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Comprehensive coverage of MPEG-2, and also includes a chapter about MPEG-4. Some sections from Netravali & Haskell's "Digital Pictures" are included to provide background. V. Bhaskaran, K. Konstantinides, "Image and Video Compression Standards," Kluwer Academic Publishers, 1995.

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Image and Video Compression

JPEG is a file format implementing compression based on the Discrete Cosine Transform DCT, together with lossless algorithms this provides good compression ratios. The way JPEG works is best suited for images with continuous tonal ranges like photographs, logos, scanned text and other images with lot's of sharp contours / lines will get more compression artifacts than photographs.

Chapter 1. Digital image representation

Digital photos are almost solely compressed using lossy technologies. The reason is that due to the nature of a photo (it includes noise, very minor changes that are hard to compress but are not important to the view and more) lossless compression technologies do not perform well on it. On the other hand Lossy compression technologies can be very effective in reducing digital photo file sizes - sometimes an order of magnitude or more.

Lossless And Lossy Digital Photo File Compression

An important development in digital image compression was the discrete cosine transform (DCT), a lossy compression technique first proposed by Nasir Ahmed in 1972. DCT compression became the basis for JPEG , which was introduced by the Joint Photographic Experts Group in 1992. [23]

For thousands of years mankind has been creating pictures which attempt to portray real or imagined scenes as perceived by human vision. Cave drawings, paintings and photographs are able to stimulate the visual system and conjure up thoughts of faraway places, imagined situations or pleasant sensations. The art of motion picture creation has advanced to the point

where viewers often undergo intense emotional experiences. On-the spot news coverage gives the impression of actually witnessing events as they unfold. Relatively recently, other forms of visual information have been invented which do not, in themselves, stimulate the eye. For example, voltage variations in an electrical signal, as in television, can represent in analogous fashion the brightness variations in a picture. In this form the visual information can be stored on magnetic tape or transmitted over long distances, and, at least for engineering purposes, it is often much more useful than other forms which do stimulate human vision. With the evolution of digital techniques for information processing, storage, and transmission, the need arises for digital representation of visual information, that is, the representation of images by a sequence of integer numbers (usually binary). In this form, computer processing and digital circuit techniques can be utilized which were undreamed of only a short time ago. Machine manipulation and interpretation of visual information becomes possible. Sophisticated techniques can be employed for efficient storage of images. And processing methods can be used to significantly reduce the costs of picture transmission.

In order to utilize digital images effectively, specific techniques are needed to reduce the number of bits required for their representation. This Tutorial Text provides the groundwork for understanding these image compression techniques and presents a number of different schemes that have proven useful. The algorithms discussed in this book are concerned mainly with the compression of still-frame, continuous-tone, monochrome and color images, but some of the techniques, such as arithmetic coding, have found widespread use in the compression of bilevel images. Both lossless (bit-preserving) and lossy techniques are considered. A detailed description of the compression algorithm proposed as the world standard (the JPEG baseline algorithm) is provided. The book contains approximately 30 pages of reconstructed and error images illustrating the effect of each compression technique on a consistent image set, thus allowing for a direct comparison of bit rates and reconstructed image quality. For each algorithm, issues such as quality vs. bit rate, implementation complexity, and susceptibility to channel errors are considered.

Intelligent Image and Video Compression: Communicating Pictures, Second Edition explains the requirements, analysis, design and application of a modern video coding system. It draws on the authors' extensive academic and professional experience in this field to deliver a text that is algorithmically rigorous yet accessible, relevant to modern standards and practical. It builds on a thorough grounding in mathematical foundations and visual perception to demonstrate how modern image and video compression methods can be designed to meet the rate-quality performance levels demanded by today's applications and users, in the context of prevailing network constraints. "David Bull and Fan Zhang have written a timely and accessible book on the topic of image and video compression. Compression of visual signals is one of the great technological achievements of modern times, and has made possible the great successes of streaming and social media and digital cinema. Their book, Intelligent Image and Video Compression covers all the salient topics ranging over visual perception, information theory, bandpass transform theory, motion estimation and prediction, lossy and lossless compression, and of course the compression standards from MPEG (ranging from H.261 through the most modern H.266, or VVC) and the open standards VP9 and AV-1. The book is replete with clear explanations and figures, including color where appropriate, making it quite accessible and valuable to the advanced student as well as the expert practitioner. The book offers an excellent glossary and as a bonus, a set of tutorial problems. Highly recommended! --Al Bovik An approach that combines algorithmic rigor with practical implementation using numerous worked examples Explains how video compression methods exploit statistical redundancies, natural correlations, and knowledge of human perception to improve performance Uses contemporary video coding standards (AVC, HEVC and VVC) as a vehicle for explaining block-based compression Provides broad coverage of important topics such as visual quality assessment and video streaming

