Frame Wavelets in High Dimension

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Abstract

In this dissertation, the classic one dimension orthogonal wavelet construction scheme is discussed and extended to construct Parseval's frame wavelets in high dimension scenario. An iterative algorithm is developed to construct various Parseval's frame wavelets, where the input is a set of wavelet coefficients which satisfies the associated Lawton's System of Equations.

The relation between one dimension and high dimension wavelet coefficients is explored. Examples are given, showing that, it is possible to use existing one dimension wavelet coefficients to form high dimension versions, with purposeful rearrangement of the terms of the wavelet coefficients that satisfy both one dimension and high dimension Lawton's System of Equations associated with. And it follows that one can obtain one dimension wavelet coefficients sets from high dimension versions.

Applications of Parseval's frame wavelets in signal processing are discussed. Unlike the classic axis-by-axis discrete wavelet transform method, a different quincunx down-sampling approach is proposed in the two dimension image processing scenario, with the use of a quincunx sub-lattice.

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