Block-Based Discrete Wavelet Transform-Singular Value Decomposition Image Watermarking Scheme Using Human Visual System Characteristics

Nasrin M. Makbol[1]; Bee Ee Khoo[1]; Taha H. Rassem[2]

[1]*School of Electrical and Electronic Engineering, Universiti Sains Malaysia, Malaysia ;*
[2]*Faculty of Computer Systems and Software Engineering, Universiti Malaysia Pahang (UMP), Malaysia*

ABSTRACT

Digital watermarking has been suggested as a way to achieve digital protection. The aim of digital watermarking is to insert the secret data into the image without significantly affecting the visual quality. This study presents a robust block-based image watermarking scheme based on the singular value decomposition (SVD) and human visual system in the discrete wavelet transform (DWT) domain. The proposed method is considered to be a block-based scheme that utilises the entropy and edge entropy as HVS characteristics for the selection of significant blocks to embed the watermark, which is a binary watermark logo. The blocks of the lowest entropy values and edge entropy values are selected as the best regions to insert the watermark. After the first level of DWT decomposition, the SVD is performed on the low-low sub-band to modify several elements in its U matrix according to predefined conditions. The experimental results of the proposed scheme showed high imperceptibility and high robustness against all image processing attacks and several geometrical attacks using examples of standard and real images. Furthermore, the proposed scheme outperformed several previous schemes in terms of imperceptibility and robustness. The security issue is improved by encrypting a portion of the important information using Advanced Standard Encryption a key size of 192-bits (AES-192).

KEYWORDS: singular value decomposition; cryptography; discrete wavelet transforms; edge detection; image watermarking; entropy