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An Efficient Watermarking Approach For Digital Images

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ABSTRACT
Digital Watermarking technique is used to embed the useful information in a transmission media for copyright protection, authentication and broadcast monitoring etc. This paper describes an image hiding method using Fast Fourier Transform (FFT) algorithm which calculates the Peak Signal to Noise Ratio (PSNR) values and compare them with Gray Scale and Discrete Cosine Transform (DCT). The experimental results show that the quality and embedding capacity of watermarked image for this scheme is higher as compared to other existing watermarking schemes.

Keywords: DCT, Gray Scale, FFT, PSNR.

I. INTRODUCTION

The digital revolution, the explosion of communication networks, and the increasingly growing interest of the general public in new information technologies lead to exponential growth of multimedia document traffic (Digital image, text, audio, video, etc.). Ensuring the protection and control of the exchanged data has become a major issue. The digital nature of multimedia documents can make them get duplicated, modified, and transformed very easily [1].

Digital watermarking [8][9][10][11] is the technology that represents an effective method which provides security, authentication of data and copyright protection to the digital media. It involves embedding watermark data into original information [2]. Watermark information cannot be stored in file header because anyone with a computer and a digital editing workstation would be able to convert the information to another format and remove the watermark. Thus the watermarks are always embedded to multimedia signals. There are a lot of processes performed by unauthorized persons who aim to damage or corrupt the embedded information termed as attack [4][5]. Digital watermarking consists of watermark embedding and watermark detection & extraction module. The watermark embedding module inserts a watermark key onto the cover signal and the watermark detector detects the presence of watermark signal. An entity called is used during the process of embedding and detecting watermarks [1].

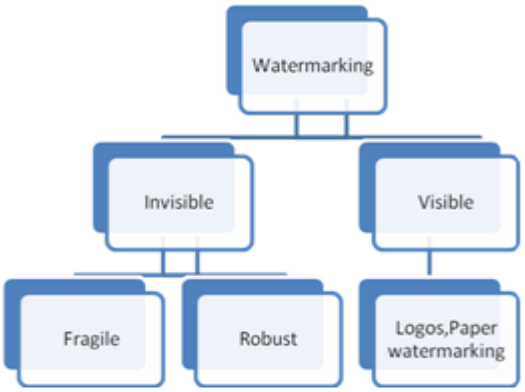

Fig 1: Watermarking Techniques

A digital watermark is an invisible signature embedded inside an image to show authenticity and ownership (Fig. 1). An effective digital watermark should be perceptually invisible to prevent obstruction of the original image. It should be statistically invisible to prevent detection, and it should also be resistant to image adulteration such as filtering, additive noise, and compression [6].

Digital image authentication systems can be classified in several ways according to whether they ensure integrity or content authentication, and also according to the storage mode [4] [7].

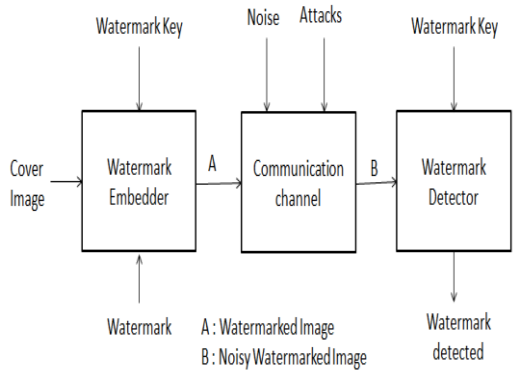

Fig 2: Digital Watermarking

Before the watermarking image is embedded, it should be encrypted in advance, namely made the scrambling transformation in order to ensure the security of the watermarking information and improve the robustness of the original image (Fig. 2). The size of the image cannot be changed by the scrambling transformation, because the scrambling transformation of digital images is a reversible transformation attained by changing the image pixel position or gray level [2].

II. Proposed Methodology

An original image as an input image is taken on which a watermark is embedded. For embedding the watermark, the entropy [16][17] in three different Domains namely DCT [3], Gray Scale and FFT is calculated as shown in Fig. 3. The maximum entropy is found in FFT so it is selected for embedding the watermark as maximum entropy region is quiet immune to noise.

Algorithm:

Step1: An original image is taken as an input image.
Step2: For embedding the watermark the entropy in three different Domains namely DCT, Gray Scale and FFT is calculated.
Step3: Now, Determine the maximum entropy in FFT Domain.

