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# IMPLEMENTATION OF COMBINE ALGORITHM FOR COPYRIGHT PROTECTION OF MEDICAL IMAGES

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## ABSTRACT

*In modern era, growth of the communication media has led to the critical issue of copyright protection of digital contents. One of the most promising means to safe guard the copyright of digital images is watermarking. In this secured copyright protection encoding procedure we have used joint Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) algorithm. According to the characters of human vision, in this algorithm, the information of digital copyright protection which has been discrete Cosine transformed, is put into the high frequency band of the image which has been wavelet transformed. Digital copyright protection hides the secret or private information in digital images in order to facilitate copyright protection. The proposed combined algorithm invisibly embeds a protection of image into the host image and also increases robustness & concealing properties of an image. The decoding process necessitates not only the copyright image but also the original image and its characteristics. We conclude that copyright protection has found a niche role in healthcare systems, as an instrument for protection of medical information [7] [8], for secure sharing and handling of medical images. The concern of medical experts on the preservation of documents diagnostic integrity remains paramount.*

## KEYWORDS

Digital image watermarking, Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), High frequency band, Copyright Protection.

## INTRODUCTION

Developments in digital content distribution have brought about immense prospects for business content suppliers and with that also claim to be a major threat because of the simplicity of illegal copying and distribution of the digital data. With the redundancy of the medium as image and voice, digital watermarking technology is to use the digital embedding method to hide the watermarking information into the digital products of image. The watermarking signal being embedded into carrier is as a feeble signal to add into a strong background [1]. As long as the intensity of watermarking is lower than the contrast restriction of human visible system (HVS) or the apperceive restriction of human audio system (HAS), the watermarking signal won't be felt by HVS or HAS. This paper

introduces an algorithm of digital watermarking based on Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) which increases robustness and concealing of a watermarked image. The watermarking image will be discrete Cosine transformed at first. Because these DCT modulus contain the low frequency information of watermarking image, as long as these information do not lose or lose little then the watermarking image can be renewed well. This enhances the robustness and concealment. The host image I is decomposed through DWT transform, then choose the appreciate wavelet modulus in the high frequency level. The watermarking information is embedding into the corresponding position. Make the whole image IDWT transformed and get the watermarked image I'. The watermarking distilling is quite the contrary.

## DISCRETE COSINE TRANSFORM

With the character of discrete Fourier transform (DFT), discrete cosine transform (DCT) turn over the image edge to make the image transformed into the form of even function. It's one of the most common linear transformations in digital signal process technology[9]. Two dimensional discrete cosine transform (2D-DCT) is defined as

$$F(j,k) = \alpha(j)\alpha(k)\sum_{m=1}^{M}\sum_{n=1}^{N} f(m,n)\cos\frac{(2m+1)j\Pi}{2N}\cos\frac{(2n+1)j\Pi}{2N} \quad (1)$$

The corresponding inverse transformation (Whether 2D-IDCT) is defined as

$$f(j,k) = \sum_{m=1}^{M}\sum_{n=1}^{N}\alpha(j)\alpha(k)F(j,k)\cos\frac{(2m+1)j\Pi}{2N}\cos\frac{(2n+1)j\Pi}{2N} \quad (2)$$

The 2D-DCT can not only concentrate the main information of original image into the smallest low- frequency coefficient, but also it can cause the image blocking effect being the smallest, which can realize the good compromise between the information centralizing and the computing complication. So it obtains the wide spreading application in the compression coding.

## DISCRETE WAVELET TRANSFORM

Wavelet transform is a time domain localized analysis method with the window's size fixed and forms convertible. There is quite good time differentiated rate in high frequency part of signals DWT transformed. Also there is quite good frequency differentiated rate in its low frequency part. It can distill the information from signal.

The basic idea of discrete wavelet transform (DWT) in image process is to multi-differentiated decompose the image into sub-image of different spatial domain and independent frequency district. Then transform the coefficient of sub-image. After the original image has been DWT transformed, it is decomposed into 4 frequency districts which is one low-frequency district(LL) and three high-frequency districts(LH,HL,HH). If the information of low-frequency district is DWT transformed, the sub-level frequency district information will be obtained. A two-dimensional image after three-times DWT decomposed can be shown as Fig.1. Where, L represents low-pass filter, H represents high-pass filter. An original image can be decomposed of frequency districts of HL1, LH1, and HH1. The low-frequency district information also can be decomposed into sub-level frequency district information of LL2, HL2, LH2 and HH2. By doing this the original image can be decomposed for *n* level wavelet transformation [3].

