

A New Two-Dimensional Quantization Method for Digital Image Watermarking

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Abstract—We propose a new technique of Distortion Compensation (DC) for the two dimensional Quincunx Lattice Quantization that is used in watermarking. The choice of a new direction of quantization is explained by the form of Voronoi cell of the lattice elements. Parameter α controls DC and can be adjusted to maximize the mutual information between embedded and detected message in a noisy channel. For a special case of initial distribution of original samples, quantization distortion is estimated and expressed analytically. Experimental evaluation of robustness under Additive White Gaussian Noise (AWGN) is conducted using natural images and compared with several other known two-dimensional Lattice as well as Scalar Quantization methods with conventional DC. Criterion of Watermark to Noise Ratio (WNR) was used for comparison. Among the most important findings related to the Modified Quincunx are: manipulating only a half of samples required in contrast to the other two-dimensional methods; considerably increased mutual information under low WNR; identical to the conventional Quincunx procedure of watermark extraction (decoding).

Keyword— watermarking, quantization, lattice, quincunx

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