
**Image Wavelet
Coding Systems:
Part II of Set Partition
Coding and Image Wavelet
Coding Systems**

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Image Wavelet Coding Systems: Part II of Set Partition Coding and Image Wavelet Coding Systems

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Abstract

This monograph describes current-day wavelet transform image coding systems. As in the first part, steps of the algorithms are explained thoroughly and set apart. An image coding system consists of several stages: transformation, quantization, set partition or adaptive entropy coding or both, decoding including rate control, inverse transformation, de-quantization, and optional processing (see Figure 1.6). Wavelet transform systems can provide many desirable properties besides high efficiency, such as scalability in quality, scalability in resolution, and region-of-interest access to the coded bitstream. These properties are

built into the JPEG2000 standard, so its coding will be fully described. Since JPEG2000 codes subblocks of subbands, other methods, such as SBHP (Subband Block Hierarchical Partitioning) [3] and EZBC (Embedded Zero Block Coder) [8], that code subbands or its subblocks independently are also described. The emphasis in this part is the use of the basic algorithms presented in the previous part in ways that achieve these desirable bitstream properties. In this vein, we describe a modification of the tree-based coding in SPIHT (Set Partitioning In Hierarchical Trees) [15], whose output bitstream can be decoded partially corresponding to a designated region of interest and is simultaneously quality and resolution scalable.

This monograph is extracted and adapted from the forthcoming textbook entitled *Digital Signal Compression: Principles and Practice* by William A. Pearlman and Amir Said, Cambridge University Press, 2009.

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1

Subband/Wavelet Coding Systems

1.1 Introduction

This monograph describes coding systems, primarily for images, that use the principles and algorithms explained in the first part. A complete coding system uses a conjunction of compression algorithms, entropy coding methods, source transformations, statistical estimation, and ingenuity to achieve the best result for the stated objective. The obvious objective is compression efficiency, stated as the smallest rate, in bits per sample, for a given distortion in lossy coding or smallest rate or compressed file size in lossless coding. However, other attributes may be even more important for a particular scenario. For example, in medical diagnosis, decoding time may be the primary concern. For mobile devices, small memory and low power consumption are essential. For broadcasting over packet networks, scalability in bit rate and/or resolution may take precedence. Usually to obtain other attributes, some compression efficiency may need to be sacrificed. Of course, one tries to obtain as much efficiency as possible for the given set of attributes wanted for the system. Therefore, in our description of systems, we shall also explain how to achieve other attributes besides compression efficiency.

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