

## MULTI-PURPOSE DIGITAL WATERMARKING METHOD – INTEGRATING ROBUST, FRAGILE AND SEMI-FRAGILE WATERMARKING

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**ABSTRACT.** *Many digital-image watermarking schemes have been proposed over the last decade, but most of them have focused on robust, fragile or semi-fragile watermarking. This paper proposes a multi-purpose watermarking method that integrates robust, fragile and semi-fragile watermarking. Both authentication and watermark information are generated by discrete wavelet transform (DWT) and embedded into DWT sub-bands as a watermarked image. The authentication system verifies the copyright and integrity of images and locates modified parts of the received image as unauthentic. To improve the visual quality of watermarked images and extracted copyright logos, the variable quantization interval and refined algorithm also are proposed. The effect of this method and a comparison with related studies are shown in experimental results.*

**Keywords:** Multi-purpose watermarking, Robust, Semi-fragile, Discrete wavelet transform, Image authentication

1. **Introduction.** Because of the rapid growth of digital media techniques, digital products have become very popular, and the availability of powerful image-processing software has made it possible to modify images without leaving obvious traces. As a result, image authenticity has become an important issue. Digital watermarking and image authentication have grown into brisk areas of research and have been widely acknowledged as necessary for image security. At present, image-watermarking technologies are classified into three categories: robust, fragile and semi-fragile. Robust watermarking schemes [5,7,21] are generally used for copyright protection and verification of ownership because they tolerate most image-processing operations. Fragile authentication schemes [15,17] are mainly applied to content authentication and integrity identification because they are destructible after common attacks; in other words, they are fragile in regard to any kind of image modification. Semi-fragile image authentication schemes [10,16] allow non-malicious modifications, but not malicious ones; generally, the images may be manipulated by some incidental processes, such as compression, which are considered non-malicious. In non-malicious modification, such as JPEG and JPEG2000 compression, the content is not modified in such a way that the content meaning is altered.

Traditional watermarking schemes are usually designed for either copyright protection or content authentication; only a few multi-purpose image-authentication schemes have been presented. These methods have focused on achieving the goal of both robust and fragile watermarking. Hsu and Wu [11] implemented multiple watermark-embedding in the median-frequency of discrete cosine transform (DCT) coefficients. Shieh et al. [22] presented an approach to hide several watermarks in vector quantization and DCT domains.