DC and DWT approach for Copyright Protection

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Abstract: With great demand of internet, it is very difficult to secure data over environment of internet. Watermarking is a technology which deals with security for digital data. Currently, digital image watermarking is widely implemented as a tool for copyright protection. So, research on image watermarking should continue to grow for improved copyright security. It involves the process of superimposing an image (original) on another image (watermark) and results a new image (watermarked) and from the generated image, watermark is also extracted. Image transform techniques are Discrete Fourier Transform (DFT), Discrete Wavelet Transform (DWT), Discrete Cosine Transform (DCT).

Index Terms **-** Image watermarking, Discrete Cosine Transform (DCT), Discrete wavelet Transform (DWT), Peak Signal to Noise Ratio (PSNR).

I. INTRODUCTION

Intern has become a vast source for transferring digital information. Though it is a fastest and easiest way to communicate, the data can be stolen or any theft can be done on the digital information. It is very important to maintain the privacy of the data. The best solution to achieve is by using digital watermarking techniques. In watermarking the information that needs to be secured are stored in the form of pieces these are watermarked with the multimedia data such as videos, audio, images sometimes it can be text documents also. So, practically this information is protected under the name of copyright, which tells that multimedia data belongs to the particular owner and these types of data cannot be stolen

Watermarking based on their performance are classified into different types. Invisible watermarking it is one of the types of watermarking which are applicable only for images one of the examples of these type of watermarking is logos, this type of watermarking cannot be removed even by changing the design of the image. There are drawbacks in using this type of technique that is it degrade the quality of the image which can be detected by the visual means

Second type is invisible watermarking: as the name itself says this type of watermark cannot be seen in bare eyes. In order to detect them we require authorized agency. These type watermarking are also for author authentication and also to detect unauthorized access another type is public watermarking this type of watermarking can be utilized, accessed and modified by any one there is no restriction in accessing of these watermarked contents

Fragile watermarking technique are one of those type of watermarking technique that are destroyed when manipulating of data is found. So, the main use of these type of watermarking is that destroyed when unauthorized person tries to copy it. The absence of watermark indicates that the image or the data that is transferred is copied by some third person by the we can find out the privacy of the image or data. Private watermarking is the reverse of public watermarking one can only access this watermarking only if that person has the secret key to accessed the embedded secret inside the image.

Watermarking technique has a lot of application which are highly useful these days. Some are copyright protection, unauthorized copying prevention, fingerprint enhancement and even a lot more application in medical field so due to these many applications use of watermarking has increased these days.

In watermarking technique there are many ways some are special domain technique and some are frequency domain technique in frequency domain technique there are basically three type they are Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT)

Discrete Cosine Transform the data are represented in the frequency space. DCT techniques has no restriction on images which makes it robust in use, but it is high cost efficient that all other techniques. Discrete Wavelet Transform which is widely used in applications containing signal processing some are video compression, audio compression and also for removal.

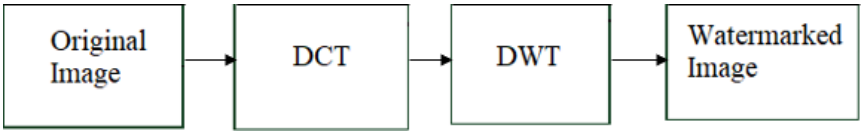


Figure 1: Watermarking Process

II. OVERVIEW OF THE USED TECHNIQUES

A. Discrete Cosine Transform (DCT):

Table I: DCT Overview

Method	Disadvantage / Problem
Watermarking DCT [6]	Image hiding is less secured
DCT [7]	It is irresistible for all types of attacks which make it less robust
DCT, Hash functions [5]	This technique is sensitive to modifications
Discrete Cosine Transform (DCT), Pyramid Transform (PT) [4]	This technique is not applicable for low intensity images
Singular Value Decomposition (SVD); Discrete Cosine Transformation (DCT) [3]	This technique does not resist to cropping effect
Multilevel DCT [2]	It is applicable for only particular
DCT transform, Chaos Permutation, Arnold cat map [1]	Applicable for some attacks It is not robust