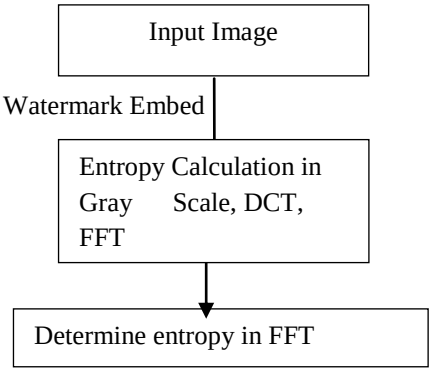

Fig 3: Flow Chart of Proposed Methodology

III. Experiment & Results

The Functional code of proposed system is implemented using MATLAB 2012b on an intel i5 processor. The proposed method is tested using an image database of various gray scale images. Some examples are presented in this section to show the effects of the modifications caused to the image after embedding the watermark. Up to now, no general benchmarking platform for watermarking systems has been deployed considering the quality of the produced watermarked image. The common practice is to measure the quality of the watermarked image. The results are presented below in Fig 4 where the original image along with the watermarked Fig 5 one can be viewed. The proposed method produces a high quality watermarked image shown in Fig 6.

Fig 4: Original Image

Fig 5: Watermark

Fig 6: Watermarked Image

The performance criteria include PSNR, Bit by Bit compression between the original and watermarked image. The most common metric in watermarking field is PSNR. The results of the proposed method considering PSNR are presented in Table 1(Fig. 7).

Table 1: Comparison Results In Terms of Quality

Schemes	Quality
Scheme1 (Histogram Shifting) [12]	48.22
Scheme2 (Three Pixel block Differences) [13]	46.60
Scheme3 (Reversible Image Hiding Scheme) [14]	51.33
Scheme4 (Interpolation Technique) [15]	48.82
Scheme5 (FFT)	50.23

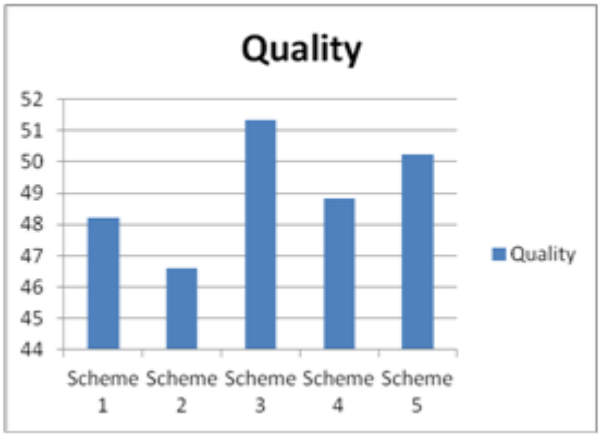

Fig 7: Results In Terms of Quality

From the results, we can conclude that the different domain of entropy calculation will result in different watermarking performance and the FFT domain entropy masking model show high PSNR value as given in Table 2 (Fig. 8).

Table 2: Calculated PSNR

Domain	PSNR/dB
Gray Scale Pixel	41.8268
DCT coefficients	38.6187
FFT coefficients	43.4102

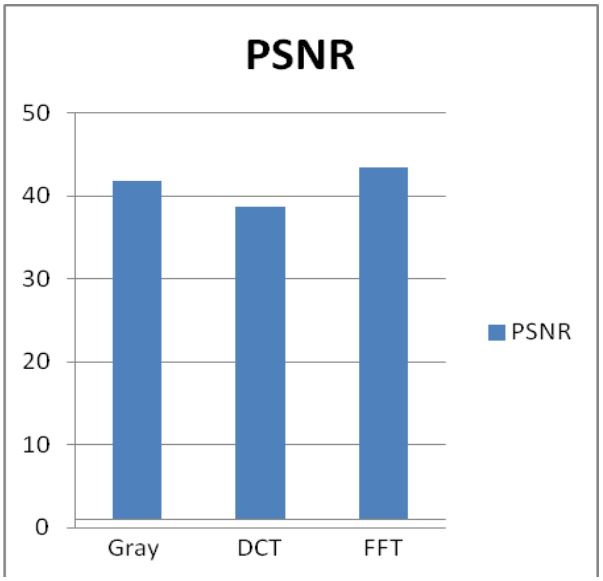

Fig 8: Calculated PSNR

IV. CONCLUSION

This paper finally concludes that FFT Domain is far better than DCT Domain and Gray Scale Domain. In this paper, the PSNR is considered as the performance parameter.

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