Quality Enhancement of Watermarking System Using Discrete Cosine Transform

Priyanka Sharma

Abstract— The growth of networking boosted the use of information technology to a greater coverage and this leads to the comprehensive overview of current digital watermarking techniques. The purpose of this review paper is to present a new-fragile and non-blind watermarking insertion technique is defined using the DCT domain and a mathematical model is proposed using simulink.

Index Terms—DCT(Discrete Cosine Transform),DWT(Discrete Wavelet Transform), FDCT, Fragile, IDCT, JPEG, Non-Blind, Simulink

1 INTRODUCTION

Image authentication using watermarking is quite a different from steganography and cryptography. In cryptographic authentication, the intention is to protect the communication channel and make sure that the message received is authentic and in Steganography offers an interesting alternative to image integrity and authenticity problem. Because the image data is typically very superfluous, it is possible to slightly modify the image so that we can later check with the right key if the image has been modified and identify the personalized portions. So Steganography and Watermarking are more complementary to each other.

Protection of digital information has attracted a lot of attention during the last few years. The most common method to protect the digital information is watermarking schemes like fragile tamper detection and authentication of visual as well as digital information. In formation of digital libraries the care should be taken to prevent it from the unauthorised, malicious and inadvertent act made to digital libraries. Digital watermarking term is derived from the word "wassermarke" means the marks resembles the possessions of water on paper and defined as a process of adding/embedding an image as a watermark to another image. Digital watermarking is still a extremely young research area with its first academic conference held in 1996. Numerous algorithms have been projected and implemented since then. The multiple watermark method is used to solve the problem of authentication. Recently some multiple watermark algorithms have been proposed like CDMA, DCT, and DWT. The requisite of watermarking technique needs to posses the following distinctiveness such as:

a) Imperceptibility for hidden information.

b) Watermark must also be highly healthy.

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Unplanned watermarks involve transforms that are commonly applied to images during normal uses such as cropping, resizing, and enhancement etc.A particularly interesting form of unplanned attack is that of **image compression.** In this paper visible watermarking is done with the help of the Discrete Cosine Transform (DCT) domain. DCT is a transform from the spatial domain (the pixel values) to the frequency domain. This new domain consists of cosines with increasing frequency. Generally before this transform is performed, the image is segmented into blocks of for example 8 x 8 pixels. The transform is then performed on the individual blocks. The cosine coefficients are computed for each block. This is done, because when the transform would be performed on the whole image, the memory needed would be very large. This method is therefore a form of block transform coding. The image coding standard JPEG segments the image in blocks of 8 x 8 pixels and then performs a DCT on these blocks.

2 JPEG COMPRESSION AND DECOMPRESSION

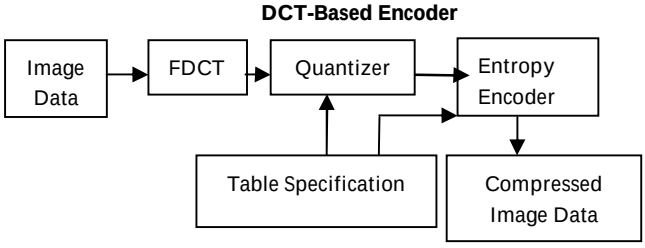

Fig1 DCT based Encoder

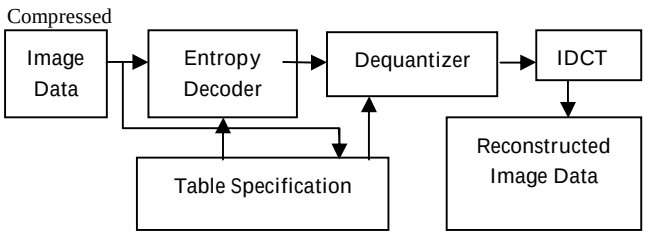

Fig2 DCT based Decoder

JPEG compression steps are discussed below:-

1) The image is first divided into blocks of size 8*8.
2) Discrete Cosine Transform (DCT) is the basis for many image and video compression algorithms, specially the baseline JPEG and MPEG standards for compression of still and video images respectively. The equation X The one-dimensional forward discrete Cosine transform (1D FDCT) of N samples is formulated by:-

$$F(u) = \sqrt{\frac{2}{N}} C(u) \sum_{x=0}^{N-1} f(x) \cos\left[\frac{\pi(2x+1)u}{2N}\right] \quad (1)$$

for u = O , I , . . . , N - 1, where

C(u)=1 / √2 for u=0;
=1 for otherwise

JPEG compression artifacts blend well into photographs with detailed non-uniform textures, allowing higher compression ratios. The very high compression ratio severely affects the quality of the image, although the overall colors and image form are still recognizable. The function f (z) represents the value of the x[th]sample of the input signal. F(u) represents a DCT coefficient for u=0,1,N-1The one-dimensional inverse Discrete Cosine transform (1D IDCT) is formulated in a similar fashion as follows:

$$f(x) = \sqrt{\frac{2}{N}} \sum_{u=0}^{N-1} C(u) F(u) . \cos\left[\frac{\pi(2x+1)u}{2N}\right] \quad (2)$$

Where x-0,1,…….N-1.

