



## ON THE SECURE WATERMARK EMBEDDING SCHEME BASED ON SELECTIVE ENCRYPTION

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**ABSTRACT**—Some joint fingerprinting and decryption (JFD) schemes used for copyright protection were reported recently. However, most of them need to be investigated before practical applications. In this paper, the typical one proposed by Lemma et al. is investigated and evaluated. Since this scheme aims to distribute multimedia content by encryption and watermarking, some important performances determine its practicability, including the perceptual security of the encryption operation, the imperceptibility of the embedded watermark and the robustness of the embedded watermark. Some flaws are found in the scheme, such as the low encryption strength, the data overflow caused by encryption/decryption and the low correlation value caused by collusion, which degrade the performances greatly. To improve the scheme, some means are proposed, including adaptive media preprocessing, chaos-based selective media module addition and collusion-resistant fingerprint encoding. Comparative experiments show that better performances are obtained by the improved means. The analysis method proposed in this paper can be used to investigate some other JFD schemes.

**Key Words:** digital fingerprinting, selective encryption, traitor tracing, watermarking, chaos, data filtering