Digital Watermarking Using Modified Techniques in Spectral Domain of Images

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Abstract. Digital watermarking using advanced techniques in spectral domain and pictorially showing the comparisons of importance and efficiency of discrete fourier transform and discrete cosine transform in spectral domain of digital watermarking is mainly reflected in this paper. The proposed technique will produce more efficient output but under certain specifications. The comparisons of various transforms are essentially performed and contemplated for better results .The features of the digital world lead to economical changes such as cheap distribution and also serious risks in simplifying unauthorized copying and distribution. So, there is an immediate requirement for a well-established and advanced technique for digital watermarking.

1 Introduction

Watermarking can be used in a wide variety of applications. In general, if it is useful to associate some additional information with it, this metadata can be embedded with the watermark [1] . A visible watermark is an opaque or semi transparent sub-image or image placed at the top of another image so that it is obvious to the viewer. An invisible watermark cannot be seen with the naked eye. They are imperceptible but can be recovered. The embedded information is hidden (in low value bits or least significant bits of the picture pixels, frequency or other value domains and linked in separably with the source data structure. Technically speaking, a code conveying some important information about the legal data owner, or the allowed uses of data is hidden within the data itself instead of being attached to the data as a header or separate file [1-3].

Nomenclature

LVSP – Linear valued spectral processed formula; NVSP – n-valued spectral processed formula; IVSP – Infinite valued spectral formula; ENVSP – Extended n-valued spectral formula; ENVSP – Extended infinite valued spectral formula.

Watermarking is classified as:

- Watermarking in spatial domain.
- Watermarking in spectral domain.

Watermarking in spatial domain is a method in which the secret message has to be embedded in the asset. So, the technique implemented here is the asset is broken

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down to 8-bit planes and the most significant bits of message are embedded in the place of the least significant bits of the asset [3,4,7]. Watermarking in spectral domain is a method in which image is brought to frequency domain by using variety of transforms like discrete cosine transform .In frequency domain, coefficients are slightly modified. This makes some unnoticeable changes in the whole image and makes it robust to attack [3,5].

2 Existing Algorithm for Watermarking in Spectral Domain

1. Calculate the 2-D Discrete cosine Transform of the asset to be watermarked with the message.[6][7].
2. Find out the M largest coefficients m_1, m_2, m_3 ……m_M from the above calculated discrete cosine transform .
3. Create a message(watermark) by generating a M-element pseudo-random sequence of numbers from Gaussian distribution μ=1 and variance=1 [2] [3] .
4. The message signal is been embedded into the M-largest discrete cosine transform coefficients.

Linear valued spectral processed formula (LVSP).

$$D_i = C_i \,.\, (1 + \alpha \,.w_i)$$

5. Calculate the inverse discrete cosine transformation of the result obtained in the above point.

2.1 Advanced Techniques for Watermarking in Spectral Domain

The main theme of this paper is modifying the equation in Step4 of existing algorithm by inducing more amount of message signal power in the asset and at the same time, keeping the quality of the image intact. And thereafter comparing the differences in the usage of discrete fourier transform over discrete cosine transform and their individual advantages are visualized through results.

2.2 Modified Algorithm for Watermarking in Spectral Domain

The modification is required in Step1 and Step4 of the existing algorithm.

Modified Step1: It is suggested to use both the discrete fourier transform and discrete cosine transform according to how the application demands and details shown pictorially below.

Modified Step2: The modified formula below will help in strengthening the message signal to be embedded in the asset (message to asset signal power ratio increases) and by modifying the values of the coefficients, we can directly increase the strength without going for higher strength signal.

n-valued spectral processed formula (NVSP) :

$$D_i = C_i \,.\, (1 + \beta_1.w_i + \beta_2 \,.w_i^2 + \beta_3.\, w_i^3 \; +\ldots\ldots\ldots + \beta_n \,.\, w_i^n) \qquad (1)$$

Extended n-valued spectral processed formula(ENVSP) :

$$D_i = C_i \,.\, (1 + \beta_1.w_i^2 + \beta_2 \,.\, w_i^4 + \beta_3 \,.\, w_i^6 \; +\ldots\ldots\ldots + \beta_n \,.w_i^{2n}) \qquad (2)$$