3) The DCT coefficients than quantized using a quantization matrix.
4) The quantized coefficients are then arranged in zig zag order.
5) Then compressed using the Huffman encoder.

For each block B, the quantized DCT coefficients obtained from the JPEG file are multiplied by the quantization coefficients stored in the quantization matrix Then the Inverse Discrete cosine transform (IDCT) is computed.

3 WATERMARK IMPLEMENTATION USING MATLAB

Matlab is a tool that was originally designed to simplify the implementation of jpeg image compression. In this paper we make use of matlab Simulink which is the model based approach. We have to simulate our model and analyzes dynamic systems. It enables you to pose a question about a system, model the system, and see what happens. With Simulink, you can easily build models from scratch, or modify existing models to meet your needs. Simulink supports linear and nonlinear systems, modeled in continuous time, sampled time, or a hybrid of the two. Systems can also be multirate — having different parts that are sampled or updated at different rates. The Matlab Simulink model of watermarking is constructed using ordinary blocks available in video and image processing tool box of Matlab Simulink. The implementation of watermarking system for simulation in Simulink of Matlab is depicted in figure 1. In this model, there is video viewer which views the watermark image.

Model-Based Design is a process that enables faster, more cost-effective development of dynamic systems, including control systems, signal processing, and communications systems. In Model-Based Design, a system model is at the center of the development process, from requirements development, through design, implementation, and testing. The model is an executable specification that is continually refined throughout the development process**.**

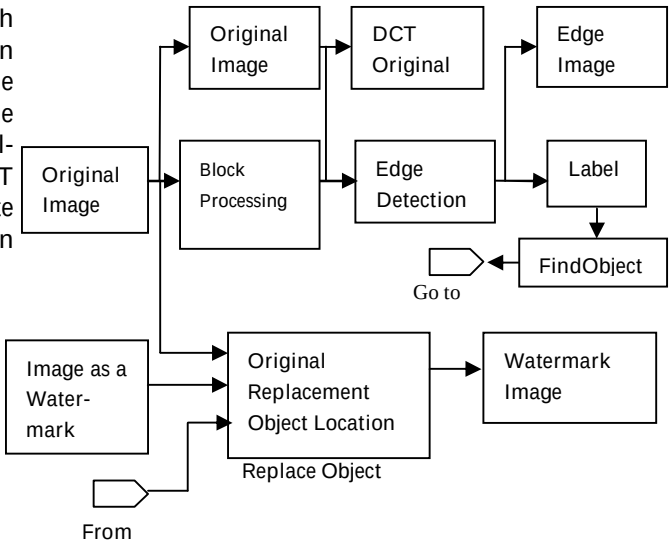

Fig:1 Digital image watermarking DCT(Discrete Cosine Transform)

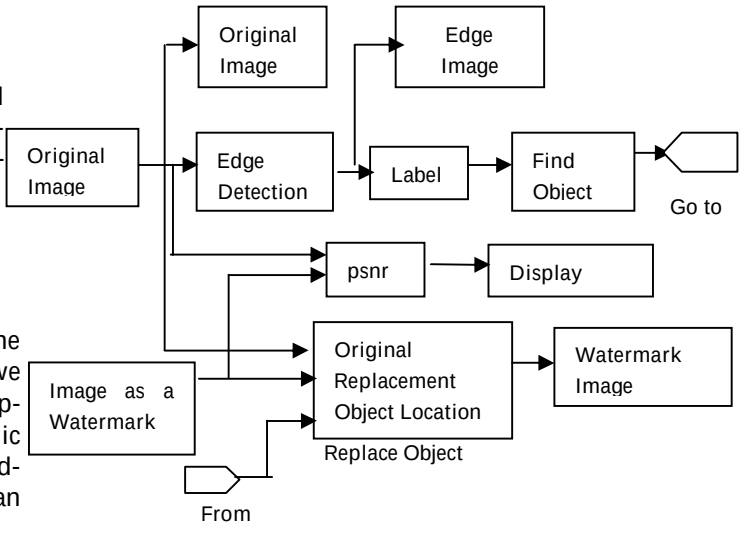

Fig:2 Digital image compression without DCT(Discrete Cosine Transform)

4 Result And Conclusion

In this work, analysis and modeling of watermarking using MATLAB Simulink is carried out. We have to analysis of watermarking model with the help of DCT and we also analysis the model without DCT and compare the watermark output of the two by calculating the PSNR value which is shown in Table 1 and we have to conclude that watermark image with DCT is easily stored and take less memory space because compression ratio is high as compare to without DCT watermarking, to find the DCT of image it is necessary to find out the gain matrix of an image and which is find out with help of edge detection, edge means higher amplitude pixel and higher amplitude gives higher gain coefficient. Scanning will be start from higher gain coefficient to lower gain coefficient so that we can easily find out the DCT of an image.

