Preface

The increasing use of multiple media (voice, data, images and video etc.) is being experienced in most application areas such as entertainment, communication, collaborative work, electronic commerce and university courses, etc. The use of multimedia contributes to the enhancement of user’s ability to communicate and collaborate. Decreasing hardware costs, a relatively inexpensive storage capacity, and a rapid increase in computing power and network bandwidth, all major requirements of multimedia applications, have contributed to the recent tremendous growth in production and use of multimedia contents. Multimedia technology has demonstrated the potential to evolve the paradigm of end user computing from interactive text and graphics model into one, which is more compatible with the digital electronic world of the next century. Multimedia technologies have enabled the electronic processing of information to be recorded in formats that are different from the standard text format (e.g. image, audio and video formats). The increased availability and easy access to electronic multimedia information brings new challenges to all areas involving data management, specially in terms of retrieval, synchronization and transportation of a large volumes of media-generated data.

This book discusses many of these major multimedia related issues and recently proposed approaches to address them. Topics include methods and tools to provide optimum access to desired contents from large amount of multimedia data, content management, synchronization and of course copyright issues etc. The following paragraphs are intended to put together the abstracts from each chapter in a manner to provide an overview of the topics covered. The chapters are grouped into the following interrelated sections.

- Modeling for Multimedia Communication, Management, Document Retrieval and Compression
- Media Retrieval and Database Access
- Design and Applications: 2D, 3D and Virtual reality environments
- Design and Application: Educational Multimedia
- Temporal Modeling
- Legal Issue - Multimedia Copyright

The chapters in the first section aim to introduce terminologies and provide some relevant modeling and representation approaches for multimedia data management and retrieval. The first chapter provides fundamental terminology, definitions, and theory needed to communicate about multimedia systems. Models of multimedia communication attempt to classify the numerous types of media objects available and to provide a basis for the use of unambiguous terminology in a new and expanding field. Many of these models are products of theory, rather than practical investigation, and few have been empirically studied to assess their suitability. This chapter presents a multimedia model, which is based on a common classification of semiotic representational systems and uses three dimensions of sign, syntax and modality. The chapter also reports on an experiment, that investigated the understandability of the dimensions comprising the proposed model. The second chapter presents an architecture for media content management as well as methods for extraction, and representation of content from different media and different applications.
Though media content management is deeply rooted in traditional databases, the richness of the media that needs to be stored requires new methods to characterize, analyze, store, retrieve and filter the information from different media. *Chapter three* deals with designs of the multimedia storage server, which are concentrated on the high disk bandwidth and guaranteed QoS. These designs are not considered in conventional operating systems. These issues are important for multimedia applications in which disk requests need to be scheduled to meet timing constraints and to minimize the total service time. *Chapter four* introduces a new data structure called N-string, which characterizes the spatial information of the objects on a picture. In addition, this chapter also provides a method for image matching based on the N-string representation. *Chapter five* presents a conceptual framework that supports reuse in hypermedia applications. Reuse is important in hypermedia, and especially in hypervideo, as it is rich in content but often costly to capture, store, and annotate. The framework’s use is illustrated through three different example hypervideo applications, which exhibit several forms of reuse. This chapter goes beyond the notion of reuse of parts of hypermedia applications and considers the reuse of classes of hypermedia applications structure, and the issues relating to such reuse.

The large volume of data generated by different media is an important issue for storage and transportation of multimedia information. Data compression and image compression in particular, is an important topic. *Chapter six* discusses some of the important compression techniques that provide basic knowledge that may be needed to select the most suitable compression algorithms in a given application to help its management and design.

The chapters in section two address the major issues of data retrieval. The growth in size and accessibility of multimedia databases has changed approaches to information retrieval. Classical text-based systems show their limitations in the context of multimedia retrieval. While large advances in image analysis techniques have been made, understanding processes of the automated image content still misses a substantial part of the semantic content in a visual document. This strongly influences the way in which images will be represented internally and therefore the choice of the features that should be extracted. The first chapter in this section addresses the problem of conceiving and evaluating a content-based image retrieval system. The conception of such a system can be approached from a number of viewpoints, ranging from computer vision to software engineering. In this chapter, CBIRS is investigated from different viewpoints — from the usability to its technical development and evaluation. This investigation is done in close relationship with the experience acquired from the text retrieval (TR), which is a mature field when compared with that of image retrieval. The next chapter deals with the design and implementation of a multimedia document retrieval system that can support both structure-based retrieval and content-based retrieval. It also contains performance evaluation of the proposed multimedia document retrieval system in terms of system efficiency, such as retrieval time, insertion time, and storage overhead, as well as system effectiveness, such as recall and precision measures. It is based on a general idea that the conventional information retrieval systems for web documents support only structure-based retrieval, which may sometime cause difficulty in dealing efficiently with a user query.

