. This foreground image is converted to binary feature image. This is carried out by implementing thresholding and performing certain morphological closing on each foreground image. Then object tracking is carried out by another block. The model locates the objects in each binary feature image using the Blob Analysis block. Then the Draw Shapes block is used to draw a green rectangle around the objects that moves beneath the white line. A counter is used in the upper left corner of the Results window to track the number of objects in the region of interest.

Adaptive Contrast Change Detection

The method of adaptive contrast change detection for video object tracking essentially involves integrating both the wavelet-based contrast change detector and locally adaptive thresholding scheme. This is preferred for night surveillance and multiple colour objects tracking. The first step includes computing the contrast in local change over time which is used to detect potential moving objects. This is followed by motion prediction and spatial nearest neighbour data association which helps to suppress false alarms.

CONCLUSION

The objective has been to detect moving objects and thereafter, decide on objects of particular interest which would be tracked. While earlier we worked with object-intrinsic properties such as the centroid of a moving object in order to make a probable prediction of its immediate future motion, methods to detect a rectangular boundary for the object, then used background estimation method using Simulink models and got fair output for single object, but we did not obtain satisfactory results when the methods were worked with multiple objects. Further we made an attempt using the Optical Flow method wherein the Horn-Schunck algorithm for motion estimation was put into effect. The latest method of Adaptive Contrast Change Detection gave satisfactory results in sufficiently reducing the noise while detecting multiple objects. But in some cases it gives unwanted noise. Hence, we have used correlation which basically gives the relation between to frames having significant contrast change. Use of correlation has significantly improved the output and gives better result even with multiple moving objects. The approach seems to have efficient practical applications in poorly-lighted conditions such as night-time visual surveillance systems.

References

[1] F. Oberti, G. Ferrari, and C. S. Regazzoni. A Comparison between Continuous and Burst, Recognition Driven Transmission Policies in Distributed 3GSS, chapter 22, pages 267–278. Video-Based Surveillance Systems. Kluwer Academic Publishers, Boston, 2002.

[2] R. T. Collins et al. A system for video surveillance and monitoring: VSAM final report. Technical report CMU-RI-TR-00-12, Robotics Institute, Carnegie Mellon University, May 2000.

[3] Ding Zhonglin and Lili, “Research on Hybrid Moving Object Detection Algorithm in video Surveillance system” Dec 24-26 2011.

[4] Y. Z. Hsu, H. H. Nagel, and G. Rekers. New likelihood test methods for change detection in image sequences. Computer Vision, Graphics, and Image Processing, 1984

[5] C. Stauffer and W. Grimson. Adaptive background mixture models for real-time tracking. In Proc. of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, page 246252, 1999.

[6] L. Wang, W. Hu, and T. Tan. Recent developments in human motion analysis. Pattern Recognition, 36(3):585–601, March 2003.

[7] Sherin M. Youssef, Meer A. Hamza, Arige F. Fayed, “ Hybrid wavelet-based video tracking using adaptive contrast detection in night time visual surveillance systems”, vol.2183, vol.41, pp. 732 – 737, WEC 2010.

[8] Y. Rubner, C. Tomasi, and L. J. Guibas. The Earth Mover's Distance as a Metric for Image Retrieval. International Journal of Computer Vision 40(2): 99-121, 2000.

[9] A. M. McIvor. Background subtraction techniques. In Proc. of Image and Vision Computing, Auckland, New Zealand, 2000.

[10] J. Heikkila and O. Silven. A real-time system for monitoring of cyclists and pedestrians. In Proc. of Second IEEE Workshop on Visual Surveillance, pages 74–81, Fort Collins, Colorado, June 1999.

[11] A. J. Lipton, H. Fujiyoshi, and R.S. Patil. Moving target classification and tracking from real-time video. In Proc. of Workshop Applications of Computer Vision, pages 129–136, 1998.

[12] Liao Ping-Sung, Chen Tse-Sheng, Chung Pau-Choo, "A fast algorithm for multilevel thresholding", J. vol.17, pp. 713–727, Inform. Sci. Eng. 2001.

[13] Otsu N., “A thresholding selection using gray level histograms”, IEEE IEEE Trans., vol.9, pp. 62-69 , Systems Man Cybernetics 1979.

[14] Horn B.K.P., Schunck B.G., "Determining optical flow", vol.17, pp. 185-203 Artificial Intelligence 1981.