Fast Wavelet Packet Image Compression

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The main contribution of this paper is a new fast wavelet packet compression algorithm that encodes very efficiently textured images. This fast wavelet packet compression technique relies on four stages:

1. Very fast convolution and decimation of the image with factorized filters,
2. Selection of a best basis in a large library of waveforms. The best basis is that basis which is "best adapted" to the content of the image,
3. Scanning of the wavelet packet coefficients by increasing frequency. This organization yields sequences of coefficients with a rapid decay.
4. Successive embedded approximation quantization, and entropy coding of the coefficients.

We implemented the wavelet packet coder and decoder, and actual bit streams were created for each experiment. Our implementation used the 7-9 biorthogonal filters. We present the results of the algorithm, using the test image 512×512 "Barbara". Barbara is difficult to compress because it contains a mixture of smooth regions and richly textured regions. In order to evaluate the performance of the algorithm, we compared our algorithm to the SPIHT wavelet coder of Amir Said and William A. Pearlman (IEEE Trans.on Circ.& Sys. for Video Tech. vol. 6, pp. 243-250, 1996) . The performance of the algorithm is summarized in Table 1. At very low compression rate ($4 : 1 \rightarrow 8 : 1$) the wavelet coder (SPIHT) slightly outperforms the wavelet packet coder: –at such a high bit rate, there is enough budget to code the texture, and the wavelet coder can take full advantage of the multiscale structure. At medium to high compression rate ($12 : 1 \rightarrow 112 : 1$) the wavelet packets coder clearly outperforms the wavelet coder.

Barbara			Barbara		
Ratio	PSNR: SPIHT	PSNR: Wavelet Packets	Ratio	PSNR: SPIHT	PSNR: Wavelet Packets
4	42.64	41.76	32	27.58	28.25
8	36.41	36.24	48	26.01	26.62
12	33.40	33.52	64	24.86	25.58
16	31.39	31.76	96	24.25	24.86
20	30.10	30.52	80	23.81	24.27
24	29.13	29.61	112	23.58	23.77
28	28.27	28.86	128	23.35	23.37

Table 1: Coding results: PSNR for 8bpp. 512x512 Barbara