An efficient adaptive scaling factor for 4×4 DCT image watermarking

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Abstract

The imperceptibility and robustness properties of the watermarked image are the major requirements for maintaining the watermarked image similar to the original image and keeping the inserted watermark resistant under various attacks. In order to optimize the scaling factor for balancing between imperceptibility and robustness, this paper proposed a technique to generate scaling factors by considering the image content. The scaling factor is generated based on selected DCT coefficients of 4×4 DCT. The proposed watermarking can generate dynamic scaling factors for different DCT coefficients. The embedding regions are determined by using variance pixels, whereby the highest variance pixel was prioritised for the first embedding watermark. The watermark image pixels were scrambled by using an Arnold cat map before the watermark was embedded. This research uses 10 images from USC-SIPI image database to evaluate the effectiveness of the proposed watermarking. The experimental results showed that the proposed method improved the invisibility of the watermarked image with PSNR value of 45.38 dB rather than other watermarking schemes. The proposed watermarking showed superior performance against different types of attack.

Keywords Image watermarking · Adaptive scaling factor · Embedding watermark · Extracting watermark · Discrete cosine transform · Robustness · Imperceptibility

1 Introduction

The massive digital technology helped to evolve the production and distribution of digital content which may increase illegal copies [14]. Digital content such as images was easily

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