Factors Affected to Image in Digital Watermarking

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Abstract—Digital watermarking is a method through which we can authenticate images, texts and videos. Watermarking functions are not only authentication purpose, but also protection for such documents against malicious intentions to change such documents or even claim the rights of such documents. The aim of Watermarking is adding "ownership" information in multimedia contents to prove the authenticity. In this paper, DCT technique is used and discussed about the watermark length and size of image. Both factors affected to quality of image [1][2][5].

Keywords-Discrete Cosine Transform(DCT),Peak Signal to Noise Ratio(PSNR),Mean Square Error (MSE).

I. INTRODUCTION *(DIGITAL WATERMARKING)*

Digital watermarking technology is drawing the attention as a new method of protecting copyrights for digital images. It is realized by embedding data that is insensible for the human visual system. The embedded information data is called watermark. So watermarking in digital images is the process by which a discrete data stream is hidden within an image imposing imperceptible changes of the image. The general process involved in Watermarking System as illustrated in fig.1.The process can be divided into three parts: Embedding, Transmission and Extraction.

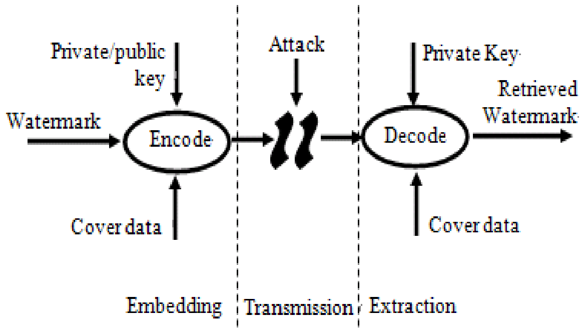

Fig: 1 Watermarking System [6]

In the embedding process, the watermark signal may be encoded into the cover data using a specific key. This key is used to encrypt the watermark as an additional protection level. The output of the embedding process, the watermarked image, is then transmitted to the receiver. During this transmission process, the watermarked image can be damage or corrupt due to noise or some attacks. Therefore, there is no guarantee that the watermarked image received by the receiver is exactly the same data as that sent by the transmitter. After finding the watermarked image we apply Extraction process. Extraction process, compare the watermarked image with original image. Similar watermark will prove the authenticity.

II.Properties of watermark

The important properties that arise in the study of digital watermarking techniques are [7]:

A. *Invisibility*

The digital watermark embedded into the image data should be invisible to the human observer.

B. *Robustness*

The robust watermarking aims to embed information into a file which cannot be easily destroyed.

C. *Fragile*

Fragile watermarking involves embedding information into a file which is destroyed if the file is modified. This method is suitable for verification or authenticity of original content.

D. *Semi-fragile*

Semi-fragile watermark are robust to incidental modification, but fragile to another modification. It is sensitive to some degree of the changed to a watermarked image.

E. *Imperceptible*

The watermark should be imperceptible to human observe while the host image is embedded with secret data and illegal removal watermark must be impossible.

F. *Fidelity*

A watermark is said to have high fidelity if the degradation it causes is very difficult for a viewer to perceive. However, it only needs to be imperceptible at the time that the media is viewed. If we are certain that the media will be seriously degraded due to other means such as transmission before being viewed, we can rely on that degradation to help mask the watermark.

III. Application of Watermarking

The major applications include copy control, broadcastmonitoring, fingerprinting, copyright protection.

A. *Copy Control*

Copy control is possible for recording and playback devices to react to embedded signals. In this way, a recording device might inhibit recording of a signal if it detects a watermark that indicates recording is prohibited. Watermarking here complements the available technologies in which the information is secured in the header and prevents the copying of data when it is converted into analog.

B. *Broadcast Monitoring*

Many valuable products are distributed over the TV network. So, a broadcast surveillance system has to be built in order to check all broadcasted channels. We can use watermarks for broadcast monitoring by putting a unique watermark in each video prior to broadcast.

Automated monitoring stations can then receive broadcasts and look for these watermarks, identifying when and where each clip appears.

C. Fingerprinting

Electronic distribution of content allows each copy distributed to be customized for each recipient. This allows a unique watermark to be embedded in the copy of each customer like customer name or ID. This allows the distribution companies to track down the source of illegal copy in case of a leakage. Second important issue is the illegal copying of brand new movies projected onto cinema screens by means of a handhold video camera. A watermark can be embedded during the show time identifying the cinema, the presentation date and time. If the illegal copy created with a video camera is found, the watermark is extracted and the cinema to blame is identified.

D. Copyright Protection

The underlying strategy consists in embedding a watermark, identifying the copyright owner, in digital multimedia data. The rightful owner can show the watermark in case of a dispute. Watermarking algorithms are consequently required to be non-invertible in order to provide copyright protection services especially in cases of multiple ownership issues.

IV. Watermark Techniques

Watermark techniques are mainly classified into spatial or frequency domain. In spatial domain technique, still have relatively low-bit capacity and are not resistant enough to lossy image compression and other image processing. For instance, a simple noise in the image may eliminate the watermark data. On the other hand, frequency domain techniques can embed more bits for watermark and are more robust to attack. Some transforms such as Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) are used for watermarking in the frequency domain [3].