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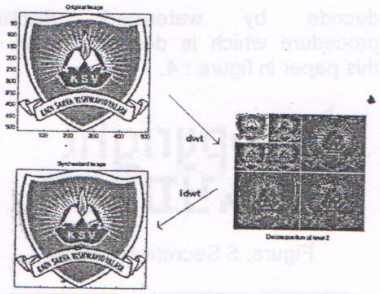


Figure:1 2nd level Discrete Wavelet Transform

The information of low frequency district is an image close to the original image. Most signal information of original image is in this frequency district. The frequency districts of LH, HL and HH respectively represents the level detail, the upright detail and the diagonal detail of the original image.

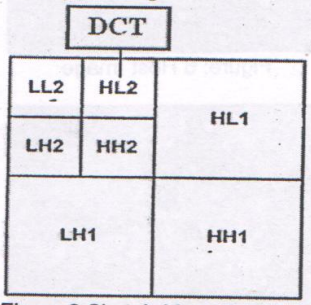


Figure:2 Sketch Map of combined algorithm [4]

According to the character of HVS, human eyes are sensitive to the change of smooth district of image, but not sensitive to the tiny change of edge, profile and streak. Therefore, it's hard to conscious that putting the watermarking signal into the big amplitude coefficient of high-frequency band of the image DWT transformed. Then it can carry more watermarking signal and has good concealing effect.

## COPYRIGHT PROTECTION ALGORITHM

Following figure: 3 & figure: 4 shows the encoding and decoding algorithms for implementation and execution steps.

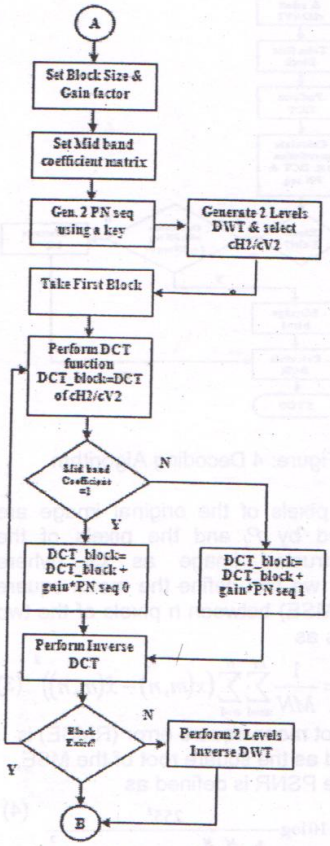


Figure: 3 Encoding Algorithm

## ANALYSIS & RESULTS

There are some analysis parameters from which we can conclude robustness and concealing of watermarked image[2]. The concealing of the watermark is quantitatively analyzed by using Peak Signal to Noise Ratio (PSNR).

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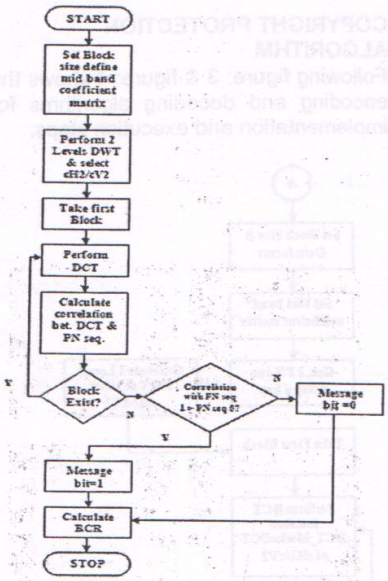


Figure: 4 Decoding Algorithm

If the pixels of the original image are denoted by $P_i$ and the pixels of the reconstructed image as $Q_i$ (where $1 \le i \le n$), we first define the mean square error (MSE) between n pixels of the two images as

$$MSE = \frac{1}{MN}\sum_{m=1}^{M}\sum_{n=1}^{N}\left(x(m,n)-\hat{x}(m,n)\right)^2 \quad (3)$$

The root mean square error (RMSE) is defined as the square root of the MSE, and the PSNR is defined as

$$PSNR = 10\log\frac{255^2}{\frac{1}{MN}\sum_{m=1}^{M}\sum_{n=1}^{N}\left(x(m,n)-\hat{x}(m,n)\right)^2} \quad (4)$$

Considering the results with these parameters with image shown in figure: 9.

