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Digital Watermarking Using DCT & DWT Technique

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ABSTRACT : The digital data are transmitted using the internet so the digital data may be secure, copyright protected and authenticated .Digital watermarking is one of such technology that has been developed to protect digital data or content like text ,audio ,video from any editing or any manipulations .In this paper we analyze performance analysis of different techniques such as DCT,DWT .To check effectiveness ,robustness, imperceptibility of both the techniques we use parameters such as PSNR,NCC,MSE etc. .The experimental result shows that proposed method is more robust against different kinds of attacks and the watermarked image has good transparency ,further future scope is also mentioned in paper .

KEYWORDS*: DCT, DWT, PSNR, MSE &NC*

I. INTRODUCTION

In this modern era of globalization the vast growing internet and various applications used through different modern technologies and easy availability of information led to need to secure the data as without security one can easily manipulate the original one. Digital watermarking is a process in which one can easily secure the data .A digital watermark is a visible or invisible code that is embedded into the data. it is a method used for authentication ,proofing of data [1].For this many techniques are still developing based upon the different criteria ,one of most important criteria includes the data hiding capacity, imperceptibility and robustness, depend upon the specification of image. Two phases are used for embedding and its detection of watermark,

Watermarking quality is measured by its quality, robustness, transparency and capacity. Transparency demands that the original image should not be distorted [2] [3]. Robustness is related to attacks means the removal of watermark is difficult or hard by any of methods like by scaling, compression, rotation, resizing then that watermark is said to be robust[5] [6] .The capacity of watermark is determine the amount of information that can be hide inside it.

Watermarking is classified into two groups:

(1) Spatial domain methods
(2) Transform domain methods

In spatial domain methods the watermark is embedded directly inside the pixel locations, this type of domain has various advantages like the computational cost is very less, have high capacity so it is mainly use for various authentic purposes but it has a disadvantage that it is not very much robust. In transform domain method watermark is embed by various mathematical transform while inverse transform is used to get the embedded image. The most used method in transform domain method includes DCT [6] DWT [7].DCT based watermarking includes the low frequency information so image contains all information similar to the original image . In DWT, image is decomposed into a set of band limited components which again can be assembled like an original image without error.

2 .LITERATURE REVIEW

This section contains the knowledge or brief description of various technologies.

DCT BASED DOMAIN WATERMARKING : In DCT based watermarking low and mid frequencies are considered as during the compression high frequencies are disappeared .It expresses a data of finite sequence points as a sum of cosine function oscillating at different mid frequencies .the cosine functions are to be considered rather than sine function as for many applications such as image compression cosine function works efficiently than that of sine function .DCT transforms real data into real spectrum thus removes the possibility of the data redundancy . In particular duct segments the image into non overlapping blocks and applies the transform into these blocks resulting in the formation of three sub bands ;low frequency sub band ,mid frequency sub band and high frequency sub band .High frequency sub bands are disappeared by noise attacks and compression [8].Mostly in digital signal processing two dimensional DCT is used . The DCT of image A of size N×N is given as

$$C(u,v) = \alpha(u)\alpha(v)\sum_{x=0}^{M-1}\sum_{y=0}^{N-1} f(x,y) \times \cos[\frac{\pi(2x+1)u}{2M}]\cos[\frac{\pi(2y+1)v}{2N}]$$

And inverse transform is written as

$$f(u,v) = \sum_{u=0}^{m-1}\sum_{v=0}^{m-1} \alpha(u)\alpha(v)C(u,v) \times \cos[\frac{\pi(2J+1)v}{2N}]\cos[\frac{\pi(2J+1)v}{2N}]$$

DISCRETE WAVELETTRANSFORM- DWT decompose the image into various into a set of band limited components by which image can be reassembled without any error, the coefficient sets have the bandwidth lower than that of image so these sets are down sampled . Reconstruction of image is done by using up sampling ,filtering and summing the sub band .the decomposed image contains four parts or the image is divided into four sub sets ,these include one part is a low frequency of original image or written as LL1, the one bottom left is vertical one part is a low frequency of original image written as LH1, the one bottom left is vertical details of the original image, the top right contains horizontal detail of the image written as HL1, the bottom right block contain high frequency details of the original image written as HH1. In the decomposition of DWT it must be the multiple of 2n where n denotes the number of levels. The detail of original image lies in the low frequency coefficients so the watermark is embed on the low frequency coefficients [8] and the for the removal of watermark IDWT is used[9] .

