Chapter 28
An Improved Security 3D Watermarking Method Using Computational Integral Imaging Cryptosystem

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ABSTRACT

Robustness and security are difficult to be solved by conventional two-dimensional (2D) digital watermarking technology. In recent years, three-dimensional (3D) digital watermarking has become a new hotspot in optical information security. This paper presents a new improved security 3D digital watermarking method based on computational integrated imaging cryptosystem. Firstly, 3D digital watermarking is generated and encrypted by computational integral imaging cryptosystem that is implemented with smart pseudoscopic-to-orthoscopic conversion (SPOC) model. Secondly, discrete wavelet transform algorithm is applied to embed and extract the 3D digital watermarking. Finally, the extracted watermark is decrypted,

and3D digital watermarking is displayed by integral imaging system. The feasibility and effectiveness of the proposed method is demonstrated by experiment. A primary implication of encrypted processing is that the majority of integral imaging cryptosystem will be encryption-in-the-loop applications, and the majority of system will improve the security and robustness of 3D digital watermarking. The new method is able to meet the requirements of robustness and security. Image quality and display quality achieve these criterions of the human visual model. The proposed method can be applied in the aspects of cloud computing and big data.

1. INTRODUCTION

With the rapid development of modern communication technologies, threats on network information security are increasing, people are not only concerned about the multimedia information should not be illegally copied, distributed and tampered, but also pay more attention to security and confidentiality of information transmission. Digital watermarking provides secure means for copyright protection, content authentication, encrypted communication, and digital forensics of multimedia products. Watermark images is embedded into cover images in spatial domains (Cox, & Kalker, 2008; Abbas Cheddad, & McKevitt, 2010; Tang Qing sheng, & She Kun, 2005; Shen Chang-Xiang, 2007). Currently there are various methods for embedding and extraction of digital watermarks. The methods fall into two types: spatial domain methods and transform domain methods. In spatial domain methods, it is easy to realize embedding and extraction of digital watermarks but with weak robustness. In transform domain methods, watermarks are processed in transformed frequency domains, with better robustness and invisibility. To the best of our knowledge, transform domain technology of digital watermarking has become a new hotspot in digital watermarking research. Common transform domain methods are Discrete Cosine Transform (DCT) algorithm, Fast Fourier Transform (FFT) algorithm, discrete wavelet transform (DWT) algorithm, and so on. It becomes a new research hotspot on information hiding with optical techniques. Digital holography (Takai, & Mifune, 2002; Matoba, & Javidi, 2009) and random-phase encoding (Kishk, & Javidi, 2002; Peng, & Yu, 2006) are two major optical information hiding techniques. Digital holography is a technique (Takai, & Mifune, 2002; Matoba, & Javidi, 2009) to record with interferometer method the space phase of an object in intensity modulation form. Random-phase encoding, however, realizes information encryption via optical transformation processing (Kishk, & Javidi, 2002; Peng, & Yu, 2006) of random-phase marks and lens. Xiang Peng et al. introduced a 3Ddigital watermarking algorithm based on virtual optics (Peng, & Yu, 2006; X. Peng, & D. Zhang, 2005). The algorithm realizes embedding and blind extraction of 3D digital watermarks utilising the morphological variation of virtual Fresnel diffraction in 3D space. To enhance robustness and security of digital watermarks, multi-image digital watermarking was proposed in (Giakoumaki, & Koutsouris, 2006). The 3D digital watermarking algorithm is based on wavelet decomposition. Various watermark information is embedded into various wavelet subbands, watermark data may be digital signature and personal information of the copyright owner. This method, which can be also applied in image communication and copyright protection of images, significantly improves robustness of digital watermarks. The invisibility of watermarks, however, decreases as the watermark information accumulates. Processing time of watermark embedding and extraction will be extended.

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