An Entropy Masking in Digital Images using FFT

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ABSTRACT
The essence of transmitting digital information in digital watermarking system and the dissymmetric digital watermarking framework lived on media content communication is being discussed in this paper. The protection and integrity of information during transmission is also discussed in this paper. Fast Fourier Transform (FFT) is applied for watermarking embedding algorithm to keep the balance between watermarks' imperceptibility and its robustness.

Keywords
Discrete Cosine Transform (DCT), Fast Fourier Transform (FFT), Gray Scale, Peak Signal to Noise Ratio (PSNR).

1. INTRODUCTION
Digital Watermarking works by concealing information from digital data, as it cannot be detected without special software package with the purpose of ensuring that the concealed data is present in all its copies regardless of attempts to damage/removing it. Digital watermarking technology makes use of the actual fact that the human eye has solely a restricted ability to look at variations. Minor modifications among the color values of an image are subconsciously corrected by the attention, in order that the observer doesn't notice any difference. The quality of digital watermarks are often judged in two ways; first of all it should be resistant to all intentional and unintentional attacks and also the embedded watermark should not detract from the image quality. Higher the resistance of a watermark against attacks, lower is the risk of image quality getting reduced.

There are many types of information and data. The kinds focused on during our research are:
• Digital Images
• Digital Audio, and
• Digital Videos

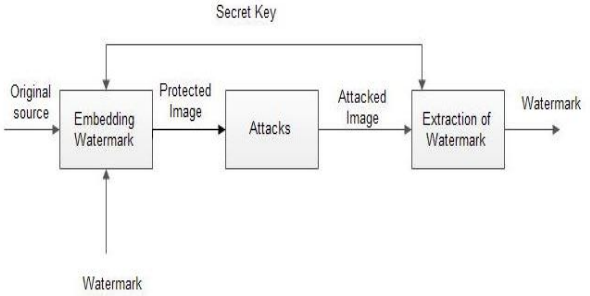

Fig: 1.1 Digital Watermarking Method

Data concealment techniques specializing in protecting copyright related problems are of considerable interest in academic domain and industry. Information conceal meant ways can conceal additional information in media. Most information concealment/data hiding schemes distort the cover media so as to embed the secret key. Though the distortion is often very less and in cognoscible, the reversibility is crucial to some sensitive applications. In applications, such as law enforcement, medical image systems, it is needed to be able to reverse the marked image back to the cover image for legal consideration. High accuracy is being demanded in remote sensing and military imaging. Reversibility of the original media is required under these situations.Image processing depends on compression that helps in reduction of file size for transmission of huge amount of data in an exceedingly stipulated and reduced time. The signal or image clearance and simplification that are unit a part of denoising or filtering is one of the common goals of image compression which is being provided by wavelet analysis. In the current era medical therapies has evolved drastically which needs transmission of medical information over long distances beneath high security with maintaining efficiency. On the basis of compression ratio and PSNR, a comparative study considering the values of image quality has been delivered.
The FFT is a DFT algorithm that reduces the amount of computations required for ^{N} points from $2N^2$ to $2N \lg N$, where log is the base-2 algorithm. If the function to be transformed is not harmonically associated with the frequency, the response of associate degree FFT appears like a sine function (although the integrated power continues to be correct). Aliasing (also called leakage) are often reduced by using a modification function. However, aliasing reduction is at the expense of broadening the spectral response.

2. LITERATURE SURVEY
Cox[6] and Moulin[7] introduced information analysis into watermarking system, and constructed communication figs based on Shannon's theory. In fig A and B (seeing in figure 1) original signal is regarded as either strong noise or side information and the importance of watermarking information is factitiously emphasized. In fig C even if it is, the original information is considered symmetrical coordinate information as watermarking information.

