Chapter XIX
Multimedia Data Indexing

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ABSTRACT

The rapid advances in multimedia capture, storage and communication technologies and capabilities have ushered an era of unprecedented growth of digital media content, in audio, visual, and synthetic forms, and both individually and commercially produced. How to manage these data to make them more accessible and searchable to users is a key challenge in current multimedia computing research. In this chapter, the authors discuss the problems and challenges in multimedia data management, and review the state of the art in data structures and algorithms for multimedia indexing, media feature space management and organization, and applications of these techniques in multimedia data management.

INTRODUCTION

The 21st century is unique in human history in the sense that the amount of information produced and consumed by human being is unprecedented, especial those in the digital media forms, e.g., audio, im-
Multimedia Data Indexing and Management

Media data like images, video clips, audio clips are often represented by their \( d \)-dimensional features, and each media object becomes a point in some feature space \( \mathbb{R}^d \). How to find a proper feature representation that captures necessary information for effective search and retrieval tasks is the active research topic in the multimedia analysis community. Industrial standard like MPEG-7 also captures the state of the art of image/video features and metrics for search and retrieval, including color, shape and texture features for images, as well as motion and camera features for video.

The purpose of multimedia data base system is to have structured storage and indexing such that the amount of I/O operations that load data into memory, and also the amount computation involved for a query request can be reduced and therefore achieving fast response time to end users. This is also a well studied field dates back to early days of computer science and with a rich set of tools and solutions. The multimedia data base present unique challenges in the sense that the typical feature data space dimensionality is high, and if this issue is not dealt with effectively, the retrieval performance of the traditional indexing and storage solutions degenerates quickly.

In this section, we discuss the multimedia data indexing and storage solutions, and the typical queries supported. The effect of dimensionality on retrieval performance is discussed in detail.

Multimedia Data Storage and Indexing Solutions

A set of multimedia objects can be viewed as a collection of data points in some \( d \)-dimensional feature space \( \mathbb{R}^d \). The most naive solution of storage and indexing would be just store the data in sequential order, e.g., timestamp of images, and allow sequential retrieval of data at query time. In fact, most people