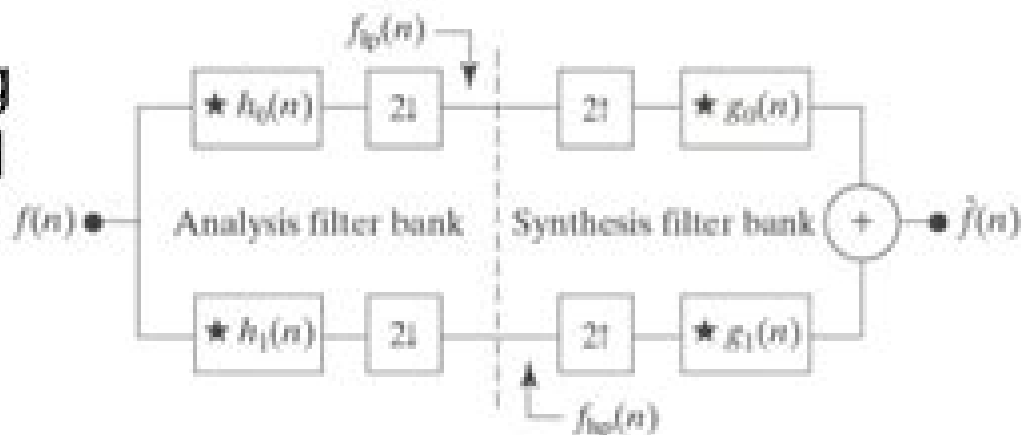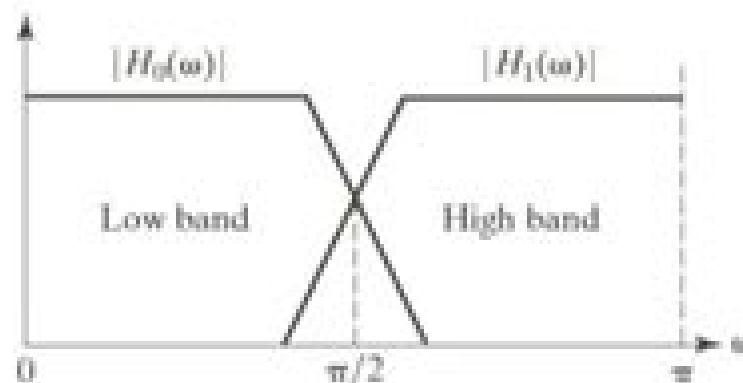# Subband Coding (cont...)

The goal of subband coding is to select the analysis and synthesis filters in order to have *perfect reconstruction* of the signal.

It may be shown that the synthesis filters should be modulated versions of the analysis filters with one (and only one) synthesis filter being sign reversed of an analysis filter.

Subband Image Coding

John W. Woods

Subband Image Coding:

   Subband Image Coding John W. Woods,2013-06-29 This book concerns a new method of image data compression which weil may supplant the well established block transfonn methods that have been state of the art for the last 15 years Subband image coding or SBC was first perfonned as such in 1985 and as the results became known at first through conference proceedings and later through journal papers the research community became excited about both the theoretical and practical aspects of this new approach This excitement is continuing today with many major research laboratories and research universities around the world investigating the subband approach to coding of color images high resolution images video including video conferencing and advanced tele vision and the medical application of picture archiving systems Much of the fruits of this work is summarized in the eight chapters of this book which were written by leading practitioners in this field The subband approach to image coding starts by passing the image through a two or three dimensional filter bank The two dimensional 2 D case usually is hierarchical consisting of two stages of four filters each Thus the original image is split into 16 subband images with each one decimated or subsampled by 4x4 resulting in a data conservation The individual channel data is then quantized for digital transmission In an attractive variation an octave like approach herein tenned subband pyramid is taken for the decomposition resulting in a total of just eleven subbands   *Sub-band image coding* ,1902 Este trabalho aborda o problema da compress o de imagens explorando a t cnica de codifica o por sub bandas SBB Como estrutura b sica usada na primeira parte do trabalho tem se a divis o da imagem em 16 sub bandas buscando replicar os resultados de woods 1 As componentes das 16 SBB s o quantizadas e codificadas e bits s o alocados s SBB usando como crit rio a minimiza o do erro m dio quadr tico Os quantizadores s o projetados segundo uma distribui o Gaussiana Generalizada Neste processo de codifica o a sub banda de mais baixa freq ncia codificada com DPCM enquanto as demais SBB s o codificadas por PCM Como inova o proposto o uso do algoritmo de Lempel Ziv na codifica o sem perdas compacta o das sub bandas quantizadas Na compacta o s o empregados os algoritmos de Huffman e LZW modifica o do LZA Os resultados das simula es s o apresentados em termos da taxa bits pixel versus rela o sinal ru do de pico e em termos de analise subjetiva das imagens reconstru das Os resultados obtidos indicam um desempenho de compress o superior quanto o algoritmo de Huffman usado comparado com o algoritmo LZW A melhoria de desempenho na t cnica de decomposi o em sub bandas observada com o algoritmo de Huffman foi superior 2dB acima Todavia tendo em vista as vantagens da universalidade do algoritmo de Lempel Ziv deve se continuar a investigar o seu desempenho implementado de forma diferente do explorado neste trabalho   *Subband Compression of Images: Principles and Examples* T.A. Ramstad,S.O. Aase,J.H. Husøy,1995-07-18 Sixth in the book series Advances in Image Communication which documents the rapid advancements of recent years in image communication technologies this volume provides a comprehensive exploration of subband coding Originally subband coding and transform coding were developed separately The former however benefitted considerably from the earlier

