

Chapter 19

A Novel Framework for Efficient Extraction of Meaningful Key Frames From Surveillance Video

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ABSTRACT

The key frame extraction, aimed at reducing the amount of information from a surveillance video for analysis by human. The key frame is an important frame of a video to provide an overview of the video. Extraction of key frames from surveillance video is of great interest in effective monitoring and later analysis of video. The computational cost of the existing methods of key frame extraction is very high. The proposed method is a framework for Key frame extraction from a long surveillance video with significantly reduced computational cost. The proposed framework incorporates human intelligence in the process of key frame extraction. The results of proposed framework are compared with the results of IMARS (IBM multimedia analysis and retrieval system), results of the key frame extraction methods based on entropy difference method, spatial color distribution method and edge histogram descriptor method. The proposed framework has been objectively evaluated by fidelity. The experimental results demonstrate evidence of the effectiveness of the proposed approach.

1. INTRODUCTION

In today's scenario the consumers have great interest in the acquisition and access of multimedia information. The video is a form of multimedia data. The video processing (Dey et al., 2012; Gautam et al., 2015; Ikeda et al., 2014) is prime area of current research. The very large databases of videos need efficient

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methods for fast access and browsing (Agraim et al., 1996). Particularly in case of surveillance videos, most of the visual data is redundant. There is a requirement to find a way to eliminate the redundancy of surveillance video and retain only the information strictly needed for analysis by human.

The surveillance systems are operated manually in today's scenario. The effectiveness of surveillance system for suspicious security threat depends upon the security personnel who expected to monitor many videos feeds at the same time. The ability of security personnel is challenged in low traffic videos. They may lapse attention. In post video analysis, it is a tedious task to review the complete surveillance video. To increase the effectiveness of surveillance monitoring, it would be better to extract few informative frames from surveillance video for the analysis to be done later. The Key frames are those informative frames. The Key frame extraction generally involves selecting few informative frames from a video. Key frames can be used to measure the relevance or value of information of a video, thus avoiding the necessity to view the entire video.

The key frames can also be used in representation of summary of other type of videos like movie clip, sports video and consumer video. The key frames can be used as video bookmarks to designate interesting events captured in video. The key frames, representing visual contents of the video, can also be used in video indexing and retrieval process where the indexing and retrieval algorithms of images can be used for video retrieval. The key frame can also be used in making of short summaries of long videos for the quick and fast analysis by user. In video steganography, the key frame can be used to hide a video inside a video (Ciocca & Schettini, 2006). The main issue of key frame extraction is to quantify the importance of a frame. There is no standard method for this measurement. Different authors used different measures for it.

According to (Omidyeganeh et al., 2011) video is combination of a set of shots. A shot is a sequence of frames captured from a view point. Each shot is a sequence of set of segments. Each segment consists of similar frames. Key frame extraction generally involves selecting few informative frames from each shot segment, which represents that video segment. The key frame characterized by two properties to represent its segment: (1) it should be similar enough to the frames in its segment and (2) it should tolerably differ from frames in other segments.

A surveillance video generally captured from a certain view point so it contains a long segment. The main objective of the key frame extraction from surveillance video is to extract informative frames and eliminate redundant frames. The challenge of key frames extraction is to measure amount of information contained in a frame. The frames with high value of information can be used to represent entire video. The interestingness and the amount of information contained in a frame, measured using the parameters depending upon the application.

The previously proposed methods for key frame extraction are based on detecting either events or objects. The detection of changes is the key concern of event focused methods.

Theoretically, semantic video properties of the video, such as salient objects (identities or people), actions and events should be used to measure interestingness of a frame. The most of the methods uses motion information to detect abrupt changes (Li et al., 2011; Shao & Ji, 2009). The spatial color distribution can also be used to detect abrupt change (Chang et al., 2009).

In complicated actions involving repeated activities, the change detection may not be the proper choice. The methods of foreground detection were proposed to address this issue (Li et al., 2009; Ogale et al., 2007). In comparison to change detection based method, the object detection based methods provides more relevant and less number of key frames but requires high computation.

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