Distance-based Multimedia Indexing

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Abstract: This tutorial aims at providing a unified and comprehensive overview of the state-of-the-art approaches to distance-based multimedia indexing.

1 Introduction

Concomitant with the explosive growth of the digital universe [GCM+08], an immensely increasing amount of multimedia data is generated, processed, and finally stored in very large multimedia databases. The rapid expansion of the internet and the extensive spread of mobile devices allow users to generate and share multimedia data everywhere and at any time. As a result, multimedia databases tend to grow continuously without any restriction and are thus no longer manually manageable by humans. Automatic approaches that allow for effective and efficient information access to massive multimedia databases become immensely important.

Multimedia retrieval approaches [LSDJ06] are one class of information access approaches that allow to manage and access multimedia databases with respect to the users' information needs. These approaches deal with the representation, storage, organization of, and access to information items [BYRN11]. In fact, they can be thought of approaches allowing users to *search*, *browse*, *explore*, and *analyze* multimedia databases by means of similarity relations among multimedia objects.

One promising and widespread approach to define similarity between multimedia objects consists in automatically extracting inherent properties of multimedia objects and comparing them with each other. For this purpose, the content-based properties of multimedia objects are modeled by feature representations which are comparable by means of *distance-based similarity measures*. This class of similarity measures follows a rigorous mathematical interpretation [She57] and allows domain experts and database experts to address the issues of effectiveness and efficiency simultaneously and independently. In fact, it has become mandatory for current distance-based similarity measures to be indexable in order to facilitate large-scale applicability.

2 Tutorial Outline

This tutorial aims at providing a unified and comprehensive overview of the state-of-the-art approaches to distance-based multimedia indexing. We intend to cover a broad target audience starting from beginners to experts in the domain of multimedia databases.

The tutorial is structured into four parts as shown below:

- Object Representation
    - Feature Extraction
    - Feature Representations
    - Algebraic Properties
    - Clustering-based Computation
- Fundamental Similarity Models
    - Similarity Measures
    - Dissimilarity Measures
- Efficient Query Processing
    - Similarity Queries
    - Lower-Bounding
- Indexing
    - Spatial Indexing
    - High-dimensional Indexing
    - Metric and Ptolemaic Indexing

3 About The Presenters

Christian Beecks is a postdoctoral researcher in the data management and data exploration group at RWTH Aachen University, Germany. His research interests include efficient content-based multimedia retrieval and exploration, adaptive distance-based similarity measures such as the Earth Mover's Distance [RTG00], Signature Quadratic Form Distance [BUS10], and Signature Matching Distance [BKS13], as well as metric and Ptolemaic indexing.

Merih Seran Uysal is a researcher in the data management and data exploration group at RWTH Aachen University, Germany. Her research interests include similarity search in multimedia databases and efficient query processing based on adaptive distance-based similarity measures.

Thomas Seidl is a professor for computer science and head of the data management and data exploration group at RWTH Aachen University, Germany. His research interests include data mining and database technology for multimedia and spatio-temporal databases in engineering, communication and life science applications. Prof. Seidl received his Diplom (MSc) in 1992 from TU Muenchen and his PhD (1997) and venia legendi (2001) from LMU Muenchen.

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