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Chapter XXII

Future Multimedia Databases and Research Directions

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Distributed Multimedia Databases will be a trend for future information repository. With the growing popularity of the Internet and the improvement of its bandwidth, the accessibility, diversity, mobility, and scalability of multimedia information retrieval will accelerate information exchange in our global society. Previous chapters presented in this book cover most of the recent issues in distributed multimedia systems. This final chapter points out some research issues and challenges of the underlying new technologies.

INTRODUCTION

The success of distributed multimedia database systems and the related applications relies heavily on the integration of different technologies. One of the most important issues is the infrastructure of network. Current Internet was not designed for real-time multimedia information retrieval and communication. It is a best-effort based protocol. Applications running on the current Internet will take whatever resource is available on the Internet. No

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priority is differentiated. This type of infrastructure does not guarantee Quality of Services of multimedia communication. Another problem of the current Internet is the IP address domain, and its capacity of embedding extra information, such as for security reasons. The newly proposed IPv6 solution seems to replace IPv4. Hopefully, with the broader bandwidth and the new protocol of Internet2, multimedia communication will be more realistic in the near future. Yet, distributed multimedia database needs other enhancements on current technology. Some of the issues are potential research topics, and those will be discussed in this chapter.

MULTIMEDIA DATABASE TECHNIQUES

Content-based multimedia information retrieval is one of the research areas contributing to the success of multimedia database. Unlike traditional database systems, which focus on numerical and keyword search, multimedia information needs visual query methods and tools to retrieve useful information from videoclips, pictures, and audioclips. We summarize some of the challenges in this section.

Video Database

The challenges of video database include data compression, user-video interaction, segmentation, object extraction, and clustering/indexing of video data. Most of these subjects were investigated (Flicker et al., 1995). However, there are problems to be solved. The structure of a videoclip consists of a sequence of frames. Video frames have different purposes. Some store the entire screen layout while others store only the differences between frames. Videoclips can be compressed by compression standards, such as MPEG. General strategy of compression includes the estimation of space that can be saved either in the spatial domain or in the temporal domain. Compression technique not only saves storage and increases transmission efficiency, but affects the efficiency and accuracy of video information retrieval.

One of the most interesting recent subjects is the technology to divide a videoclip into a sequence of shots, which is a composition from a number of video frames. A sequence of shots may compose a scene. Shot and scene detection are useful. Because videoclips can be summarized such that a video tape can be shortened to a sequence of representative scenes. Audiences can retrieve the portion of videoclip based on an efficient browsing of a video summary. Video summarization is difficult since shot and scene detections are not easy. However, several solutions have already successfully separated video shots. Detecting the boundary of a video scene sometimes involves semantic processing, as well as human perception. In spite of this difficulty, scene detection solutions are also available; however, the accuracy varies. Another issue is the level and granularity of summarization. A video tape can be summarized into one minute, five minutes, or even twenty minutes. Some researchers propose a hierarchical organization strategy that allows a video summary to be extracted based on different length requirement. Common approach of video summary hierarchy includes the following levels: frame, shot, scene, and episode. The higher the level of the abstraction, the more difficult is precise summarization due to the degree of semantics involved. Yet, video segmentation and summarization are challenging research topics.

The purpose of video summarization and shot detection is to provide the user with a convenient interface for information browsing. However, the mechanism still relies on a human to look through each summary. One of the most interesting research directions is to