

A block-based RDWT-SVD image watermarking method using human visual system characteristics

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Abstract

With the rapid growth of internet technology, image watermarking method has become a popular copyright protection method for digital images. In this paper, we propose a watermarking method based on 4×4 image blocks using redundant wavelet transform with singular value decomposition considering human visual system (HVS) characteristics expressed by entropy values. The blocks which have the lower HVS entropies are selected for embedding the watermark. The watermark is embedded by examining $U_{2,1}$ and $U_{3,1}$ components of the orthogonal matrix obtained from singular value decomposition of the redundant wavelet transformed image block where an optimal threshold value based on the trade-off between robustness and imperceptibility is used. In order to provide additional security, a binary watermark is scrambled by Arnold transform before the watermark is embedded into the host image. The proposed scheme is tested under various image processing, compression and geometrical attacks. The test results are compared to other watermarking schemes that use SVD techniques. The experimental results demonstrate that our method can achieve higher imperceptibility and robustness under different types of attacks compared to existing schemes. Our method provides high robustness especially under image processing attacks, JPEG2000 and JPEG XR attacks. It has been observed that the proposed method achieves better performance over the recent existing watermarking schemes.

Keywords Image watermarking · Arnold transform · Human visual characteristics · Redundant wavelet transform · Singular value decomposition