Multimedia Encryption, Transmission and Authentication

Edited by

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Performance Evaluations of Digital Watermarking System

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24.1Introduction

A properly designed and implemented watermarking system needs to be evaluated of its performance so that it can be compared with other systems designed for the same purpose using the same conditional/experimental parameters. Muharemagic and Furht (2003) stated that by definition, watermarking is a technique for embedding a watermark into a cover image imperceptibly and robustly. Therefore a quality of a new or improved watermarking system can be measured by evaluating these two properties.

24.2 Watermark Imperceptibility

Watermark imperceptibility can be assessed either through subjective human observations or using distortion measures. It can be expressed either as fidelity or quality measure. Fidelity represents a measure of similarity between the original and watermarked image, while quality represents an independent measure of its acceptability.

Human's eyes are the most usable to test and measure fidelity and quality. Developed by psychophysics, its goal is to determine relationship between the physical world and people's subjective experience of that world. Variations of tests which are based on human's judgements are possible, and more information about it can be found in (Cox et al., 2002). These subjective tests can provide very accurate measure of perceptibility of an embedded watermark. However, they can be very costly as they can not be easily repeated or automated.

Another alternative is based on measuring distortion caused by embedding a watermark. This distortion can be represented as a measure of difference or distance between the original and the watermarked signal. Two commonly used measures are the Mean Squared Error (MSE) function and the Peak Signal to Noise Ratio (PSNR). The MSE between the original image, I_o and watermarked image, I_w is defined as:

$$MSE = \frac{1}{N}\sum_{j,k}(I_o[j,k]-I_w[j,k])^2 \qquad (24.1)$$