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A HOS-BASED WATERMARK DETECTOR

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Abstract. *An innovative and efficient higher-order statistics-based digital image watermark detector is proposed. The DCT (Discrete Cosine Transform) coefficients of original image plus watermarks are first clipped to binary value and then transformed through 3^{rd}- and 4^{th}-order cumulant operation, the result is compared with that obtained with the same procedure on the received image through a cumulant-based similarity estimator. Experimental results prove its robustness to anti-Gaussian noise and anti-rotation attacks, and better detection probability will also be expected.*
Keywords: Watermarking, HOS (higher-order statistics), Cumulant, Discrete cosine transform (DCT)

1. **Introduction.** The demand for digital images increases as rapidly as widespread and success of digital communication and Internet, which then facilitates the efficient distribution, reproduction, and manipulation over the network. Therefore, the protection and enforcement of intellectual property rights for digital images are urgent, which thus emerge the digital watermarking technology [1-8]. Digital image watermarking process includes two main procedures, watermark embedding and detecting/decoding. The most often and easily employed watermark embedding process is to add (hide) data directly or through transform domain (DCT, DWT, FFT, and etc.) to the original image, which is based on the classical correlation relationship [6-8] and is so sensitive to Gaussian-type noise as to degrade system detection performance much. In [9], a chaotic watermarking scheme accompanied by Markov maps is proposed and their statistical properties are also analyzed in detail. At the same time, the performance of correlation-based watermarking detector is proved to some important observations. The work in [10] is to improve the reliability and robustness of correlation-based watermark detecting scheme against attacks via embedding high-frequency spectrum in the low frequency of DCT domain. It does apply successfully to audio signals and demonstrate superiority with respect to both robustness and inaudibility.

In this paper, an innovative watermark detection scheme based on higher-order statistics (HOS) is proposed to overcome the noise-degraded system performance efficiently. The paper is organized as follows. In Section 2.1, the simple concepts of image watermarking will be summarized briefly. Section 2.2 describes brief concepts of the higher-order statistics. The proposed higher-order statistic-based watermark detector is discussed in Section 3. The simulation results and comparison with the early correlation-based scheme are shown in Section 4. A brief summary is given in Section 5.

2. **Background.**