Chapter I

Video Data Management and Information Retrieval

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ABSTRACT

In this chapter, we present a basic introduction to two very important areas of research in the domain of Information Technology, namely, video data management and video information retrieval. Both of these areas need additional research efforts to seek solutions to many unresolved problems for efficient data management and information retrieval. We discuss those issues and relevant works done so far in these two fields.

INTRODUCTION

An enormous amount of video data is being generated these days all over the world. This requires efficient and effective mechanisms to store, access, and retrieve these data. But the technology developed to date to handle those issues is far from the level of maturity required. Video data, as we know, would contain image, audio, graphical and textual data.

The first problem is the efficient organization of raw video data available from various sources. There has to be proper consistency in data in the sense that data are to be stored in a standard format for access and retrieval. Then comes the issue of compressing the data to reduce the storage space required, since the data could be really voluminous. Also, various features of video data have to be extracted from low-level features like shape, color, texture, and spatial relations and stored efficiently for access.
The second problem is to find efficient access mechanisms. To achieve the goal of efficient access, suitable indexing techniques have to be in place. Indexing based on text suffers from the problem of reliability as different individuals can analyze the same data from different angles. Also, this procedure is expensive and time-consuming. These days, the most efficient way of accessing video data is through content-based retrieval, but this technique has the inherent problem of computer perception, as a computer lacks the basic capability available to a human being of identifying and segmenting a particular image.

The third problem is the issue of retrieval, where the input could come in the form of a sample image or text. The input has to be analyzed, available features have to be extracted, and then similarity would have to be established with the images of the video data for selection and retrieval.

The fourth problem is the effective and efficient data transmission through networking, which is addressed through Video-on-Demand (VoD) and Quality of Service (QoS). Also, there is the issue of data security, i.e., data should not be accessible to or downloadable by unauthorized people. This is dealt with by watermarking technology which is very useful in protecting digital data such as audio, video, image, formatted documents, and three-dimensional objects. Then there are the issues of synchronization and timeliness, which are required to synchronize multiple resources like audio and video data. Reusability is another issue where browsing of objects gives the users the facility to reuse multimedia resources.

The following section, Related Issues and Relevant Works, addresses these issues briefly and ends with a summary.

RELATED ISSUES AND RELEVANT WORKS

Video Data Management

With the rapid advancement and development of multimedia technology during the last decade, the importance of managing video data efficiently has increased tremendously. To organize and store video data in a standard way, vast amounts of data are being converted to digital form. Because the volume of data is enormous, the management and manipulation of data have become difficult. To overcome these problems and to reduce the storage space, data need to be compressed. Most video clips are compressed into a smaller size using a compression standard such as JPEG or MPEG, which are variable-bit-rate (VBR) encoding algorithms. The amount of data consumed by a VBR video stream varies with time, and when coupled with striping, results in load imbalance across disks, significantly degrading the overall server performance (Chew & Kankanhalli, 2001; Ding Huang, Zeng, & Chu, 2002; ISO/IEC 11172-2; ISO/IEC 13818-2). This is a current research issue.

In video data management, performance of the database systems is very important so as to reduce the query execution time to the minimum (Chan & Li, 1999; Chan & Li, 2000; Si, Leong, Lau, & Li, 2000). Because object query has a major impact on the cost of query processing (Karlapalem & Li, 1995; Karlapalem & Li, 2000), one of the ways to improve the performance of query processing is through vertical class partitioning. A detailed
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