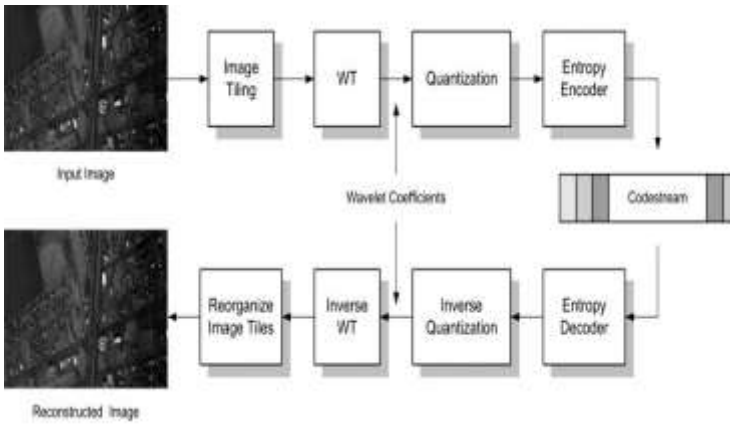

Fig1: BLOCK DIAGRAM OF IMAGE PROCESSING

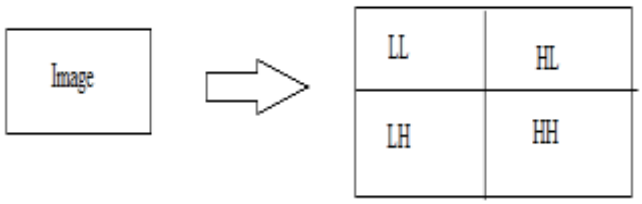

FIGURE 2: DECOMPOSITION OF DWT

2.1 CHARACTERTICS OF DWT

1. Transformation of the whole image introduces inherent scaling.
2. Suitable for applications where scalability and tolerance is important
3. Robustness is high as compared to that of DCT

2.2 DISADVANTAGES OF DWT

1.The cost of computing is higher than that of DCT

2.It takes a large amount of time to compress an image

3. The use of wavelet filters causes the blurring and noise effect to be appear on the edges of the image

III.APPLICATIONS OF DIGITAL WATERMARKING

After having the preview of different techniques, here are the some applications of digital watermarking

1. Copyright protection
2. In medical fields such as XRAY
3. Remote sensing
4. Video processing
5. Pattern recognition
6. Annotation and privacy control
7. Document and image security

IV. PERFORMANCE METRICS

1. Peak signal to noise ratio (PSNR):PSNR is a measure of quality of quality of loss compression or it is the ratio of loss in quality of watermarked image to the original image .it is given as

PSNR= 10 log_10 $[(MAXI^2/MSE]$

2. Mean square error(MSE) :It is defined as the average square between original image and distorted image and it is given as

MSE= $\frac{1}{XY}\left[\sum_{i=1}^{X}\sum_{j=1}^{Y}(m(i,j)-n(i,j)^2\right]$

3. Bit error rate (BER): It is the ratio of bit values of watermarked image to the original image and it is given as

BER = A / (B*C)

Where B and C denotes the height and width of watermarked image and A is the count number ,its initial value is regarded as zero ,if there is some difference between watermarked image and original image then the value of A increases by 1 and this process continues [10]

V EXPERIMENTAL RESULTS

In order to have high robustness of an image testing is performed by using different techniques mentioned above and also this is tested using performance metrics such as PSNR,NC,MSE ,BER etc. we test on different images such as leena ,photographer ,etc. .The original images are shown as "host images" and watermarked images are shown in fig 3(a), 3(b), 3(c).the result shows that

the quality of watermarked image is very imperceptible means it is difficult to manipulate the original data.

Quality of watermarked is measured by calculating the values of PSNR between original and watermarked at the receiver side, watermarked is extract from watermarked image .high the value of PSNR better will be quality of watermarked image.

DCT TECHNIQUE

Fig:3(a) ORIGINAL IMAGE

Fig: 3(b) WATERMARKED IMAGE

DWT TECHNIQUE

Fig:3(c) ORIGINALIMAGE

Fig:3(d)**WATERMARKED IMAGE**

VALUES OF PSNR AND MSE OF DCT &DWT

TECHINQUES	PSNR	MSE
DCT	23.8	265
DWT	27.54	128

VI .CONCLUSION

By having the above results we analyze that watermarking is best suited for authentication purpose .This paper contains the detailed information of various techniques such as spatial domain methods and transform domain methods which consists methods such as DCT ,DWT We have discussed the merits ,demerits and performance analysis of DCT and DWT method. We have seen that by above result that the values of PSNR between these two techniques; DWT has high value but MSE of DWT is lower than that of DCT .this shows that the impeccability of DWT is high than DCT although value of MSE is low. For research purpose this topic is very interesting as new technologies are emerging which enhances the performance of watermark and provides high security or protection to our data.

VII. FUTURE SCOPE

There is a vast scope in this field of image processing .Now at present the watermarking is limited to only images it can further be developed for the audio and videos as image is a frequency component and video is a series of images so watermarking can be applied to these also and make them watermarked .

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