**A Robust Audio Multi-watermarking algorithm Based on Vector Quantization**

**Abstract**

Combined with zero-watermarking technology, a novel robust audio multi-watermarking algorithm based on index characteristics of the efficient VQ compression technique is proposed. We make use of the relativity of the neighboring indices to calculate the variance and mean, then generate the polarities by considering these properties. The permuted watermarking information loads on the corresponding polarity sequences to generate the secret keys, which have to be sent to copyright licensing bodies for registering. In this paper, we realize the zero-embedding of multiple watermarks and guarantee the watermarks’ invisibility thoroughly. The watermarks can be extracted without the original digital audio signal and watermarking images, only depending on the private keys. Besides, algorithm can embed different copyright information into one audio work synchronously and need not consider the embedding order. The experimental results show it’s perfect robustness under a variety of attacks, such as MP3 compression, low pass filtering, noise addition, resampling, cropping and so on**.**

Keywords-audio multi-watermarking; vector quantization; zerowatermarking; copyright protection