Volume 3, Issue 4, April 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Study of Moving Object Detection and Tracking for Video Surveillance

Abhishek Kumar Chauhan*
I.T. Department
Dehradun Institute of Technology
Dehradun, India.

Deep Kumar
Asst. Prof. (C.S.E. Department)
Dehradun Institute of Technology
Dehradun, India.

Abstract—In this paper, we are discussing a video surveillance scenario with real-time moving object detection and tracking. The detection of moving object is important in many tasks, such as video surveillance and moving object tracking. The design of a video surveillance system is directed on automatic identification of events of interest, especially on tracking and classification of moving objects. Normally a video surveillance system combines three phases of data processing: moving object extraction, moving object recognition and tracking, and decisions about actions. The extraction of moving objects, followed by object tracking and recognition, can often be defined in very general terms. This survey paper reviews briefly research works on object detection and tracking in videos. The definition and tasks of object detection and tracking are first described, and the important applications are mentioned.

Keywords— Object Tracking, Moving Objects, Object Detection, Video Surveillance, Traffic Monitoring.

I. INTRODUCTION

The aim of object tracking and detection is to establish a correspondence between objects or object parts in consecutive frames and to extract temporal information about objects such as trajectory, posture, speed and direction. Tracking detected objects frame by frame in video is a significant and difficult task. It is a crucial part of smart surveillance systems since without object tracking, the system could not extract cohesive temporal information about objects and higher level behavior analysis steps would not be possible. Moving object detection is the first step in video analysis. It can be used in many regions such as video surveillance, traffic monitoring and people tracking.

The rest of this paper is organized as follows, Section II describes the object detection and tracking contains various method and algorithm. Section III describes the video surveillance and its importance with the use of tracking. Section IV describes how tracking is useful for video surveillance and its application. Finally Section V presents our conclusions and future work.

II. OBJECT DETECTION AND TRACKING

Tracking is a significant and difficult problem that arouses interest among computer vision researchers. The objective of tracking is to establish correspondence of objects and object parts between consecutive frames of video. It is a significant task in most of the surveillance applications since it provides cohesive temporal data about moving objects which are used both to enhance lower level processing such as motion segmentation and to enable higher level data extraction such as activity analysis and behaviour recognition. Tracking has been a difficult task to apply in congested situations due to inaccurate segmentation of objects. Common problems of erroneous segmentation are long shadows, partial and full occlusion of objects with each other and with stationary items in the scene. Thus, dealing with shadows at motion detection level and coping with occlusions both at segmentation level and at tracking level is important for robust tracking. Tracking in video can be categorized according to the needs of the applications it is used in or according to the methods used for its solution. Whole body tracking is generally adequate for outdoor video surveillance whereas object's part tracking is necessary for some indoor surveillance and higher level behaviour understanding applications [1][5].

There are two common approaches in tracking objects as a whole one is based on correspondence matching and other one carries out explicit tracking by making use of position prediction or motion estimation. On the other hand, the methods that track parts of objects employ model-based schemes to locate and track body parts. Fig 1 shows the tracking diagram that we generally use in object tracking and detection. In the end we find object attributes and its features that could be used in various application and real time scenario. Object detection methods have been classified as point detectors, segmentation and background subtraction [3].

The aim of an object tracker is to generate a trajectory of the path followed by the moving object over time by locating its position in every frame of the video. The tasks of detecting the object and establishing correspondence between the detected object across frames can either be performed separately or jointly. We can use various object detection algorithms for tracking and can use in different application and technology like data mining, neural network, artificial intelligence, wireless sensor network and biometrics. Below is the block diagram that we generally follow for object detection and tracking. Foreground and Background are two basic terminologies for an image or set of images. We can use background subtraction and foreground detection to tack the object and can extract object attributes [2].

