Preface

The great proliferation and enhancements in wireless networking, specifically the development of the wireless Ethernet protocols and the quick deployment and growth of mobile communication protocols and technologies such as 2.5G, 3G, DVBH, and so forth, have enabled a broad spectrum of new applications and systems. The “anytime, anywhere, anyhow” principle of communicating data, emergence of network content providers, and the growing attractiveness of handheld devices are among the factors that have formed the field of multimedia communication in wireless and mobile video. Recently, this field brought about a very sophisticated computing paradigm, the multimedia transcoding in mobile and wireless networks. This paradigm is usually focused on filling the gap between the high resources requirements of multimedia applications and the limited bandwidth and capabilities offered by networking protocols and technologies and handheld devices. In addition, the advance of multimedia systems has had a major influence in the area of image and video coding. The problems of interactivity and integration of video data with computer, cellular, and television systems are relatively new and subject to a great deal of research worldwide. Since the number of networks, types of devices, and content representation formats has increased, interoperability between different systems and different networks is becoming more important. Therefore, multimedia transcoding in wireless and mobile networks must be developed to provide a seamless interaction between content creation and usage.

This book is designed to provide researchers and practitioners with relevant theoretical frameworks and latest technical and institutional solutions for transcoding multimedia in mobile and wireless networks, as well as providing an insight into the field of multimedia and its associated technologies and communication protocols. Moreover, this book establishes the background for understanding those emerging applications and systems that deploy multimedia transcoding and present a standpoint in the future of transcoding wireless and mobile multimedia and its applications. From a technical point of view, the book intends to embody state-of-the-art knowledge of transcoding multimedia for mobile and wireless networks as it is practiced today and as it is embedded in the pioneering technologies and leading research proposals.

The book is intended for people interested in wireless and mobile multimedia transcoding at all levels. The primary audience of this book includes students, researchers, developers, engineers, innovators, and research strategists who are seeking a general overview of how to realize, develop, and integrate multimedia transcoding systems in mobile and wireless environments. While the book can be used as a textbook by students, engineers, and researchers, it can also be used as a reference book.

This book comprises three sections. Section I is an introduction to Multimedia, Wireless Networks, and Transcoding Essentials, Challenges and Approaches. This section is composed of six chapters. Chapter I introduces multimedia and multimedia elements and technology that are influencing and will continue to influence much of the exchanged data over the Internet today. While chapter II presents the importance and applications of wireless communication, such as IEEE 802.11 WLAN, Bluetooth, or Inferred port. IEEE 802.11, it also proposes some enhancement schemes, most of them focusing on enhancing a particular part or mode of the standard by first discussing QoS support for multimedia application and then proposing a framework for classifying the QoS enhancements.
Chapter III provides an overview of the key factors that influence the quality of experience (QoE) of mobile TV services. It compiles the current knowledge from empirical studies and recommendations four key requirements for the uptake of mobile TV services. The next chapter is a comprehensive review of analysis algorithms to extract semantic information from multimedia content, as well as discuss statistical approaches to analyze images and video. The last chapter of Section 1 sheds light on modality conversion as an important adaptation method. The authors of this chapter point out two main challenging issues of the problem of modality conversion: (1) the quantification of the content value (quality) when contents are drastically scaled and/or converted to other modalities and (2) the method to accurately decide the modality and the content value for each object given that quantification.

In Section II, many frameworks and algorithms for multimedia transcoding in mobile and wireless networks are proposed. The first chapter of this section, which happens to be chapter VI of this book, highlights the pros and cons of transcoding and scalable coding techniques, presenting solutions based on layered coding, and multiple descriptions coding as a valuable alternative to transcoding, especially in those cases where network losses are not negligible. Chapter VII outlines comprehensive awareness and understanding of research efforts in the field of extreme rate-distributed video transcoding. The basic concepts and theories of rate control methods, such as a requantization, a temporal resolution reduction, a spatial resolution reduction, and an object-based transcoding, are introduced.

Several efficient mechanisms for improving the QoS delivered to the client by deploying content-based transcoding schemes are introduced in chapter VIII. The proposed approaches are performing the required transcoding based on the video content. Some approaches study the texture and temporal features. Other approaches perform object detection in order to determine the important objects to achieve semantic transcoding. Chapter IX investigates the new multichannel constraints and opportunities of the new means of multimedia-based service, as well as the new user-demanding requirements that arise. It further examines the relationship between the adaptation and personalization research considerations, and proposes three-layer architecture for adaptation and personalization of Web multimedia content based on the “new” user profile, with visual, emotional, and cognitive processing parameters incorporated. Informative discussion on the various issues that surround the development stage of mobile TV services is presented in chapter X. This chapter highlights the importance of QoE, and discusses the factors affecting QoE and the types of assessment methods used to evaluate QoE. It also presents a QoE layered model with the aim of ensuring end-to-end user satisfaction.

Chapter XI presents and elaborates an effective enhancement to the operation of Content Delivery Networks (CDNs) through Hybrid Streaming Mechanism (HSM), whereby an average of more than 40% of client requests are served. Section two ends with chapter XII, which introduces a novel error detection algorithm for H.264/AVC video transmission. In this chapter, the authors present the possibility of detecting errors in H.264/AVC encoded video streams through a proposed error detection method that exploits the set of entropy coded words as well as range and significance of the H.264/AVC information elements.

Section III, the last section of this book, introduces the applications and systems that can benefit from either deploying multimedia transcoding or the transcoding itself. Chapter XIII, the first chapter of section three, provides an overview of second language learning and an approach to how wireless collaborative virtual reality can contribute to resolving important pedagogical challenges. The next two chapters, chapter XIV and chapter XV, discuss security issues in multimedia transcoding. Chapter XIV proposes and analyzes a transcoding scheme for scalable video coding, in conjunction with the introduction to scalable video coding and multimedia encryption, an overview of existing secure transcoding schemes, and some open issues in this field. On the other hand, chapter XV presents an expandable keyless self-encrypting/decrypting system to be used in various communications systems, by which the
information is transmitted securely over the medium from the sender to the intended receiver who is supposed to get it in the first place and deter others from getting the information sent.

Chapter XVI addresses digital signal processing techniques for sound restoration and enhancement. The most common sound degradations found in audio recordings, such as thumps, pops, clicks, and hiss are characterized. Moreover, the most popular solutions for sound restoration are described, with emphasis on their practical applicability. Finally, critical views on the performance of currently available restoration algorithms are provided, along with discussions on new tendencies observed in the field.

The last two chapters of this section address the digital watermarking for multimedia to be deployed in transcoding systems. Chapter XVII deals with the issue of transaction tracking in multimedia distribution applications through digital watermarking terminology and proposes an Independent Component Analysis- (ICA-) based watermarking scheme that can overcome the problems of the existing watermarking schemes. Chapter XVIII describes three discrete wavelet transform- (DWT-) based digital image watermarking algorithms in terms of basis of operation, composition, and performance analysis. The ideas described in the chapter can be easily extended to watermarking multimedia objects that include audio and video data contents.

This is a new reference and textbook for multimedia transcoding in wireless and mobile networking. This book sets a solid foundation for the paradigm of multimedia transcoding in wireless networking, as this field has recently emerged, and only a few papers related to it have been published. Many researchers and developers need such a reference to guide them through their work in realizing multimedia transcoding in wireless and mobile environment. This book is the first attempt to introduce the field of multimedia transcoding from all perspectives, and there is no other book that addresses the field thoroughly. This book is expected to be a reference in many future publications or researches in the field of multimedia transcoding in wireless and mobile environment.