evolution of transform coding theory and practice Retaining their own terminology and views the two methods are closely related and this book indeed aims to unify the approaches Specifically the volume contributes effectively to the understanding of frequency domain coding techniques Many images from coding experiments are presented enabling the reader to consider the properties of different coders Chapter 1 introduces the problem of image compression in general terms Sampling of images and other fundamental concepts such as entropy and the rate distortion function are briefly reviewed The idea of viewing coding techniques as series expansions is also introduced The second chapter presents signal decomposition and the conditions for perfect reconstruction from minimum representations Chapter 3 deals with filter bank structures primarily those displaying the perfect reconstruction property Quantization techniques and the efficient exploitation of the bit resources are discussed from a theoretical perspective in Chapter 4 and this issue is further examined in Chapter 6 from a more practical point of view Chapter 5 provides a development of gain formulas i e quantitative measures of the performance of filter banks in a subband coding context and these are then employed in a search for optimal filter banks A number of examples of coded images using different subband coders are presented in Chapter 7 these indicating that subband coders give rise to some characteristic types of image degradations Accordingly Chapter 8 presents several techniques for minimizing these artifacts The theory and practice of subband coding of video at several target bit rates is discussed in the last chapter   Subband/transform Functions for Image Processing Daniel Glover,1993   **Vector Quantization in Subband Coding of Images** Saad John Bedros,1995   **Subband Image Coding with Vector Quantization** Jonathan Nelson Bradley,1989   **Subband and Wavelet Transforms** Ali N. Akansu,Mark J.T. Smith,2012-12-06 The scientists and engineers of today are relentless in their continuing study and analysis of the world about us from the microcosm to the macrocosm A central purpose of this study is to gain sufficient scientific information and insight to enable the development of both representative and useful models of the superabundance of physical processes that surround us The engineers need these models and the associated insight in order to build the information processing systems and control systems that comprise these new and emerging technologies Much of the early modeling work that has been done on these systems has been based on the linear time invariant system theory and its extensive use of Fourier transform theory for both continuous and discrete systems and signals However many of the signals arising in nature and real systems are neither stationary nor linear but tend to be concentrated in both time and frequency Hence a new methodology is needed to take these factors properly into account   *A Theory of Subband Image Coding* Shinichi Doi,1991   Wavelet, Subband and Block Transforms in Communications and Multimedia Ali N. Akansu,Michael J. Medley,2006-04-18 Wavelet and subband transforms have been of great interest in the fields of gineering and applied mathematics The theories of these powerful signal p cessing tools have matured and many applications utilizing them are emerging in different disciplines This book comprised of eleven chapter contributions from prominent researchers in the field focuses on communications and mul media

