JPEG2000
Image Compression Fundamentals, Standards and Practice

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JPEG2000
Image Compression Fundamentals, Standards and Practice

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Printed on acid-free paper.

to Mandy, Samuel and Joshua,
Therese, Stephanie and Sarah

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Preface

JPEG2000 is the most recent addition to a family of international standards developed by the Joint Photographic Experts Group (JPEG). The original JPEG image compression standard has found wide acceptance in diverse application areas, including the internet, digital cameras, and printing and scanning peripherals. Image compression plays a central role in modern multi-media communications and compressed images arguably represent the dominant source of internet traffic today. The JPEG2000 standard is intended as the successor to JPEG in many of its application areas. It is motivated primarily by the need for compressed image representations which offer features increasingly demanded by modern applications, while also offering superior compression performance.

This text is written to serve the interests of a wide readership and to facilitate the adoption of the JPEG2000 standard by providing the tools needed to efficiently exploit its capabilities. The book is organized into four parts and is accompanied by a comprehensive software implementation of the standard. The first part provides a thorough grounding in the theoretical underpinnings and fundamental algorithms contributing to the standard. Although the elements of the original JPEG standard are carefully expounded in a large body of existing works, JPEG2000 employs fundamentally different approaches and many recently developed techniques to achieve its goals. This first part of the book provides in-depth coverage of a diverse range of topics, which have not previously been brought together in a single volume. The intent is not only to provide a backdrop to the JPEG2000 standard, but also to serve the needs of students and academics interested in modern image compression techniques.

The second part of the book is devoted to a thorough description of the JPEG2000 standard. This material is intended to serve as a compre-

hensive reference for implementors of the standard. The authors draw upon their extensive involvement with the development of JPEG2000 to shed light on all technical aspects of JPEG2000 Part 1. Treatment of JPEG2000 Part 2 (extensions) is less comprehensive. Parts I and II of the book are written so as to complement one another. The book offers at least two different perspectives on many of the key concepts, with Part I offering the more theoretical perspective and Part II offering the more practical. As far as possible, Part II of the book strives to provide an accessible description of the standard, which can be comprehended without first absorbing the more theoretical material in Part I.

The third part of the book addresses practical considerations for implementing and efficiently utilizing the standard. The intention is to impart a body of knowledge acquired by the authors through their involvement in developing the standard, including software and hardware implementation strategies and guidelines for selecting the most appropriate parameters for a variety of applications. This part of the book also deals with compliance testing and related matters.

The fourth and final part of the book provides a useful introduction to other image compression standards, namely JPEG and JPEG-LS. The purpose of this material is twofold. In the first place, these much simpler standards provide excellent practical examples of some of the image compression techniques which are treated in Part I of the book, but do not find expression in JPEG2000. Secondly, JPEG and JPEG-LS provide the most important alternatives to JPEG2000 in its two most important fields of application: lossy and lossless compression of continuous tone imagery. Only by describing these standards is the text able to offer meaningful comparisons with JPEG2000. In some cases, particularly those in which scalability and accessibility are not sought-after features, the use of JPEG2000 in preference to JPEG or JPEG-LS may be likened to using a sledge hammer to swat a fly. Part IV of the book should prove a useful guide to application developers wishing to avoid such excesses.

Included with the book is a compact disc, containing documentation, binaries and all source code to the Kakadu software tools. This software provides a complete C++ implementation of JPEG2000 Part 1, demonstrating many of the principles described in the text itself. The software is frequently referenced from the text as an additional resource for understanding complex or subtle aspects of the standard. Conversely, the software makes frequent reference to this text and has been written to mesh with the terminology and notation employed herein. The Kakadu tools have been commercially licensed by a significant number of corporations. Non-commercial licenses are also sold separately by the University

of New South Wales and the software may otherwise be obtained only with the purchase of this book. A copy of the non-commercial license granted with this book may be found at the back cover. Provisions are also in place to encourage site-licensing by Universities whose libraries own a copy of the book. For more information in this regard, refer to the compact disc itself and the accompanying license statement.

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