Manel Dridi, Abdellatif Mtibaa, BelgacemBouallegue et al in Crypto-compression of medical image Based on DCT and chaotic system [1], in this proposed system image permutation and scumbag operations are described. Which says that cipher image is produced by using scrambling values from the REL code along with the Arnold map function. By using this technique encryption time is reduced and the result is estimated. By estimating PSNR and many other analyses it is concluded that the proposed method can be performed against some attack like statistical and differential attack. So, in order to increase the performance of the method proposed it has to be made flexible for all types of attack.

Kankan Zheng, Rong Xie, Liang Zhang et al in Multilevel DCT-Based Zerotree Image Coding [2] in the method proposed in this paper performance of multi-level DCT considering zerotree image coding algorithm is estimated. By using the techniques like Lost-cost hardware implementation of DCT and multilevel DCT based zerotree image coding we can estimate is codding performance by using coding terms like PSNR. By use of this method codding time is reduced. The only disadvantage of this method is that it is applicable only to particular set of images. Though this method reduces the codding time, the main affect to this technique is applicable only to particular range of images. In order to make this technique efficient to use it has to be applicable for all types of Images.

Hu Guan1, Shuwu Zhang Zhi Zeng, Jie Liu, and Peiyu Guo et al in novel algorithm for multi-bit watermark embedding and blind extraction [3] the method that is being used is SVD_DCT based watermarking for embedding the watermarked image to the macroblocks containing largest singular value it is done by transforming the singular valued matrixes into its DCT domains using scumbling schemes and image enlargement technique into the algorithm. The results are estimated, which states that this method is good resisting to almost all types of attacks. But this technique does not resist to cropping effects.

Alavi Kunhu and Hussain Al-Ahmad et al in the Multi Watermarking Algorithm Based on DCT and Hash Functions for Color Satellite Images [5] the different watermarking scheme like FEFT, FFT and DCT based pyramid transformations are compared. As a result, DCT technique is more robust when considering FRFT and FFT techniques. To consider this type of technique the only problem is that low intensity images cannot make use of this proposed system, so by making it consider even the low intensity image this proposed system can be made more robust.

Jagdish Prasad Maheshwari, Mahendra Kumar, Garima Mathur, R P Yadav, Rajesh Kumar Kakerda et al in Robust Digital Image Watermarking using DCT based Pyramid Transform via image compression2015[4] the paper proposes the method of distortion of satellite images making use of new watermarking algorithm. The watermarking is invisible and its, working is tested by using PSNR value. As a result, it is estimated that by considering RGB and CyCbCr RGB images are better than CyCbCr the main advantage is that the watermarked image is visible even after affected by the all type of attack. The main disadvantage of this method is it is highly sensitive to modifications done so even image enhancement is highly difficult in the proposed method.

O. Habbouli, and D. B. Megherbi et al in A Secure, Self- recovery, and High Capacity Blind Digital Image Information Hiding and Authentication Scheme Using DCT Moments [6] the method proposed in this paper is that DCT image is separated into two different images where they are same size as that of the arbitrary carrier image and they are hidden with higher intensities within the carrier image the proposed system is tested against all types of cropping attacks and their performance is measured The only disadvantage of this proposed method is that image hiding is less secured.

Hansa Mehra Silviya Chouhan Rita Choudhary et al in Forgery Resistant Image Watermarking Technique using Discrete Cosine Transform (DCT) [7] in the proposed method the image is divided into three frequency bands high frequency, mid frequency and lower frequency. The mid frequency is used for the watermarking it is segmented and its coefficient are averaged for the better protection of watermarking. The result of DCT is measured by considering two parameter they are PSNR and cross correlation of

the images. Based on the TABLEII it is been estimated that the Lena image has highest PSNR value than that of the baboon image it says that PSNR value is better for additive noise attack. The main disadvantage is that this method is not robust.

