Chapter 44
Object-Based Surveillance Video Synopsis Using Genetic Algorithm

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ABSTRACT

Video synopsis provides representation of the long surveillance video, while preserving the essential activities of the original video. The activity in the original video is covered into a shorter period by simultaneously displaying multiple activities, which originally occurred at different time segments. As activities are to be displayed in different time segments than original video, the process begins with extracting moving objects. Temporal median algorithm is used to model background and foreground objects are detected using background subtraction method. Each moving object is represented as a space-time activity tube in the video. The concept of genetic algorithm is used for optimized temporal shifting of activity tubes. The temporal arrangement of tubes which results in minimum collision and maintains chronological order of events is considered as the best solution. The time-lapse background video is generated next, which is used as background for the synopsis video. Finally, the activity tubes are stitched on the time-lapse background video using Poisson image editing.

INTRODUCTION

The ability of videos to represent dynamic activities makes them more powerful compared to still images. Because of increasing demands of video surveillance and the arrival of inexpensive network cameras, there is an explosive growth of surveillance videos, which are used by governments and other organizations for intelligence gathering, prevention of crime, the safety of a person, group or organization, or investigating crime. According to a recent survey carried out by The British Security Industry Authority (BSIA), 2013, there are up to 5.9 million closed-circuit television cameras in the UK only, that is, one

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for every 11 people. (Berret, 2013). With this easily deployed and remotely managed, network cameras that operate 24 hours a day, amount of captured video is also growing. It becomes necessary to view the whole video to find the activity of interest. As browsing and retrieval is of such large videos is very time consuming and tedious task, most of the captured videos are never watched or examined. Continuous monitoring of such videos by human operators is also impractical due to high cost and reliability issues (e.g., operator fatigue). So, it is becoming more and more important to develop automated tools to abstract these infinite videos for easy browsing and retrieval such that the human involvement in the process can be reduced. Video synopsis is a step taken in the direction of sorting through video for creating its summary and it is especially advantageous for surveillance videos.

Video synopsis is an approach used to create short video summary of a long input video, while preserving the essential activities of the original video. Most of the video abstraction techniques discard inactive frames. Video synopsis represents video in a temporally compact way by simultaneously displaying the multiple activities, which are occurred at different times in original video, thus reducing temporal as well as spatial redundancy in the video. The activities are shifted from their original time intervals to other time interval when no activity is taking place at that spatial region. It provides a condensed representation of a video sequence, which significantly reduces the computational complexity of many video content analysis and video retrieval applications, like, object detection and segmentation. The abstracted video can be used for video indexing. It can also be used to provide the user with efficient links for accessing activities in the videos. It is an effective tool for browsing and indexing long surveillance videos (Rav-Acha, Pritch, & Peleg, 2006; Pritch, Rav-Acha, & Peleg, 2008). For example, it can be used as a powerful tool by security agencies or police to browse a large number of surveillance videos quickly, and thus speeding up analysis of any case and saving cost of human resources (Yogameena, & Priya, 2015). It can also be employed for home security, in which video synopsis of videos captured by home monitoring cameras are sent to cellular wireless networks and then users can view these video synopsis by smart devices, such as smart phones and tablets, for home remote monitoring, elder or child care, etc. Figure 1 shows frames of an input video consisting of a walking person and, after a period of inactivity; a moving car comes in it. A condensed video synopsis of this video is also shown, which is produced by playing the movements of person and car simultaneously.

The rest of this chapter is organized as follows.

Figure 1. Video synopsis