

Applications of Communications Theory  
Series Editor: R. W. Lucky

# DIGITAL PICTURES

Representation, Compression,  
and Standards

SECOND EDITION



Arun N. Netravali and Barry G. Haskell

# Digital Pictures Representation Compression And Standards Applications Of Communications Theory

**Liyong Dong**



## **Digital Pictures Representation Compression And Standards Applications Of Communications Theory:**

*Digital Pictures* Arun Netravali,2012-12-24 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 use ful 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

**Digital Pictures** Arun N. Netravali,2014-09-01 *Webb's Physics of Medical Imaging* M Flower,2016-02-03 Since the publication of the best selling highly acclaimed first edition the technology and clinical applications of medical imaging have changed significantly Gathering these developments into one volume Webb s *Physics of Medical Imaging* Second Edition presents a thorough update of the basic physics modern technology and many examples of clinical application across all the modalities of medical imaging New to the Second Edition Extensive updates to all original chapters Coverage of state of the art detector technology and computer processing used in medical imaging 11 new contributors in addition to the original team of authors Two new chapters on medical image processing and multimodality imaging More than 50 percent new examples and over 80 percent new figures Glossary of abbreviations color insert and contents lists at the beginning of each chapter Keeping the material accessible to graduate students this well illustrated book reviews the basic physics underpinning imaging in medicine It covers the major techniques of x radiology computerised tomography nuclear medicine ultrasound and magnetic resonance imaging in addition to infrared electrical impedance and optical imaging The text also describes the mathematics of medical imaging image processing image perception computational requirements and multimodality imaging

*Video Coding for Mobile Communications* Mohammed Al-Mualla,C. Nishan Canagarajah,David Bull,2002-05-13 In order for wireless devices to function the signals must be coded in standard ways so that the sender and the receiver can communicate This area of video source coding is one of the key challenges in the worldwide push to deliver full video communications over

wireless devices Video Coding for Mobile Communications reviews current progress in this field and looks at how to solve some of the most important technology issues in the months and years ahead The vision of being able to communicate from anywhere at any time and with any type of information is on its way to becoming reality This natural convergence of mobile communications and multimedia is a field that is expected to achieve unprecedented growth and commercial success Current wireless communication devices support a number of basic multimedia services voice messages basic internet access but have coding problems that need to be solved before real time mobile video communication can be achieved Addresses the emerging field of mobile multimedia communications **Advances in Neural Networks - ISNN 2005** Jun Wang,Xiaofeng

Liao,Zhang Yi,2005-05-04 This book and its sister volumes constitute the proceedings of the 2nd International Symposium on Neural Networks ISNN 2005 ISNN 2005 was held in the beautiful mountain city Chongqing by the upper Yangtze River in southwestern China during May 30 June 1 2005 as a sequel of ISNN 2004 successfully held in Dalian China ISNN emerged as a leading conference on neural computation in the region with creasing global recognition and impact ISNN 2005 received 1425 submissions from authors on ve continents Asia Europe North America South America and Oc nia 33 countries and regions Mainland China Hong Kong Macao Taiwan South Korea Japan Singapore Thailand India Nepal Iran Qatar United Arab Emirates Turkey Lithuania Hungary Poland Austria Switzerland Germany France Sweden Norway Spain Portugal UK USA Canada Venezuela Brazil Chile Australia and New Zealand Based on rigorous reviews 483 high quality papers were selected by the Program Committee for presentation at ISNN 2005 and publication in the proce ings with an acceptance rate of less than 34% In addition to the numerous contributed papers 10 distinguished scholars were invited to give plenary speeches and tutorials at ISNN 2005 **Synchronization Techniques for Digital Receivers** Umberto

Mengali,1997-10-31 Synchronization is a critical function in digital communications its failures may have catastrophic effects on the transmission system performance Furthermore synchronization circuits comprehend such a large part of the receiver hardware that their implementation has a substantial impact on the overall costs For these reasons design engineers are particularly concerned with the development of new and more efficient synchronization structures Unfortunately the advent of digital VLSI technology has radically affected modem design rules to a point that most analog techniques employed so far have become totally obsolete Although digital synchronization methods are well established by now in the literature they only appear in the form of technical papers often concentrating on specific performance or implementation issues As a consequence they are hardly useful to give a unified view of an otherwise seemingly heterogeneous field It is widely recognized that a fundamental understanding of digital synchronization can only be reached by providing the designer with a solid theoretical framework or else he will not know where to adjust his methods when he attempts to apply them to new situations The task of the present book is just to develop such a framework **3D Videocommunication** Oliver

Schreer,Peter Kauff,Thomas Sikora,2005-11-01 The migration of immersive media towards telecommunication applications is

advancing rapidly Impressive progress in the field of media compression media representation and the larger and ever increasing bandwidth available to the customer will foster the introduction of these services in the future One of the key components for the envisioned applications is the development from two dimensional towards three dimensional audio visual communications With contributions from key experts in the field 3D Videocommunication provides a complete overview of existing systems and technologies in 3D video communications and provides guidance on future trends and research considers all aspects of the 3D videocommunication processing chain including video coding signal processing and computer graphics focuses on the current state of the art and highlights the directions in which the technology is likely to move discusses in detail the relevance of 3D videocommunication for telepresence systems and immersive media and provides an exhaustive bibliography for further reading Researchers and students interested in the field of 3D audio visual communications will find 3D Videocommunication a valuable resource covering a broad overview of the current state of the art Practical engineers from industry will also find it a useful tool in envisioning and building innovative applications