Table II: PSNR values for different images

Sl. No.	Images	PSNR (dB)
1.	Lena	38.53
2.	Baboon	36.34
3.	Scene	34.37
4.	Kid	40.35
5.	Peppers	38.71
6.	Fourviere	40.67

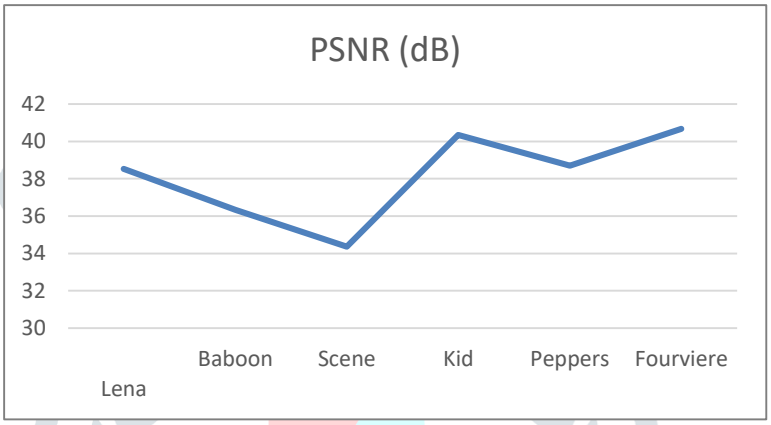


Figure 2: Graph For Table II

B. Discrete Wavelet Transform (DWT):

Table III.: DWT Overview

Method Used	Disadvantage / Problem
Visual Cryptography (VC), low frequency domain of DWT [8]	Embedding capacity is small, introduces distortion in input image
DWT and inverse DWT (IDWT) [9]	Authentication, Confidentiality, and the combination of both
Discrete Wavelet Transform (DWT) [10]	MRI images with no functional parameter, blurring of images and distortion of images
Discrete wavelet transformation (DWT), singular value decomposition (SVD) [11]	Visual information and entropy values not so good for chest and coronal tumor image
Third level of DWT, FWHT and SVD [12]	Two watermarks are placed in one medical image, susceptible to geometrical medical images
DWT, Discrete wavelet transform - Stationary wavelet transforms (DWT- SWT): Dual tree complex wavelet transform (DT-CWT) [13]	The DT-CWT has given superior performance in PSNR, RMSE, and CC compared to DWT and DWT- SWT
Discrete Wavelet Transform (DWT) and Discrete Fourier Transform (DFT) [14]	Method based on DWT DFT- SVD requires more of watermark information compared to phase watermark
Discrete Wavelet Transform (DWT) compatible with the norm JPEG2000[15]	Inefficient, insecure Only 6.25% of the DWT matrix coefficients gets encrypted.

Pranesh Kulkarni, Girish Kulkarni et al explains Visual Cryptography in Grayscale Image Watermarking using DWT domain [8] by the experiment using 3 greyscale images, i.e., Lena, Barbara and cameraman. These images are of size 256x256. A binary image of size 128x128 has been used as the key for watermarking. Watermarking is done in the LL (low-low) sub-band of the cover images. The result of this scheme is evaluated using PSNR and NC values. DWT is used to perform the feature extraction process in this proposed scheme. Watermark image had been split into two shares. One of which is embedded into the cover image and the other is rested with the Trusted Authority (TA). During extraction, the attacked image is compared with the watermarked image using PSNR and NC. This can be done without the need of extracting the watermark. Hence it satisfies the blindness property. The major drawback from this work is that the embedding capacity is very small and the procedure induces distortion in the image.

