Shape-Direction-Adaptive Lifting-Based Discrete Wavelet Transform for Arbitrarily Shaped Segments in Image Compression

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Abstract

In this paper, a new lifting-based shape-direction-adaptive discrete wavelet transform (SDA-DWT) which can be used for arbitrarily shaped segments is proposed. The SDA-DWT contains three major techniques: the lifting-based DWT, the adaptive directional technique, and the concept of object-based compression in MPEG-4. With SDA-DWT, the number of transformed coe±cients is equal to the number of pixels in the arbitrarily shaped segment image, and the spatial correlation across subbands is well preserved. SDA-DWT also can locally adapt its ¯ltering directions according to the texture orientations to improve energy compaction for images containing non-horizontal or non-vertical edge textures. SDA-DWT can be applied to any application that is wavelet based and the lifting technique provides much °exibility for hardware implementation. Experimental results show that, for still object images with rich orientation textures, SDA-DWT outperforms SA-DWT up to 5.88 dB in PSNR under 2.15-bpp (bit / object pixel) condition, and reduces the bit-budget up to 28.5% for lossless compression. SDA-DWT also outperforms DA-DWT up to 5.88 dB in PSNR under 3.28-bpp condition, and reduces the bit-budget up to 14.0%.

Keyword：compression, textures, set-partitioning embedded block coder (SPECK), object-based video coding, shape-direction-adaptive DWT (SDA-DWT)