With the increasing interest in holography for 3D imaging applications, there is a need to develop and use hologram compression techniques for the efficient storage and transmission of holographic data. This book gives a broad overview of the state-of-the-art techniques for the efficient compression and representation of digital holographic data, addressing both still and moving data sequences. An Introduction to the principles of digital holography A critical analysis of the techniques that have been developed Coverage of the most recent research results A summary of future research challenges

The hand is quicker than the eye. In many cases, so is digital video. Maintaining image quality in bandwidth- and memory-restricted environments is quickly becoming a reality as thriving research delves ever deeper into perceptual coding techniques, which discard superfluous data that humans cannot process or detect. Surveying the topic from a Human Visual System (HVS)-based approach, Digital Video Image Quality and Perceptual Coding outlines the principles, metrics, and standards associated with perceptual coding, as well as the latest techniques and applications. This book is divided broadly into three parts. First, it introduces the fundamental theory, concepts, principles, and techniques underlying the field, such as the basics of compression, HVS modeling, and coding artifacts associated with current well-known techniques. The next section focuses on picture quality assessment criteria; subjective and objective methods and metrics, including vision model based digital video impairment metrics; testing procedures; and international standards regarding image quality. Finally, practical applications come into focus, including digital image and video coder designs based on the HVS as well as post-filtering, restoration, error correction, and concealment techniques. The permeation of digital images and video throughout the world cannot be understated. Nor can the importance of preserving quality while using minimal storage space, and Digital Video Image Quality and Perceptual Coding provides the tools necessary to accomplish this goal. Instructors and lecturers wishing to make use of this work as a textbook can download a presentation of 786 slides in PDF format organized to augment the text. accompany our book (H.R. Wu and K.R. Rao, Digital Video Image Quality and Perceptual Coding, CRC Press (ISBN: 0-8247-2777-0), Nov. 2005) for lecturers or instructor to use for their classes if they use the book.

Reporting the state of the art of colour image processing, this monograph fills a gap in the literature on digital signal and image processing. It contains numerous examples and pictures of colour image processing results, plus a library of algorithms implemented in C.

This unique reference presents in-depth coverage of the latest methods and applications of digital image processing describing various computer architectures ideal for satisfying specific

image processing demands.

Binary Digital Image Processing is aimed at faculty, postgraduate students and industry specialists. It is both a text reference and a textbook that reviews and analyses the research output in this field of binary image processing. It is aimed at both advanced researchers as well as educating the novice to this area. The theoretical part of this book includes the basic principles required for binary digital image analysis. The practical part which will take an algorithmic approach addresses problems which find applications beyond binary digital line image processing. The book first outlines the theoretical framework underpinning the study of digital image processing with particular reference to those needed for line image processing. The theoretical tools in the first part of the book set the stage for the second and third parts, where low-level binary image processing is addressed and then intermediate level processing of binary line images is studied. The book concludes with some practical applications of this work by reviewing some industrial and software applications (engineering drawing storage and primitive extraction, fingerprint compression). Outlines the theoretical framework underpinning the study of digital image processing with particular reference to binary line image processing Addresses low-level binary image processing, reviewing a number of essential characteristics of binary digital images and providing solution procedures and algorithms Includes detailed reviews of topics in binary digital image processing with up-to-date research references in relation to each of the problems under study Includes some practical applications of this work by reviewing some common applications Covers a range of topics, organised by theoretical field rather than being driven by problem definitions

This book covers the MPEG H.264 and MS VC-1 video coding standards as well as issues in broadband video delivery over IP networks. This professional reference is designed for industry practitioners, including video engineers, and professionals in consumer electronics, telecommunications and media compression industries. The book is also suitable as a secondary text for advanced-level students in computer science and electrical engineering.

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