After encoding message image into this host image final watermarked image is displayed below as figure:7.

After receiving watermarked image at receiver side in message image is decode by watermark distilling procedure which is describe above in this paper in figure : 4.


Figure: 5 Secrete Message

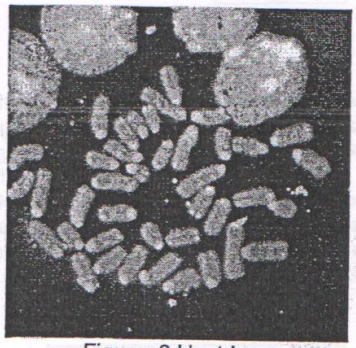

Figure: 6 Host Image

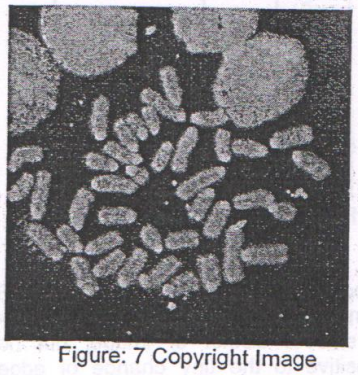

Figure: 7 Copyright Image

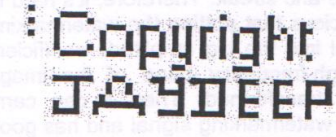


Figure: 8 Decoded message image

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We can observe from figure:7 visually not detectable difference between original host image and watermarked image. This suggest that after encoding message image on host or cover image, resultant image cannot be detected b HVS systems which ultimately increase security aspects of image on any communication media[5]. On the other hand also we cannot detect any visual difference between message image and decoded message image after applying algorithm which also implies that important properties like robustness & concealing also increase of an image. We have taken different images for comparative analysis and extracted various parameters for quality of images.

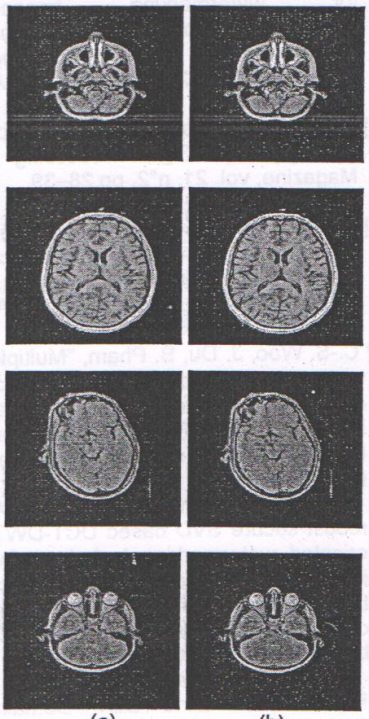
| Name of Images | PSNR (dB) | MSE(dB) |
|---|---|---|
| Chromos | 37.8815 | 10.5908 |
| Head1 | 37.2800 | 12.1640 |
| Head2 | 37.5005 | 11.5620 |
| Head3 | 39.8679 | 6.7033 |
| Head4 | 37.6384 | 11.2005 |

Table: 1 Parameter values of watermarked image

Above table illustrate PSNR (Peak Signal to Noise Ratio) and MSE (Mean Square Error) of watermarked image. Simulation results from comparative analysis suggest that algorithm developed by combining both DCT & DWT increases robustness & concealing properties image and also increases security aspects with respect to HVS system.

## CONCLUSION

This paper introduces a combine algorithm based on both DCT (Discrete Cosine Transform) and DWT (Discrete Wavelet Transform) which increase properties like robustness and concealing. In used algorithm first host image is DWT transform on higher frequency co-efficient of decomposed image. Then particular image block is transformed by DCT which encodes message image into host image. DCT Simulation results also suggest that this watermark technique is not detectable by HVS system which also increases its security aspects.



(a) (b)

Figure: 9 (a) Original Images and (b) Watermarked images tested with our algorithm

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