Application of Directional Wavelets to Image Compression
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A novel unitary directional wavelet methodology producing six complex-valued subbands per level of decomposition has been previously introduced [1,2] as a method of spatio-frequency decomposition for image fusion applications. Properties of the decomposition include unitarity, sparse computation, energy-packing efficiency, symmetry, and sub-pixel registration of all subbands at the same scale.

The directional subband decomposition generates six directionally oriented subbands and a subsampled image at each level of decomposition, as illustrated below.

This present effort demonstrates the effectiveness of directional wavelets as a transform, by comparing the zero-order entropy of their decompositions to that of other wavelets of comparable computational complexity, as well as against a theoretically ideal wavelet derived from the discrete cosine and discrete Fourier transforms.

The paper presents efficient methods of computing the decomposition, including one- and two-pass approximations to a Fourier-domain decomposition. The entropy comparisons between directional decomposition and conventional decomposition are presented two ways: (1) using directional methodology for conventional decomposition, and (2) using conventional wavelets to achieve directional composition. In both cases the directional decomposition performs favorably over a wide variety of test imagery.