Shaekh Hasan Shoron, Monamy Islam, Biprojit Mondal, Jia Uddin et al have explained, in their work, a Digital Watermarking Approach with the use of SMQT, OTSU, DWT and IDWT methods [9] where a new watermarking technique is proposed using pre-processing and segmentation techniques. Pre-processing works are done with the help of upgraded SQMT and segmentation process by OTSU thresholding. The watermark is embedded and extracted by the use of DWT and IDWT techniques respectively. The performance is evaluated using two features, unnoticed changes and strength of the model. The unnoticible changes are found using Peak Signal to Noise Ratio (PSNR) and Mean Squared Error (MSE). The strength of the model is found using Correlation Coefficient (CC). Low MSE and high PSNR gives less distortion of the image. The closer the CC to 1 implies greater robustness. The drawback of this paper is the authenticity of the model, secrecy of the model and problems regarding combining of both authenticity and secrecy of the processing model.

Mohammed Basil Abdulkareem et al has described, in his work, Design and Development of Multimodal Medical Image Fusion using Discrete Wavelet Transform [10] for obtaining single fused image with the use of various multi- modality medical images. This phenomenon's quality is improvised by basic and most desirable spectral information being correlated to the raw single scanned image. The pre- processing techniques used here are Gaussian filters for Spatial filtering approaches. For combining the images, using wavelet transform in multiband breakdown for image fusion is found to be the best approach. The use of spatial filter enhances the distortion of image changing it into better quality image. Consequently, the image combining approach takes anatomical and practical parameters without the loss of information. The major drawback of this technique is that it leads to color distortion of medical images.

Sandeepa K S, Basavaraj N Jagadale, J S Bhat, Naveen Kumar R, Mukund N Naagund, Panchaxri et al in Image Contrast Enhancement using DWT-SVD based Masking Technique [11] talk about contrast enhancement using DWT techniques. A mask is found amid recreate approximate coefficients and Inverse SVD (ISVD) to obtain find residue. The DWT and SVD methods now decompose the image. Finally, contrast enhancement is done by combining the mask with the resultant image. This is done by Intensity Exposure Histogram Equalization (IEHE). This method uses DWT, SVD, IEHE and masking methods to effectively produce maximum contrast enhancement. This method has an important role in medical image enhancement. The result of this method is understood to be the best in comparison to other methods by evaluating the results regarding real time analysis and experimented results. The major drawback of the proposed method is that the real time resulting images are not so good for chest and coronary images.

Imane Assini, Abdelmajid Badri, Khadija Safi, Aicha Sahel, Abdennaceur Baghdad et al in their work on Hybrid many watermarking techniques for safe guarding medical image using DWT-FWHT-SVD [12] talk about hybridizing multiple watermarking techniques for safeguarding a medical image. On the cover and watermark images, DWT is applied such that we achieve 3rd level high frequency sub-bands. Then Fast Walsh-Hadamard Transform (FWHT) is applied on the images. SVD is applied on the FWHT coefficients. While doing these procedures there are two watermark images taken according to the paper, the Barbara image and the fingerprint. On both these watermarking is done and then imposed into the cover image. For extraction of the watermark image, inverse SVD (ISVD), inverse FWH (IFWH) and inverse DWT (IDWT) is done in the same order. The major drawback of this process is that due to the insertion of two watermarks into the same image, the method becomes susceptible to geometric medical images.

M. HemaLatha, S. Varadarajan, Y. Murali Mohan Babu et al in their study of comparison of DWT-SWT and DT-CWT [13] they are comparing the low-resolution satellite images in their enhancement capabilities according to each of these methods. In DWT-SWT method, Bicubic application is adapted for Low-Resolution input portrait and DWT is applied to this application portrait. DWT divides given image into 4 Sub-Bands i.e., SB1, SB 2, SB 3, and SB4. SWT is directly applied on the same LR image. SWT divides input image into 4 SB's i.e., SB1, SB 2, SB 3, and SB 4. In DT-CWT method, Resolution betterment of satellite images are done by the combining DT-CWT and NLM filters. A satellite input image is divided by method3 to obtain High Frequency SB's. Lanczo's interpolator is used to introduce the LR satellite input image and High Frequency SB's. The High Frequency SB's are later sent through NLM filter as input, to avoid the disturbances produced by this method. The LR satellite input image and the output from NLM filter are combined with the help IDT-CWT. From the comparisons of both these techniques, the author concludes that the DT-CWT gives much better performance of PSNR, RMSE, and CC as compared to DWT and DWT-SWT.

