Chapter 2

Dual Scrambled Image Watermarking Algorithm in DWT–SVD Composite Domain

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ABSTRACT

There is an increased risk of copyright violation of multimedia data due to the enormous growth of computer networks that provides fast and error free transmission of any multimedia information. A copyright identifier that may contain some information about the lawful owner is inserted in the contents of the image, without sacrificing its quality. The security levels are increased by using a key value and scaling factor for the embedding and extraction process. The dual scrambled watermark using Arnold and Scrambling sequence is embedded by modifying the singular values of the scrambled cover image’s DWT middle frequency sub-band. The simulation was performed on MATLAB 7.7.0 with standard database gray scale images of size 512x512 and watermark of size 64x64 using hybrid dual scrambled watermark schemes. The performance analysis is done on the basis of the degree of scrambling and JPEG compression attack using various parameters. The proposed method achieves better imperceptibility and security for the copyright protection methods.
INTRODUCTION

Digital multimedia technology has gradually developed and increased the ease of access to digital information. As digital multimedia (video, audio and images) become available for retransmission, reproduction, and publishing over the Internet, a real need for protection against unauthorized copy and distribution has increased, thus gives rise to the digital watermark technique for copyright protection of digital contents. A digital watermark is a visible or invisible identification code that may contain some information about the intended recipient, the lawful owner or author of the original data in the form of textual data or image. On the modification of any data content, could lead to absence or degradation of the watermark.

Thus, an important role can be played by the digital watermarking in providing the evidence of copyright infringements and thus making it traceable for the improper use of protected multimedia. Digital watermarking has a wide-span of practical applications such as digital cameras, medical imaging, image databases, video-on-demand systems, broadcast monitoring, transaction tracking, authentication, copy control, and device control among many others.

Generally, watermark techniques can be broadly divided into:

- **Spatial Domain**: The watermark data is embedded in the pixel value by doing changes in the pixel value intensity in this approach (Schynde et al., 1994).
- **Transform Domain**: The watermark is added in the transform domain in order to have imperceptibility as well as robustness. In this method, transform coefficients are modified for embedding the watermark (Nikolaidis and Pitas, 2003).

BACKGROUND

In this chapter proposed watermarking method is based on DWT and SVD techniques.

1. Discrete Wavelet Transform (DWT)

Wavelet Transform uses wavelets of finite energy. Wavelets are used as basal functions for representing signals in the DWT transform. Wavelets can be realized by iteration of filters with rescaling. They are local in both frequency/scale (via dialations) and in time (via translations). The resolution of the signal is determined by the filtering operations, and the upsampling and downsampling (subsampling) operations determine the scale of an image.

- **Haar Wavelet**: It is a step function taking values 1 and -1, on [0; 1/2] and [1/2; 1], respectively. These are good for edge detection and reconstructing binary pulses.

The sequence \( x[n] \) denotes the signal in the figure, where \( n \) is an integer. \( G_0 \) denote the low pass filter while \( H_0 \) denotes the high pass filter. At each level, the high pass filter produces detail information, \( d[n] \), while the low pass filter associated with scaling function produces coarse approximations, \( a[n] \) (Dhubkarya and Sonam, 2009).
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