

# Shape-Direction-Adaptive Discrete Wavelet Transform and Two Applications in Image Compression

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## Abstract

In this paper, a new lifting-based shape-direction-adaptive discrete wavelet transform (SDA-DWT) is introduced, and two of its applications in image compression are proposed. One application is for object-based still image compression, and the other is for normal still gray-level image compression. The proposed methods are based on image partition and SDA-DWT. SDA-DWT is a lifting-based DWT, and it can be performed on arbitrarily shaped region with direction-adaptive functionality. Since SDA-DWT can be applied to arbitrarily shaped segments, we can partition the image as we wish. The extra costs for the proposed methods are the processing, coding, and storage of the side information for partition and filter direction determination. SDA-DWT is efficient for image compression especially for orientation-texture-rich or edge-rich images. For the first application (object-based images), the proposed method outperforms SA-DWT (shape-adaptive DWT) up to 5.88 dB in PSNR (peak-signal-to-noise ratio) under 2.15-bpp (bit / pixel) condition, and reduces the bit-budget up to 28.5% for lossless compression. The proposed method also outperforms DA-DWT (direction-adaptive DWT) up to 5.88 dB in PSNR under 3.28-bpp condition, and reduces the bit-budget up to 14.0%. From the experimental results of the second application, the proposed method outperforms a direction-adaptive DWT up to 1.25 dB under 1-bpp condition for a typical edge-rich test image.

Keyword : shape-direction-adaptive, discrete wavelet transform, object-based, image compression