DUAL IMAGE WATERMARKING BASED ON HUMAN VISUAL CHARACTERISTICS FOR AUTHENTICATION AND COPYRIGHT PROTECTION

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Bachelor Degree

UNIVERSITI MALAYSIA PAHANG

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Kini, kandungan multimedia seperti gambar mudah diedarkan secara global kerana penggunaan teknologi maklumat dan komunikasi yang meluas. *Digital Watermarking* ialah pendekatan untuk mencegah serangan atau perubahan pada gambar yang mungkin membawa kepada masalah kritikal seperti penyebaran berita palsu, cetak rompak gambar dan pengedaran gambar secara haram. Penyelidikan ini membentangkan skema Penanda Air Imej Duaan berdasarkan ciri visual manusia untuk pengesahan dan perlindungan hak cipta. Objektif skim yang dicadangkan ini adalah untuk membangunkan algoritma penanda air yang dipertingkatkan yang mencapai ketidakjelasan dan keteguhan yang tinggi dengan memanfaatkan prinsip ciri sistem visual manusia. Skim ini bertujuan untuk membenamkan dua tera air ke dalam imej dengan herotan yang minimum, menjadikannya tidak dapat dilihat oleh mata manusia. Tambahan pula, tera air boleh diekstrak dengan tepat walaupun selepas serangan pemprosesan imej seperti hingar Gaussian atau hingar garam dan lada. Selain itu, skema ini menunjukkan penyetempatan gangguan yang cekap, membolehkan pengesanan pengubahsuaian yang dibuat pada imej asal dengan ketepatan tinggi, ketepatan dan skor F1. Keputusan eksperimen mengesahkan keberkesanan skim yang dicadangkan, mempamerkan prestasi unggul dari segi ketidakjelasan, keteguhan dan penyetempatan gangguan berbanding skim penanda air sedia ada yang tertakluk kepada serangan yang sama. Keupayaan skema untuk membenamkan tera air yang tidak dapat dikesan memastikan perlindungan hak cipta dan pengesahan ketulenan, manakala keteguhannya terhadap pelbagai serangan pemprosesan imej meningkatkan kepraktisannya dalam senario dunia sebenar. Kesimpulannya, cadangan skim Penanda Air Dwi Imej berdasarkan ciri visual manusia menyediakan penyelesaian yang berkesan untuk pengesahan dan perlindungan hak cipta. Dengan memastikan ketidakjelasan, keteguhan dan penyetempatan gangguan, skim ini menawarkan pendekatan yang boleh dipercayai untuk mendapatkan kandungan multimedia digital dalam era pengedaran maklumat yang meluas dan kemajuan teknologi.

ABSTRACT

Nowadays, multimedia content like images are easily to be 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 a novel Dual Image Watermarking scheme based on human visual characteristics for authentication and copyright protection. The objective of this proposed scheme is to develop an enhanced watermarking algorithm that achieves high imperceptibility and robustness by leveraging the principles of human visual system characteristics. The scheme aims to embed two watermarks into an image with minimal distortion, rendering them imperceptible to the human eye. Furthermore, the watermarks can be extracted accurately even after image processing attacks such as Gaussian noise or salt and pepper noise. Additionally, the scheme demonstrates efficient tamper localization, enabling the detection of modifications made to the original image with high accuracy, precision, and F1-score. 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 enhances its practicality in real-world scenarios. In conclusion, the proposed Dual Image Watermarking scheme based on human visual characteristics provides an effective solution for authentication and copyright protection. By ensuring imperceptibility, robustness, and tamper localization, the scheme offers a reliable approach for securing digital multimedia content in the era of widespread information distribution and technological advancements.

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ARE	Absolute Reconstruction Error
Avg	Average
BER	Bit Error Rate
DCT	Discrete Cosine transform
DRM	Digital Rights Management
DWT	Discrete Wavelet Transform
FNR	False-Negative Rate
FPR	False-Positive Rate
HH	Higher Highs
HL	Higher Lows
HVS	Human Visual System
JPEG	Joint Photographic Experts Group
LH	Lower Highs
LL	Lower Lows
LSB	Least-Significant Bit
MSE	Mean Squared Error
NC	Normalized Corelation
NCML	Nested Chaotic Map Lattice
PSNR	Peak Signal-To-Noise Ratio
RDWT	Redundant Discrete Wavelet Transforms
RGB	Red-Green-Blue
RHFM	Radial Harmonic Fourier Moments
ROI	Region of Interest
SSIM	Structural Similarity Index
SVD	Singular Value Decomposition
TNR	True-Negative Rate
TPR	True-Positive Rate
VCS	Visual Cryptography

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