Another important visual component in multimedia information system is video. The traditional way in searching for a video segment and locating it by sequential
browsing is a tedious and a time-consuming process. The aim of today’s technology is automatic retrieval of video clips from a large collection of video archive. The requirement of such a system is to define a rich and sophisticated conceptual model powerful enough to describe the semantic content of video documents and to answer users’ heterogeneous queries. The third chapter in section two is aimed to study the development of a content-based retrieval system for video documents based on the formal specification of the video conceptual model and the human perception of the content of the video. This chapter also proposes architecture for a computer-aided analyzer where a human-annotator, supported by processing techniques, plays a central role in the semantic indexing of video documents.

The complexity of multimedia objects, and in particular the inherent imprecision that characterizes data, user requests, and query results, raises many issues that all need to be addressed in order to develop an effective query language. Chapter ten presents an algebraic approach that, unlike previous attempts, tries to consider within a common framework several aspects relevant to similarity query processing. It relies on fuzzy set theory to ground the proposal on a solid formal basis, which appears to be suitable to deal with both imprecise data and queries.

Multimedia has proven to be an aid in almost all aspects of life. In most applications animation may be used to convey a feeling of substance to the objects being manipulated by the user. Virtual Sets is a promising area that involves new technologies and demands constant reevaluation. In addition, its importance is also outstanding for the correlation with other areas in computer graphics. Chapters in section three mostly deals with these in application design aspects. The first chapter in this section focuses on the improvement of the legibility of users’ actions in 3D multimedia and virtual reality applications, and details animation effects to support this legibility. This chapter also presents an expansion of the 2D animation concepts to the domain of 3D interfaces for multimedia and virtual reality. To lay a solid framework for this work, an extensive review of current applications of animation to user interfaces is presented. The subsequent chapter approaches virtual sets, describing its conceptualization, and showing its correlation with other areas in computer graphics. The virtual sets’ pertinent technologies are identified in computer graphics and their given solutions and unsolved problems been argued. Chapter thirteen deals with the design and development of a multimedia dictionary of the Slovenian sign language to address the needs in special educational institutions for the deaf as well as to enable normal hearing people who are in daily contact with deaf people to learn to communicate with them in sign language. Multimedia technology seems an ideal medium for presentation, reference and learning of sign language for the deaf. The next chapter provides a comprehensive overview of various methods of fuzzy logic based image segmentation techniques. Fuzzy image segmentation techniques outperform conventional techniques as they are able to evaluate imprecise data. These techniques are more robust in noisy environment.

Section four contains chapters focussed on a different aspect of multimedia applications, namely the educational multimedia that is gaining steady increasing importance during recent years. The first chapter in this section is a step on the way to establish a multimedia didactics for compulsory school. It reviews findings from the European PEDACTICE - project that deals with pedagogical issues. It describe teachers’ competence, in terms of the use of educational multimedia in compulsory
The next chapter is a synthesis of recent instructional cognition research implications for the theory of fundamental educational multimedia. Guidelines for the effective design and use of educational multimedia in a global context are emphasized. The objectives of this chapter are to suggest a theoretical foundation for multimodal multimedia instruction, and to distill from the relevant cognition research a number of practical implications for educational multimedia planning, design and use. The third chapter in this section discusses questions and answers about the cost and production of educational multimedia programs. The production of large quantities of multimedia programs with a high level of user interaction is rather expensive. Two systems are discussed to create interactive multimedia programs both in a CD ROM environment and in network environment.

Multimedia information comprises objects from different media streams including text, image, audio, and video. The presentation of multimedia objects to the user involves spatial organization, temporal organization, and delivery of the components composing the multimedia objects, and allows the user to interact with the presentation sequence. Chapters in Section five discusses temporal models associated with a multimedia presentation that describe the ordering of presentation of various objects in the time domain. The first chapter discusses temporal models, both hard and flexible, proposed in the literature for describing the synchronization characteristics of multimedia presentations. The second chapter associates Formal Design Techniques (FDTs) with multimedia authoring, which enables the formal checking of documents against design errors. The third chapter highlights the fundamental research issues relevant to spatiotemporal data modeling, reviews and compares current research efforts in this area from both GIS and MIR communities, evaluates the work with respect to the fundamental research issues, and assesses the current state of spatiotemporal research in terms of recent trends and future priorities.

An important issue, with rapidly growing Internet and e-commerce applications, is the multimedia copyright protection. To adapt to the new digital environment, copyright protection is undergoing a dramatic evolution. The chapter in section six presents taxonomy of copyright protection methods, protection methods for multimedia (passive) documents and software protection methods.

The nature and range of the topics covered in this book means that it can be used by professionals from different categories including academics, students and researchers interested in the broad area of multimedia information management and design. This book is not intended to cover the networking aspect of multimedia information systems. A second book covering this aspect, entitled ‘Multimedia Networking: Technology, Management and Applications’ is forthcoming.

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