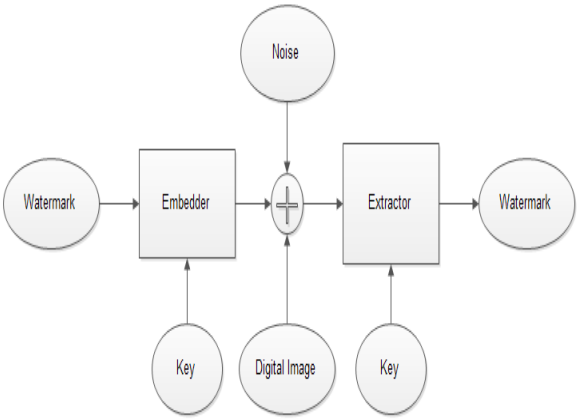

Fig.A

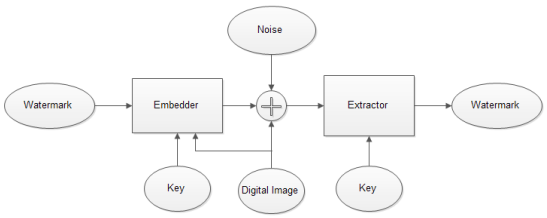

Fig.B

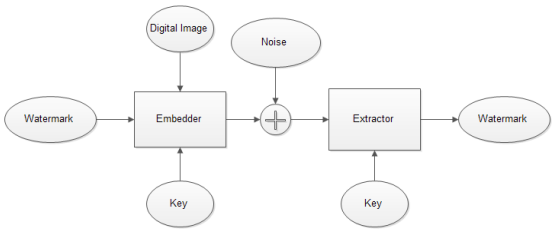

Fig.C

Fig 2.1 Communication Model For Watermarking System

All of the three figs are examined from information hidden aspect. In fact, most of the digital watermarking applications are not aimed at2 transmission of the hiding message itself. Any data process, including watermarking embedding, could not degrade the content value in use. Yang Cheng [8] proposed a robust watermarking fig based subliminal channel and dissymmetric communication. In the proposed fig the main thread of communication is media content transmission and the watermark information should be transmitted over a hidden channel of the original multimedia content.[13]

The question how to find a suitable hidden channel is the key for digital watermarking system. And the hidden channel should afford high channel capacity in order to keep excellent watermarking performances. In Shannon's information theory, the essence of communication is uncertainty elimination and information transmission.

Therefore, in order to keep effectiveness of media content communication, the area with more information provides high robustness. For another, the area with great uncertainty provides excellent masking effect, leading to high transparency. While the entropy is a measurement of uncertainty, the area with large entropy keeps balance between robustness and transparency as a result.

As analyzed above, the large entropy area is good for watermarking embedding and that is the true hidden channel.In 2002, Droogenbroeck et al.[5] put forward entropy masking based on spatial domain of gray scale image. In 2004, Kim et al.[3] proposed entropy masking based on DCT domain. In 2005, Akhbari et al.[4] offered entropy masking based on the wavelet transform.

In this section, the digital watermarks, features, their techniques and applications are classified and divided into numerous classes as shown in figure.

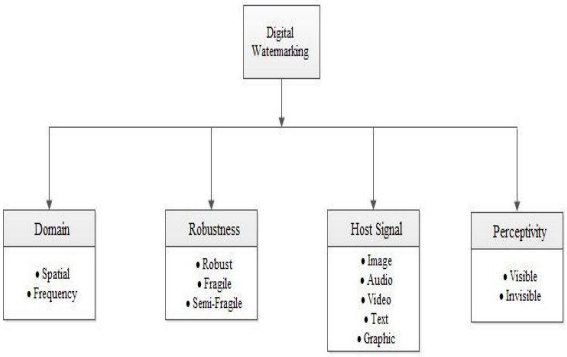

Fig 2.2 Classification of Digital Watermarking

Processing of an image depends on compression that helps in reduction of file size for transmission of large amount of data in an exceedingly stipulated and reduced time. The signal or image clearance and simplification that are a part of denoising or filtering is also provided by using wavelet analysis. Wavelet analysis uses and therefore provides long term intervals. In this era medical therapies has evolved drastically which needs transmission of medical information over long distances beneath high security with maintaining efficiency. A comparative study based on compression ratio and Peak-Signal-to-Noise-Ratio (PSNR) values of image qualities for corresponding techniques has been delivered in this paper[2]. Mathematicians outline the "Fast Fourier Transform" as a technique of solving the multipoint analysis drawback. One purpose of the document is to produce a mathematical treatment of the subject of the "Fast Fourier Transform".