Fig.1 original image

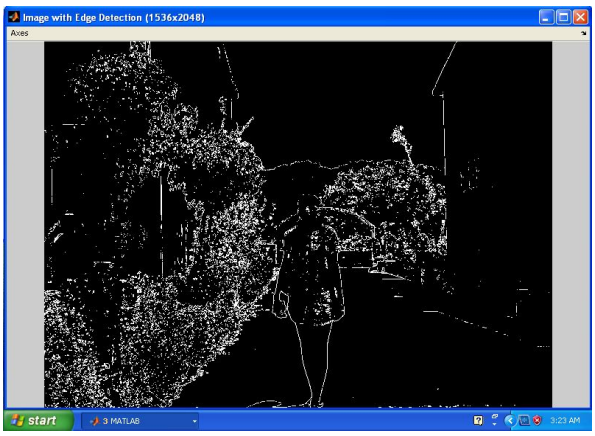

Fig.2 Edge Detection of original image

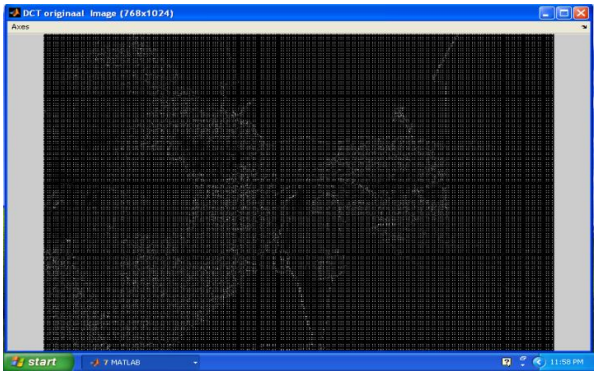

Fig.3 DCT Of original image

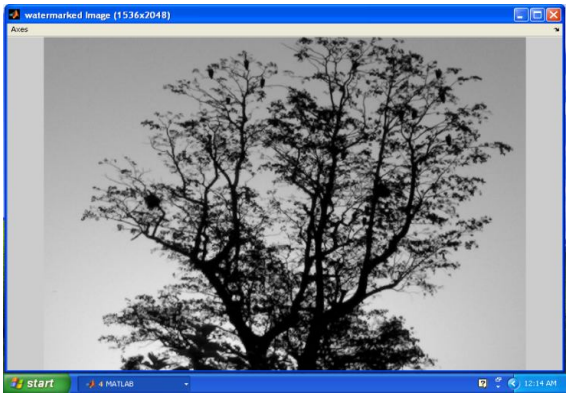

Fig.4 Image Used as a Watermark

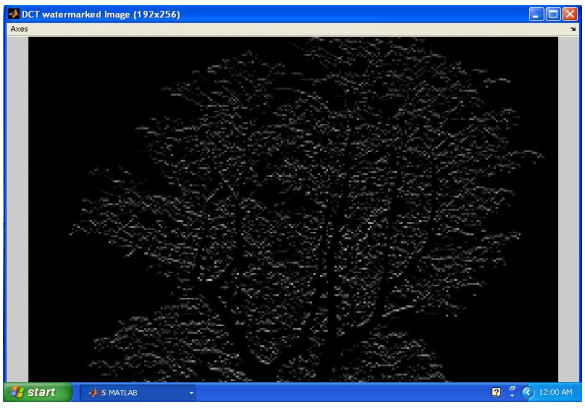

Fig.5 Edge Detection Of Watermark Image

Fig.6 Watermarking of Original Image

TABLE 1

DIFFERENT PSNR VALUE FOR DIFFERENT TECHNIQUES

S.no	Technique	Calculated Value of PSNR
1.	Without Using DCT	7.848
2.	With Using DCT	1.835

5 IMPROVEMENT AND FUTURE WORK

In our experiments, we have noticed that while using DCT some disadvantages is also associated with DCT like the segmentation of the image in blocks. Especially at a high compression ratio, it is possible that the blocks do not connect well to each other so this will overcome by making use of DWT(Discrete Wavelet Transform) because the image is not segmented into blocks deformations. Another improvement of the Wavelet Transform is that the wavelet functions which generally are used, are non-zero on a short interval, in contrary to the cosine functions of the Discrete Cosine Transform.

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