**Digital Video Image Quality and Perceptual Coding** H.R. Wu,K.R. Rao,2017-12-19 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

**Color Image Processing and Applications** Konstantinos N. Plataniotis,Anastasios N. Venetsanopoulos,2013-04-17 Reporting the state of the art of color image processing this monograph fills an existing gap in the literature on digital signal and image processing It can serve the needs of different

users at different levels as a textbook which covers a graduate image processing course as a up to date reference for researchers since it offers a broad survey of the relevant literature and as a relevant information source for development engineers who work in the design and the implementation of various image processing tasks Part of the material in the book was the basis of seminars at the University of Toronto The book contains numerous examples and pictures of color image processing results as well as tables which summarize the results of the analysis Algorithms implemented in JAVA can be downloaded from the author s website

**Digital Image Processing and Analysis** Scott E Umbaugh,2010-11-19 Whether for computer evaluation of otherworldly terrain or the latest high definition 3D blockbuster digital image processing involves the acquisition analysis and processing of visual information by computer and requires a unique skill set that has yet to be defined a single text Until now Taking an applications oriented engineering approach

**Applications and Science of Computational Intelligence** ,2002

**Communicating Pictures** David Bull,2014-07-19 Communicating Pictures starts with a unique historical perspective of the role of images in communications and then builds on this to explain the applications and requirements of a modern video coding system It draws on the author s extensive academic and professional experience of signal processing and video coding to deliver a text that is algorithmically rigorous yet accessible relevant to modern standards and practical It offers a thorough grounding in visual perception and demonstrates how modern image and video compression methods can be designed in order to meet the rate quality performance levels demanded by today s applications networks and users With this book you will learn Practical issues when implementing a codec such as picture boundary extension and complexity reduction with particular emphasis on efficient algorithms for transforms motion estimators and error resilience Conflicts between conventional video compression based on variable length coding and spatiotemporal prediction and the requirements for error resilient transmission How to assess the quality of coded images and video content both through subjective trials and by using perceptually optimised objective metrics Features operation and performance of the state of the art High Efficiency Video Coding HEVC standard Covers the basics of video communications and includes a strong grounding in how we perceive images and video and how we can exploit redundancy to reduce bitrate and improve rate distortion performance Gives deep insight into the pitfalls associated with the transmission of real time video over networks wireless and fixed Uses the state of the art video coding standard H 264 AVC as a basis for algorithm development in the context of block based compression Insight into future video coding standards such as the new ISO ITU High Efficiency Video Coding HEVC initiative which extends and generalizes the H 264 AVC approach

**Algorithms, Complexity Analysis and VLSI Architectures for MPEG-4 Motion Estimation** Peter M. Kuhn,2013-06-29 MPEG 4 is the multimedia standard for combining interactivity natural and synthetic digital video audio and computer graphics Typical applications are internet video conferencing mobile videophones multimedia cooperative work teleteaching and games With MPEG 4 the next step from block based video ISO IEC MPEG 1 MPEG 2 CCITT H 261 ITU

T H 263 to arbitrarily shaped visual objects is taken This significant step demands a new methodology for system analysis and design to meet the considerably higher flexibility of MPEG 4 Motion estimation is a central part of MPEG 1 2 4 and H 261 H 263 video compression standards and has attracted much attention in research and industry for the following reasons it is computationally the most demanding algorithm of a video encoder about 60 80% of the total computation time it has a high impact on the visual quality of a video encoder and it is not standardized thus being open to competition Algorithms Complexity Analysis and VLSI Architectures for MPEG 4 Motion Estimation covers in detail every single step in the design of a MPEG 1 2 4 or H 261 H 263 compliant video encoder Fast motion estimation algorithms Complexity analysis tools Detailed complexity analysis of a software implementation of MPEG 4 video Complexity and visual quality analysis of fast motion estimation algorithms within MPEG 4 Design space on motion estimation VLSI architectures Detailed VLSI design examples of 1 a high throughput and 2 a low power MPEG 4 motion estimator Algorithms Complexity Analysis and VLSI Architectures for MPEG 4 Motion Estimation is an important introduction to numerous algorithmic architectural and system design aspects of the multimedia standard MPEG 4 As such all researchers students and practitioners working in image processing video coding or system and VLSI design will find this book of interest