Anqi Chen, Xingjun Wang et al in their work on an Image Watermarking Scheme Based on DWT and DFT [14] explain the basic image watermarking schemes with the use of DWT and DFT methods given as follows. The authors have combined DWT and DFT method to accomplish a watermarking technique that is easier and more direct for usage. At first, the host image is subjected to second derivative DWT (2D-DWT). The LH (low high) sub-band of the output of this method is subjected to second derivative DFT (2D-DFT). The output of this method can be of either magnitude spectrum or a phase spectrum. A watermark image is imposed onto the output of the 2D-DFT method i.e., onto the input image's the magnitude or phase spectrum. For extraction process, both of these images, i.e., the watermark image and also the original image undergo 2D-DWT operation. After the output is found, 2D-DFT is carried out on the LH sub-band of the image. The final result is concluded by comparing and removing the

original image out of the two outputs. The disadvantage of this technique is that, the DWT DFT method used on magnitude spectrum needs more image data or image information when compared to the same method when used with phase spectrum.

Med Karim Abdmouleh, Ali Khalfallah and Med Salim Bouhlel et al in their work on a Novel Selective Encryption DWT-based Algorithm for Medical Images [15] have used a novel selective encryption DWT, where encryption is performed on images of type JPEG2000 medical images. The paper explains in detail, what a low pass filter is, what a high pass filter is, and what are LL, LH, HL and HH sub-bands. A technique based on selective encryption is followed. The encryption is done using DWT only on the LL sub-band at each level of iteration of the process. On the original image DWT process is applied up to 2 or 3 levels. Then the LL output of the final level is sent to the Quantizer. From the quantizer, the quantized output is further sent for selective encryption using various methods. After encryption the entropy of the output is encoded in the entropy encoder. The final output is and encrypted and compressed image. For decrypting this image, the encrypted compressed image is sent to the entropy decoder where the image is decoded. The output of this process is sent to the selective decrypter where the image is selectively decrypted. The decrypted image is sent to the dequantizer where the image takes back its original size. Finally, inverse DWT (IDWT) is performed on the image to get back the final restored image. The disadvantage of this method is that, only 6.25% of DWT matrix values would be hidden, and methods are either weak or uncertain or very time consuming.

Cover image	Watermark image	Watermarked image	PSNR (dB)	NC
			35.53	0.9994
			36.81	0.9996
			38.57	0.9999

Figure 3: Watermark Embedding Using DWT

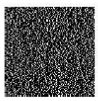
Attacked image	Share S2	Extracted watermark	PSNR (dB)	NC
			10.78	0.6817
			10.50	0.6677
			10.50	0.6716

Figure 4: Watermark Extraction Using DWT

CONCLUSION

Referring onto the mentioned papers it can be conclude that the description of the performance is given by combining DCT and DWT techniques. For the sake of comparison, it has also been considered that the evaluation of only a single method for both embedding and extracting the watermark on an input image of copyright type is not sufficient to cover all the attacks occurring on the images. The different transform techniques such as discrete wavelet transform (DWT) and the discrete cosine transform (DCT) are applied in many digital image watermarking methods. In this paper, a study has been made for comparative study of both DWT-DCT digital image watermarking algorithms. Watermarking can be achieved by applying the watermark in the 1st and 2nd levels of DWT sub-bands of the given host input image, next application of the DCT on the selected DWT sub-bands can be done. It can be concluded that, in DWT-based watermarking techniques, combination of certain apt transforms of DCT might give a better impact on the resulting conduct of the watermarking system there by the system delays in the time for the hacker to decode the cipher key.

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