applications of wavelet and subband transforms The first six chapters of this book deal with a variety of communications applications that significantly benefit from wavelet and subband theories S ilarly the remaining five chapters present recent advances in multimedia plications of wavelet and subband transforms These chapters interconnect the requirements of applications with the underlying theory and their engineering solutions Hence the reader can easily trace the entire path from fundamentals to the purpose and merit of application in hand A combined list of references for the entire volume is given at the end of the text that should be helpful to the interested reader for a further study This book is anticipated to be of particular interest to engineers and sci tists who want to learn about state of the art subband and wavelet transform applications as well as their theoretical underpinnings It can also serve as a supplementary book for graduate level engineering and applied mathematics courses on wavelet and subband transforms **Subband and Wavelet Still Image Coding for Improved Image Quality** Matthew Anthony Mow,1994 *Multidimensional Signal, Image, and Video Processing and Coding* John W. Woods,2011-06-17 This fully revised and expanded edition gives readers the necessary understanding of image and video processing concepts to contribute to this hot technology s future advances Important new topics include introductory random processes image enhancement and analysis and the new MPEG scalable video coding standard **Perceptual Image Coding with Discrete Cosine Transform** Ee-Leng Tan,Woon-Seng Gan,2015-05-13 This book first introduces classic as well as recent computational models for just noticeable difference JND applications Since the discrete cosine transform DCT is applied in many image and video standards JPEG MPEG 1 2 4 H 261 3 the book also includes a comprehensive survey of computational models for JND that are based on DCT The visual factors used in these computational models are reviewed in detail Further an extensive comparative analysis of these models using quantitative and qualitative performance criteria is presented which compares the noise shaping performance of these models with subjective evaluation and the accuracy between the estimated JND thresholds and subjective evaluation There are many surveys available on computational models for JND however these surveys seldom compare the performance of computational models that are based on DCT The authors survey of the computational models and their in depth review of the visual factors used in them will help readers understand perceptual image coding based on DCT The book also provides a comparative analysis of several perceptual image coders that are based on DCT which are compatible with the highly popular and widely adopted JPEG standard **Image Processing '92 (Icip '92) - Proceedings Of The 2nd Singapore International Conference** Srinivasan Venugopal,Sim Heng Ong,Yew Hock Ang,1992-09-02 This volume contains papers on Image Compression Implementations Feature Detection 3 D Vision Document Processing Multi Resolution Processing Medical Imaging Image Analysis Modelling Neural Networks Object Recognition Remote Sensing Dynamic Vision Application System Architecture Image Restoration Enhancement and Image Segmentation **Visual Information Representation, Communication, and Image Processing** Ya-Qin Zhang,1999-05-25 Discusses recent advances in the related technologies

of multimedia computers videophones video over Internet HDTV digital satellite TV and interactive computer games The text analyzes ways of achieving more effective navigation techniques data management functions and higher throughout networking It synthesizes data on visual information venues tracking the enormous commercial potential for new components and compatible systems **Wavelet Image and Video Compression** Pankaj N. Topiwala,2006-04-18 An exciting new development has taken place in the digital era that has captured the imagination and talent of researchers around the globe wavelet image compression This technology has deep roots in theories of vision and promises performance improvements over all other compression methods such as those based on Fourier transforms vectors quantizers fractals neural nets and many others It is this revolutionary new technology that is presented in Wavelet Image and Video Compression in a form that is accessible to the largest audience possible Wavelet Image and Video Compression is divided into four parts Part I Background Material introduces the basic mathematical structures that underly image compression algorithms with the intention of providing an easy introduction to the mathematical concepts that are prerequisites for the remainder of the book It explains such topics as change of bases scalar and vector quantization bit allocation and rate distortion theory entropy coding the discrete cosine transform wavelet filters and other related topics Part II Still Image Coding presents a spectrum of wavelet still image coding techniques Part III Special Topics in Still Image Coding provides a variety of example coding schemes with a special flavor in either approach or application domain Part IV Video Coding examines wavelet and pyramidal coding techniques for video data Wavelet Image and Video Compression serves as an excellent reference and may be used as a text for advanced courses covering the subject **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 *Still Image and Video Compression with MATLAB* K. S. Thyagarajan,2011-03-16 This book describes the principles of image and video compression techniques and introduces current and popular compression standards such as the MPEG series Derivations of relevant compression algorithms are developed in an easy to follow fashion Numerous examples are provided in each chapter to illustrate the concepts **Handbook of Image and Video Processing** Alan C.