The FFT permits us to expeditiously estimate element frequencies in information from a separate set of values sampled at a fixed rate.

3. PROPOSED METHODOLOGY

FFT is a new domain in digital watermarking which is improved extension of DFT. Till now, only audio and video signals have been processed using FFT domain. We have attempted to apply FFT on images ensuring their better protection. On comparing FFT results with already existing domains (DCT and Gray Scale), it is being observed that FFT is far better than DCT and Gray Scale.

In FFT, PSNR calculated on the basis of entropy is much higher than other techniques. Hence FFT domain came out with better results than all the existing domains.

Proposed Algorithm:

1. Original image which is taken as input image is being normalized.
2. FFT is being applied on the normalized image.
3. Another image as watermark is being taken.
4. Watermark is also normalized.
5. FFT is again applied on the watermark.

6. Watermark is embedded into the original image.
7. Using different domains, entropy is calculated.
8. Higher entropy means higher PSNR values and it is found out in FFT domain.

4. EXPERIMENTAL RESULTS

The Functional code of proposed system is implemented using MATLAB 2012a on an intel i5 processor.

For embedding the watermark, α should be 0.001. Blending factor (α) gives us the invisibility degree of the watermark to be embedded in the original image. Smaller the value of Blending factor (α), higher the value of invisibility of the watermark in the digital Image.

Original Image

Watermark

Watermarked Image

After embedding the watermark in the original image we get the following images in different domains:

Gray Scale **DCT Domain** **FFT Domain**

After the experiments we could conclude that the different domain entropy calculation will result in different watermarking performance. The current experiment proves that the entropy show high PSNR value as shown in the given table:

Table 4.1 Calculated PSNR

Domains	Values
Gray Scale	52.9204
DCT	52.0148
FFT	54.3981

5. COMPARISONS

Table 5.1 Comparison Results In Terms of Quality for Lena and Baboon

Schemes	Lena Image	Baboon Image
Hwang et al[8]	48.22	48.20
Lin et al[9]	46.60	47.61
Tsai et al[10]	51.33	52.95
Lixin et al[14]	48.82	48.36
Proposed	58.32	59.71

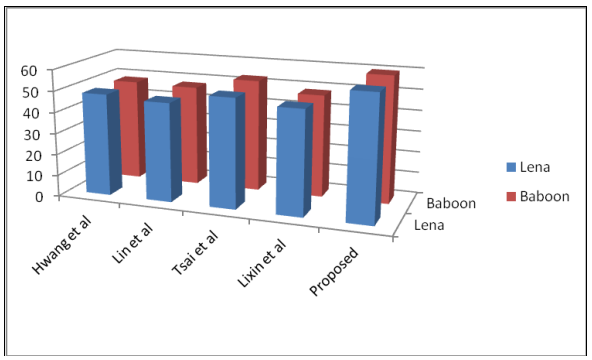

Fig. 5.1 Comparison results in terms of quality for Lena and Baboon

6. CONCLUSION

It is being concluded from the research and experimental results regarding security enhancement of data and digital images that the PSNR value on the basis of entropy in FFT domain is much higher than DCT and Gray Scale domains. Higher entropy means higher PSNR values in the different domains. Also, concluded from the experiments that a

suitable domain of entropy calculation will result in optimal watermarking performance.

Further, this technique (FFT) will be compare with DWT for getting the enhanced results.

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