International Journal of Innovative Computing, Information and Control
Volume **1**, Number **1**, March **2005**

 ISSN 1349-4198
pp. 35–41

EQUAL-AVERAGE EQUAL-VARIANCE EQUAL-NORM NEAREST NEIGHBOR CODEWORD SEARCH ALGORITHM BASED ON ORDERED HADAMARD TRANSFORM

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Received August 2004; revised December 2004

Abstract. *This paper presents a fast codeword search algorithm that performs the equal-average equal-variance equal-norm nearest neighbor search (EEENNS) in the ordered Hadamard transform (OHT) domain. By reordering the rows of Hadamard transform matrix, we can obtain the OHT with better energy packing efficiency, which is very important to the partial distance search (PDS) stage. Four elimination criteria based on three characteristic values, the first element, variance, and norm of the transformed vector, are introduced to reject a large number of unlikely codewords. Experimental results show that the proposed OHTEEENNS algorithm outperforms most of existing algorithms in the case of high dimension, especially for high-detail images.*
Keywords: Fast codeword search, Vector quantization, Image coding, Ordered Hadamard transform

1. **Introduction.** Vector quantization (VQ) [1, 2] is an efficient data compression technique that has been widely applied to image and speech coding. The original signal is first segmented into individual vectors. The VQ encoder then searches the nearest codeword in a predesigned codebook $\boldsymbol{C} = \{y_1, y_2, \cdots, y_N\}$ for each input vector $\boldsymbol{x}$ and uses the index of the nearest codeword to encode this vector. The VQ decoder simply performs a table look-up procedure in the same codebook to find the corresponding codeword for each received index. If we use the squared Euclidean distance $d(\boldsymbol{x}, \boldsymbol{y}_i) = \sum_{l=1}^{k}(x_l - y_{il})^2$ to describe the distortion between $\boldsymbol{x}$ and $\boldsymbol{y}_i$, where k is the dimension of vectors, then the full search (FS) of the nearest codeword for each input vector requires kN multiplications,