A. Discrete Cosine Transform

Discrete cosine transform is obtained from real part (it carries the cosine term) of the discrete fourier transform. It transforms the time domain or space domain of real input into its elementary frequency components. The DCT allows an image to be broken up into different frequency bands, making it much easier to embed watermarking information into middle frequency bands of an image. The middle frequencies are chosen such that they have minimized they avoid the most visual important parts of image (low frequencies) without over exposing themselves to removal through compression and noise attack (high frequencies) [3].

V. Quality Measurement

Two commonly measurements that are used to quantify the error between images are namely, Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) [7]. Their equations are as follows:

- Peak Signal to Noise Ratio(PSNR)

$$PSNR = 10 \times \log10 ((255\times255) \div MSE$$

- Mean Square Error(MSE)

D = abs (True Image – Inverse Image) ^2

MSE = sum (D (:)) /numel (True Image)

Increasing PSNR represents increasing the quality of image. In general when the PSNR is 35 dB or larger, then the two images are virtually indistinguishable by human observers. Image Quality depends upon watermark length and size of image.

VI. Experimental Results

A. Length of Watermark

In experiments, firstly 384×512, 256×256 and 537×358 standard test image are used, peppers.png,cameraman.tif, moon.tif. According to DCT technique, we can calculate PSNR, MSE when length of watermark is varying at constant alpha (power of embedded factor).
Example: Peppers.png [10] [11]

1. L=2500 ; Alpha=0.01 ; PSNR=38.19
2. L=2000 ; Alpha=0.01 ; PSNR=38.83
3. L=1000 ; Alpha=0.01 ; PSNR=38.87
4. L=100 ; Alpha=0.01 ; PSNR=42.61

Watermark Length affects the quality of image. When decrease the watermark length, then image quality increase.

A) PEPPERS.PNG IMAGE: Poor quality (PSNR Decrease)

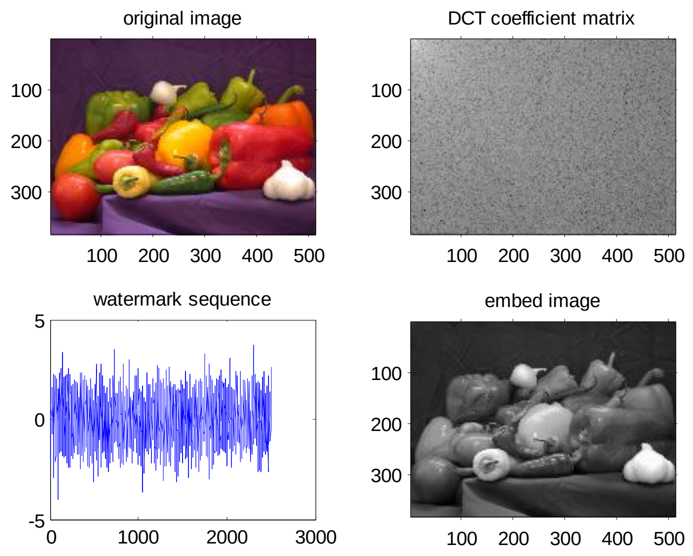

Fig: 2 Color Image (Pepper.png) at Alpha=0.01, Length=2500, PSNR=38.19

B) PEPPERS.PNG IMAGE: Good Quality (PSNR Increase)

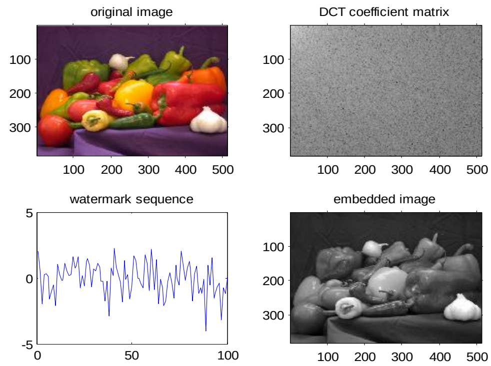

Fig:3 Color Image (Peppers.png) at Alpha=0.01, Length=100, PSNR=42.61

B. Size of Image

When increase the size of image at same value of alpha, PSNR value of large image is better than smaller image. So, PSNR value is increase means image quality increase without decreasing alpha factor (power of embedded factor).

TABLE I. SIZE OF IMAGES AT DIFFERENT VALUES OF ALPHA AND PSNR

Cameraman Image (256×256)	**Moon Image (537×358)**
1) α = 0.01, PSNR = 34.78	1) α=0.01, PSNR = 40.54
2) α = 0.1, PSNR = 14.78	2) α = 0.1, PSNR = 20.54
3) α = 0.2 , PSNR = 8.76	3) α = 0.2, PSNR = 14.52
4) α = 0.5, PSNR = 0.80	4) α = 0.5, PSNR = 6.5
5) α = 1 , PSNR = –5.2	5) α = 1, PSNR = 0.54

VII. Conclusion

In Watermarking scheme, image is considered as a communication channel to transmit messages. Experimental results shown that factors affected to quality of image are watermark length and size of image. In this paper, we discuss the watermark length, size of image. When watermark length decrease and size of image increase then quality of image is improve.

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