

Dual Watermarking based on DCT with Human Visual Characteristics for Authentication and Copyright Protection

Ferda Ernawan
Faculty of Computing
Universiti Malaysia Pahang Al-Sultan
Abdullah
 Pekan, Malaysia
 ferda@ump.edu.my

Wong Shu Jie
Faculty of Computing
Universiti Malaysia Pahang Al-Sultan
Abdullah
 Pekan, Malaysia
 cd20137@student.ump.edu.my

Suraya Abu Bakar
Faculty of Computing
Universiti Malaysia Pahang Al-Sultan
Abdullah
 Pekan, Malaysia
 surayaab@ump.edu.my

Abstract—Nowadays, multimedia contents like images are easily distributed globally because of the widespread usage of information and communication technologies. Digital watermarking is an approach to prevent attacks or modification on images that might lead to serious problems like spreading of fake news, image piracy and illegal distribution of images. This research presents dual image watermarking based on human visual characteristics for authentication and copyright protection. The scheme aims to embed a watermark by modifying U coefficients of DCT-SVD with minimal distortion to the human eye. Additionally, the scheme demonstrates embedding authentication bits in the LSB for efficient tamper localization, enabling the detection of modifications made to the original image. The experimental results validate the effectiveness of the proposed scheme, showcasing superior performance in terms of imperceptibility, robustness, and tamper localization compared to existing watermarking schemes subjected to the same attacks. The scheme's ability to embed undetectable watermarks ensures copyright protection and authenticity verification, while its robustness against various image processing attacks. The proposed scheme offers a reliable approach for securing digital image content by ensuring imperceptibility, robustness, and tamper localization.

Keywords— *digital watermarking, Human Visual Characteristics, authentication, copyright protection*

I. INTRODUCTION

Nowadays, multimedia data like video, audio and images are easily to be distributed globally because of the widespread usage of information and communication technologies. In order to preserve and authenticate copyright, digital watermarking is a crucial approach to avoid image manipulation [1]. Digital watermarking is an action of inserting information into digital multimedia, where the process must not cause any perceptual damage to the original content and could not be removed by unauthorized parties, and additionally is resistant to intentional and unintentional attacks or manipulations like scaling, cropping, compression, rotating, and filtering [2].

These criteria are also known as imperceptibility and robustness. With these two criteria, the watermarking techniques are divided into three which are robust, fragile and semi-fragile. These three categories have their own concerns and neglects. Robust watermarking is designed to endure attempts to damage or remove the watermark without noticeably degrading the image's visual quality. Hence, robust watermarking is always used for ownership verification and

copyright protection. On the other hand, fragile watermarking is utilized to maintain the integrity and authenticity of an image. It is designed for modification detection where any tamper on the image could be identified. Lastly, semi-fragile watermarking is a combination of characteristics of robust and fragile watermarking where it could detect unauthorized manipulations but still being robust [3]. In this context, authentication is to embed extracted information of image into the image and to utilize ability of the watermark to detect area that has been tampered. Moreover, copyright protection involves seamlessly integrating a watermark image into the original image.

According to Rakhmawati et al. [4], a dual watermarking system combines both robust and fragile watermarking techniques. The robust watermarking scheme is responsible for copyright protection while the fragile watermarking scheme is responsible for authentication and content recovery. The robust watermarking scheme is optimised on its embedding strengths and reference pattern. Additionally, the fragile watermarking scheme is able to verify the altered image and identify the originality of the image content.

This paper presents dual watermarking scheme to achieve robustness and authentication. HVS is presented by entropy and edge entropy to improve the imperceptibility of the watermarked image. It is used to identify the region in the host image that is suitable to embed the watermark without much distortion. The watermark is then embedded into orthogonal U of DCT-SVD, and two layers authentication bits are embedded into LSB. The proposed scheme can provide a watermark with excellent imperceptibility, robustness and authenticate the originality of the watermarked, accomplish copyright protection and authentication.

II. RELATED WORK

Maheshwari [5] presented a watermarking method for copyright protection based on DWT-SVD. The primary watermark is divided into frequency bands using DWT and further processed with SVD, while a secondary watermark was inserted into the singular values. The scheme is evaluated against various attacks and outperforms individual DWT and SVD methods. The hybrid approach provides robustness and imperceptibility, making it more effective than using DWT or SVD alone for watermarking.

The paper by Han et al.[6] presented a dual watermarking algorithm based on DWT and and visual cryptography. In this