Bovik,2010-07-21 55% new material in the latest edition of this must have for students and practitioners of image video processing This Handbook is intended to serve as the basic reference point on image and video processing in the field in the research laboratory and in the classroom Each chapter has been written by carefully selected distinguished experts specializing in that topic and carefully reviewed by the Editor Al Bovik ensuring that the greatest depth of understanding be communicated to the reader Coverage includes introductory intermediate and advanced topics and as such this book serves equally well as classroom textbook as reference resource Provides practicing engineers and students with a highly accessible resource for learning and using image video processing theory and algorithms Includes a new chapter on image processing education which should prove invaluable for those developing or modifying their curricula Covers the various image and video processing standards that exist and are emerging driving today s explosive industry Offers an understanding of what images are how they are modeled and gives an introduction to how they are perceived Introduces the necessary practical background to allow engineering students to acquire and process their own digital image or video data Culminates with a diverse set of applications chapters covered in sufficient depth to serve as extensible models to the reader s own potential applications About the Editor Al Bovik is the Cullen Trust for Higher Education Endowed Professor at The University of Texas at Austin where he is the Director of the Laboratory for Image and Video Engineering LIVE He has published over 400 technical articles in the general area of image and video processing and holds two U S patents Dr Bovik was Distinguished Lecturer of the IEEE Signal Processing Society 2000 received the IEEE Signal Processing Society Meritorious Service Award 1998 the IEEE Third Millennium Medal 2000 and twice was a two time Honorable Mention winner of the international Pattern Recognition Society Award He is a Fellow of the IEEE was Editor in Chief of the IEEE Transactions on Image Processing 1996 2002 has served on and continues to serve on many other professional boards and panels and was the Founding General Chairman of the IEEE International Conference on Image Processing which was held in Austin Texas in 1994 No other resource for image and video processing contains the same breadth of up to date coverage Each chapter written by one or several of the top experts working in that area Includes all essential mathematics techniques and algorithms for every type of image and video processing used by electrical engineers computer scientists internet developers bioengineers and scientists in various image intensive disciplines **The Essential Guide to Image Processing** Alan C. Bovik,2009-07-08 A complete introduction to the basic and intermediate concepts of image processing from the leading people in the field Up to date content including statistical modeling of natural anistropic diffusion image quality and the latest developments in JPEG 2000 This comprehensive and state of the art approach to image processing gives engineers and students a thorough introduction and includes full coverage of key applications image watermarking fingerprint recognition face recognition and iris recognition and medical imaging This book combines basic image processing techniques with some of the most advanced procedures Introductory chapters dedicated to general principles are presented alongside detailed

application orientated ones As a result it is suitably adapted for different classes of readers ranging from Master to PhD students and beyond Prof Jean Philippe Thiran EPFL Lausanne Switzerland Al Bovik s compendium proceeds systematically from fundamentals to today s research frontiers Professor Bovik himself a highly respected leader in the field has invited an all star team of contributors Students researchers and practitioners of image processing alike should benefit from the Essential Guide Prof Bernd Girod Stanford University USA This book is informative easy to read with plenty of examples and allows great flexibility in tailoring a course on image processing or analysis Prof Pamela Cosman University of California San Diego USA A complete and modern introduction to the basic and intermediate concepts of image processing edited and written by the leading people in the field An essential reference for all types of engineers working on image processing applications Up to date content including statistical modelling of natural anisotropic diffusion image quality and the latest developments in JPEG 2000 <u>Document and Image Compression</u> Mauro Barni,2018-10-08 Although it s true that image compression research is a mature field continued improvements in computing power and image representation tools keep the field spry Faster processors enable previously intractable compression algorithms and schemes and certainly the demand for highly portable high quality images will not abate Document and Image Compression highlights the current state of the field along with the most probable and promising future research directions for image coding Organized into three broad sections the book examines the currently available techniques future directions and techniques for specific classes of images It begins with an introduction to multiresolution image representation advanced coding and modeling techniques and the basics of perceptual image coding This leads to discussions of the JPEG 2000 and JPEG LS standards lossless coding and fractal image compression New directions are highlighted that involve image coding and representation paradigms beyond the wavelet based framework the use of redundant dictionaries the distributed source coding paradigm and novel data hiding techniques The book concludes with techniques developed for classes of images where the general purpose algorithms fail such as for binary images and shapes compound documents remote sensing images medical images and VLSI layout image data Contributed by international experts Document and Image Compression gathers the latest and most important developments in image coding into a single convenient and authoritative source

The Enigmatic Realm of **Subband Image Coding**: Unleashing the Language is Inner Magic

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