**Advanced IT Tools** Nobuyoshi Terashima,Edward Altman,2013-11-18 TRACK 1 Innovative Applications in the Public Sector The integration of multimedia based applications and the information superhighway fundamentally concerns the creation of a communication technology to support the activities of people Communication is a profoundly social activity involving interactions among groups or individuals common standards of exchange and national infrastructures to support telecommunications activities The contributions of the invited speakers and others in this track begin to explore the social dimension of communication within the context of integrated information systems for the public sector Interactions among businesses and households are described by Ralf Strauss through the development within a real community of a wired city with information and electronic services provided by the latest telecommunications technologies A more specific type of interaction between teacher and student forms the basis of education John Tiffin demonstrates how virtual classrooms can be used to augment the educational process Carl Loeffler presents yet another perspective on interaction through the integration of A life and agent technologies to investigate the dynamics of complex behaviors within networked simulation environments Common standards for communication in the form of electronic documents or CSCW Computer Supported Cooperative Work according to Roland Traunmiiller provide enabling technologies for a paradigm shift in the management of organizations As pointed out by William Olle the impact of standardization work on the future of information technology depends critically upon the interoperability of software systems

**Handbook of Visual Communications** Hseuh-Ming Hang,John W. Woods,2012-12-02 This volume is the most comprehensive reference work on visual communications to date An international group of well known experts in the field provide up to date and in depth contributions on topics such as fundamental theory international standards for industrial

applications high definition television optical communications networks and VLSI design The book includes information for learning about both the fundamentals of image video compression as well as more advanced topics in visual communications research In addition the Handbook of Visual Communications explores the latest developments in the field such as model based image coding and provides readers with insight into possible future developments Displays comprehensive coverage from fundamental theory to international standards and VLSI design Includes 518 pages of contributions from well known experts Presents state of the art knowledge the most up to date and accurate information on various topics in the field Provides an extensive overview of international standards for industrial applications

**Discrete Wavelet Transforms** Hannu Olkkonen,2011-08-29 The discrete wavelet transform DWT algorithms have a firm position in processing of signals in several areas of research and industry As DWT provides both octave scale frequency and spatial timing of the analyzed signal it is constantly used to solve and treat more and more advanced problems The present book Discrete Wavelet Transforms Algorithms and Applications reviews the recent progress in discrete wavelet transform algorithms and applications The book covers a wide range of methods e g lifting shift invariance multi scale analysis for constructing DWTs The book chapters are organized into four major parts Part I describes the progress in hardware implementations of the DWT algorithms Applications include multitone modulation for ADSL and equalization techniques a scalable architecture for FPGA implementation lifting based algorithm for VLSI implementation comparison between DWT and FFT based OFDM and modified SPIHT codec Part II addresses image processing algorithms such as multiresolution approach for edge detection low bit rate image compression low complexity implementation of CQF wavelets and compression of multi component images Part III focuses watermarking DWT algorithms Finally Part IV describes shift invariant DWTs DC lossless property DWT based analysis and estimation of colored noise and an application of the wavelet Galerkin method The chapters of the present book consist of both tutorial and highly advanced material Therefore the book is intended to be a reference text for graduate students and researchers to obtain state of the art knowledge on specific applications

**Image Databases** Vittorio Castelli, Lawrence D. Bergman,2004-03-24 The explosive growth of multimedia data transmission has generated a critical need for efficient high capacity image databases as well as powerful search engines to retrieve image data from them This book brings together contributions by an international all star team of innovators in the field who share their insights into all key aspects of image database and search engine construction Readers get in depth discussions of the entire range of crucial image database architecture indexing and retrieval transmission display and user interface issues And using examples from an array of disciplines the authors present cutting edge applications in medical imagery multimedia communications earth science remote sensing and other major application areas

**Fundamentals of Digital Imaging** H. J. Trussell, M. J. Vrhel,2008-10-30 Introduction to digital imaging covering core techniques of image capture and display of monochrome and color images Presents fundamental tools within a powerful mathematical framework Containing illustrations examples and

homework problems this book is suitable for advanced undergraduates and graduates in electrical engineering and computer science and practitioners in industry , **Signal Processing VI** J. Vandewalle, R. Boite, M. Moonen, A. Oosterlinck, 2012-12-02 This was the sixth in the sequence of the international conferences promoted and organized by the European Association for Signal Processing The conference has established itself as one of the world's largest and most important meetings on the subject The 444 papers in three volumes are organized under 7 themes containing the following topics 1 Theory of Signals and Systems a Detection b Estimation c Filtering d Spectral estimation e Adaptive systems f Modeling g Digital transforms h Digital filtering 2 Image Processing and Multidimensional Signal Processing a Coding b Enhancement c Restoration d Medical image processing 3 Speech Processing a Coding b Synthesis c Recognition and understanding d Enhancement 4 Implementations a Hardware b Software c VLSI d Novel Architectures e Array processing 5 Knowledge Engineering and Signal Processing a Expert systems b Pattern recognition c Signal interpretation d Image understanding 6 Neural Networks for Signal Processing a Theory b Speech c Vision d Implementations 7 Applications a Radar b Sonar c Communications d Geophysics e Digital audio f Biomedics g Sensing h Robotics i Astrophysics j Mechanics k other The diversity of topics in this 3 volume set as well as the extraordinary tempo at which Signal Processing has progressed attest to the permanent vitality of this area of research and development Workers in signal processing will find in these papers the latest advances and results as well as indications on future research and analysis in this rapidly developing field

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**Introduction**

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