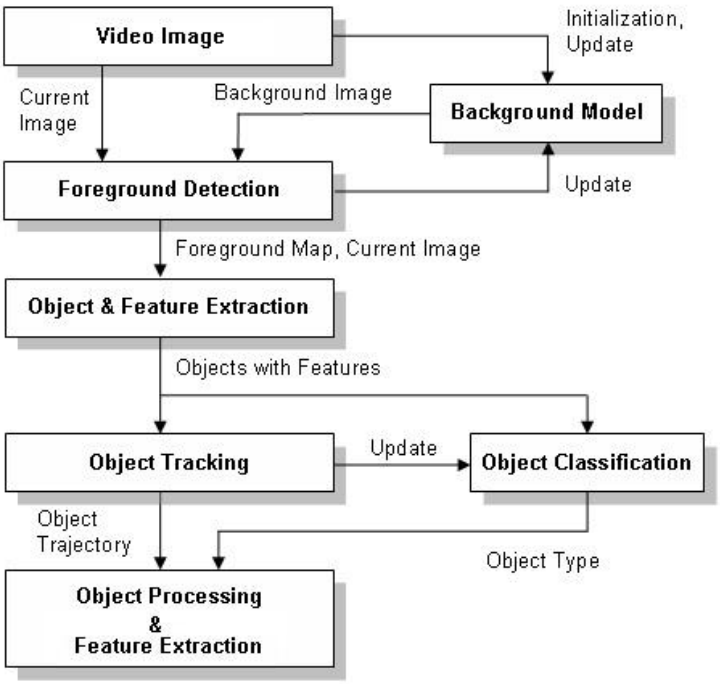

Fig.1: Tracking block diagram

III. VIDEO SURVEILLANCE

Video surveillance systems have long been in use to monitor security sensitive areas. The history of video surveillance consists of three generations of systems which are called 1GSS, 2GSS and 3GSS. The first generation surveillance systems (1GSS, 1960-1980) were based on analog sub systems for image acquisition, transmission and processing. They extended human eye in spatial sense by transmitting the outputs of several cameras monitoring a set of sites to the displays in a central control room. The next generation surveillance systems (2GSS, 1980-2000) were hybrids in the sense that they used both analog and digital sub systems to resolve some drawbacks of its predecessors. They made use of the early advances in digital video processing methods that provide assistance to the human operators by filtering out spurious events. Most of the work during 2GSS is focused on real time event detection. Third generation surveillance systems (3GSS, 2000-) provide end-to-end digital systems. Image acquisition and processing at the sensor level, communication through mobile and fixed heterogeneous broadband networks and image storage at the central servers benefit from low cost digital infrastructure. Moving object detection is the basic step for further analysis of video. It handles segmentation of moving objects from stationary background objects. This not only creates a focus of attention for higher level processing but also decreases computation time considerably. Due to dynamic environmental conditions such as illumination changes, shadows and waving tree branches in the wind object segmentation is a difficult and significant problem that needs to be handled well for a robust visual surveillance system [4].

It is necessary to distinguish objects from each other in order to track and analyze their actions reliably. Currently, there are two major approaches towards moving object classification, which are shape-based and motion-based methods. Shape-based methods make use of the objects' 2D spatial information whereas motion-based methods use temporal tracked features of objects for the classification solution. Detecting natural phenomenon such as fire and smoke may be incorporated into object classification components of the visual surveillance systems. Detecting fire and raising alarms make the human operators take precautions in a shorter time which would save properties, forests and animals from catastrophic consequences [7]. The next step in the video analysis is tracking, which can be simply defined as the creation of temporal correspondence among detected objects from frame to frame. The output produced by tracking step is generally used to support and enhance motion segmentation, object classification and higher level activity analysis. The final step of the video surveillance systems is to recognize the behaviours of objects and create high-level semantic descriptions of their actions. It may simply be considered as a classification problem of the temporal activity signals of the objects according to pre-labelled reference signals representing typical human actions. The outputs of this can be used both for providing the human operator with high level data to help him to make the decisions more accurately and in a shorter time and for offline indexing and searching stored video data effectively. The advances in the development of these algorithms would lead to breakthroughs in applications that use visual surveillance.

IV. APPLICATION DOMAINS OF VIDEO SURVEILLANCE

Video surveillance usage range in many areas starting from Security in public and commercial domains, Smart video data mining, Law enforcement and Military purposes etc. Usage in public and commercial security can be further explained as monitoring of banks, department stores, airports, museums, stations, private properties and parking lots for crime prevention and detection. Some other key areas are patrolling of highways and railways for accident detection.

Surveillance of properties and forests for fire detection. Observation of the activities of elderly and infirm people for early alarms and measuring effectiveness of medical treatments. There are number of applications in the field of smart video data mining like measuring traffic flow, pedestrian congestion and athletic performance, compiling consumer demographics in shopping centres and amusement parks, extracting statistics from sport activities, counting endangered species, logging routine maintenance tasks at nuclear and industrial facilities, artistic performance evaluation and self learning etc. Today, traffic monitoring and control is most widely used application of object detection and tracking using video surveillance. The system works on the principle of measuring the speed of vehicles and detecting red light crossings and unnecessary lane occupation. The law enforcement agencies use this system on a very high scale worldwide. The other use might be in military security for patrolling national borders, measuring flow of refugees, monitoring peace treaties, providing secure regions around bases, assisting battlefield command and control etc.

The use of smart object detection, tracking and classification algorithms are not limited to video surveillance only. Other application domains also benefit from the advances in the research on these algorithms. Some examples are virtual reality, video compression, human machine interface, augmented reality, video editing and multimedia databases [6][3].

V. CONCLUSION & FUTURE WORK

In this paper, Moving object tracking is a key task in video monitoring applications. Object detecting and tracking has a wide variety of applications in computer vision such as video compression, video surveillance, vision-based control, human-computer interfaces, medical imaging, augmented reality, and robotics. Additionally, it provides input to higher level vision tasks, such as 3D reconstruction and 3D representation. It also plays an important role in video database such as content-based indexing and retrieval.

REFERENCES

[1] Paolo Spagnolo, Marco Leo, Giovanni Attolico, Arcangelo Distante, " A Supervised Approach in Background Modelling for Visual Surveillance" in AVBPA 2003: 592-599

[2] C.Stauffer, W.E.L. Grimson. "Adaptive Bacckground Mixture Models for Real-Time Tracking," in Proc. Computer Vision and Pattern Recognition Conf., vol. 2, Fort Collins, CO. USA, June 1999,pp.246-252.

[3] A. D. Bue, D. Comaniciu, V. Ramesh, and C. Regazzoni. Smart cameras with real-time video object generation. In Proceedings of the IEEE International Conference on Image Processing, volume 3, pages 429–432, June 2002

[4] 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.

[5] Bhavana C. Bendale, Prof. Anil R. Karwankar. Moving Object Tracking in Video Using MATLAB, International Journal of Electronics, Communication & Soft Computing Science and Engineering.

[6] Qing Wanga, Feng Chena. An Experimental Comparison of Online Object Tracking Algorithms, aTsinghua University, Beijing, China

[7] Evandro Alves da Silva, Adilson Gonzaga. On-Road Automotive Vehicle Detection using Gaussian Mixture Model and NNs, University of São Paulo.

[8] A. Yilmaz, O. Javed and M. Shah, "Object Tracking: A Survey" in ACM Journal of Computing Surveys, Vol. 38, No. 4, 2006.

