

Fragile and Robust Dual Image Watermarking based on DWT-SVD

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Abstract—Digital media faces significant challenges related to unauthorized access, manipulation, and copyright infringement, necessitating effective authentication and copyright protection mechanisms. This research suggests a dual watermarking scheme based on the DWT-SVD and two authentication layers to identify tamper localization. A watermark was inserted by a set of rules for modifying $U(2,1)$ and $U(3,1)$ of DWT-SVD for the robustness watermarked image. The robust watermarked image can carry ownership and copyright information. The watermarked image is then inserted with two authentication bits into the least significant bit (LSB) which is highly sensitive to any modifications or tampering. The authentication bits are obtained from the different average sub-block 3x3 pixels with an image block of 6x6 pixels and parity bits of the sub-block image. Two authentication bits can be used to authenticate the integrity of the watermarked image. The results demonstrate its effectiveness in providing robust copyright protection and authentication capabilities. The scheme exhibits high imperceptibility, preserving the visual quality of the watermarked content with an average PSNR value of 45db, while ensuring a high level of originality to unauthorized alterations. Additionally, the proposed scheme achieved robustness with an NC value of about 0.981 against tampering rates up to 50%.

Keywords—watermark, copyright protection, image watermarking, image authentication, robustness, fragile watermarking.

I. INTRODUCTION

Images are an important carrier of information on the web. However, the increase in hacking capability and the ease of image reproduction and distribution have posed new challenges to image watermarking technology. Therefore, data protection is an important aspect of ensuring that multimedia files are protected from unauthorized access and use. Image watermarking is an important technique to protect image copyright [1][2]. Multimedia data needs to be secured to prevent piracy, illegal copying, forgery and fraud. Data hiding through watermarking is a process that involves altering the contents of

an image to conceal desired information. It must not affect the quality of the watermarked image [3]. Digital watermarking is a solution for digital copyright authentication and protection that may be used to secure and protect the intellectual property of images [4]-[6]. The research problem addressed in this study is the need for a secure and robust method for protecting the copyright of RGB images in the digital age. Protecting the ownership and integrity of the images becomes important due to the widespread use of digital images and how simple it is to copy and share them. Existing watermarking techniques have been developed to address this problem, but they often suffer from limitations such as low imperceptibility low accuracy and precision in tamper detection.

With the increasing use of digital media, the need for robust and secure methods of digital content has become more important. Traditional single watermarking methods are not sufficient to provide both authentication and protection. Therefore, a dual watermarking scheme is required to provide both authentication and protection for digital content [7].

Next, Rakhmawati et al. [8] presented dual image watermarking schemes both are based on discrete cosine transform (DCT). The scheme showed a result of imperceptibility dual watermark image below 35.687db PSNR and only greyscale image supported in their scheme. Dual watermarking scheme proposed by Rakhmawati et al., [8] used spatial and DCT method is superior compared to other existing scheme in terms of watermarking robustness, imperceptibility and tamper localization. The solution they proposed is to provide image ability in both copyright protection, and content authentication. The dual watermark is evaluated one by one separately with the PSNR value. The robust watermark produce PSNR 41.83dB, fragile watermark produce 37.27dB, and dual watermark produce 35.69dB. The scheme not having significant disadvantages proved by various measurement data compared to other schemes. Hence, it is suitable for secure image since it