2nd Level DWT Based On Image Watermarking

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***Abstract*— As the popularity of digit media is growing, and world is becoming smaller, all due to the internet connectivity and WWW phenomena, the copyright protection of intellectual properties have become a necessity for prevention of illegal copying and content integrity verification. Discrete wavelet transforms is the most popular transformation technique adopted for image Watermarking. The insertion and extraction of the watermark in the grayscale over image is robust than the other technique like DCT and DFT. The proposed method is compared 2-level DWT based image watermarking methods by using statistical parameters such as peak-signal-to-noise-ratio (PSNR) and mean square error (MSE).**

***Index Terms*—DWT, MSE, PSNR**

I. INTRODUCTION

The ability to access and "share" images has become easy with the Internet allowing people to access information from anywhere in the world. Since millions of people taking digital photos, there has been an increase in the number of digital images on the Internet. This requires for the people to protect their images or intellectual property.

A digital watermark is a visible or invisible signature embedded inside an image to show authenticity and ownership. An effective digital watermark should beperceptually invisible to prevent destruction of the original image. Digital watermark should be robust to many image manipulations, such as Cropping, Smoothing,Sharpening, JPEG compression, Gaussian noise, etc. and it should also be invisible to prevent detection.

What is Digital Watermarking?

Digital watermarking is a process of embedding watermark into digital products, where watermark can be some binary data, a small image or a seed value. It can also be any random or serial number, ownership identifier, information about the creator, date etc. that would be inserted into the original digital products.[1] Digital watermarking received increasing attention in the last decade due to massive digital artwork distribution via internet. Digital watermark technique is widely applied to tampering detection, authenticity and/or ownership protection of digital images, audio, video or even texts.

II. APPLICATIONS OF DIGITAL WATERMARKING [2]

Copyright Protection

Copyright protection is the very first targeted application for digital watermarking. In digital multimedia, watermarking is used as copyright protection to identify the copyright owner. The owner of the digital media can protect his content from being used commercially.

Fingerprinting

A key issue in real time application is illegal distribution of copy righted digital content like movies, which can be avoided by watermarking the video using a technique called fingerprinting. Fingerprinting is used to trace the origin of illegal copies.

Tamper proofing

Digital photography authentication has become a great concern as they can be easily tampered. Such problems have hindered the application of digital images for courtroom evidence, insurance claims, copyright claims and journalistic photography.

Medical Image Watermarking

The evolution of medical information systems, supported by advances in information technology, enables information to be shared between distant health professionals. However, this could pose a threat to privacy of information if security measures are not considered.

Broadcast Monitoring

Watermark can be embedded in commercial advertisements. A computer-based monitoring system could then detect the embedded watermark, to ensure that they receive all of the airtime they purchased from the broadcasters.

Indexing

Comments, markers or key information related to the data can be inserted as watermarks for the purpose of indexing. This watermarked information is used by a search engine for retrieving the required data quickly and without any ambiguity.

Bank Monitoring System

Bank monitoring system is another important real time application which could benefit by using video watermarking. Such a system comprises of surveillance video cameras with watermarking facility, such that the video cameras will watermark each frame of the video footage with the bank logo or any secret identification, and then encrypt the video taken using a key.

III. PROPERTIES OF WATERMARKS [2]

Invisibly

A watermarking system is of no use if it distorts the cover image to the point of being useless, or even highly distracting. Ideally the watermarked imaged should look indistinguishable from the original even on the highest quality equipment.

Data payload / Capacity

Capacity of watermarking refers to the amount of information of watermark that can be embedded into a host signal. A higher capacity is usually obtained at the expense of either robustness strength or imperceptibility, or both.

Robustness

Watermark must be resistant to distortion introduced during any unintentional or an intention (attempt to remove the present watermark) attack. Unintentional attacks involve transforms that are commonly applied to images during cropping, resizing, enhancement etc.

Security

Security of watermarking means the watermark should be difficult to remove or alter without damaging the host signal.

IV. WATERMARKING PROCESS

The process of general watermarking model is describes in the following steps:[3][4][5]

1. Watermark Insertion
2. Watermark distribution
3. Watermark Extraction/ Detection
4. Watermark Decision

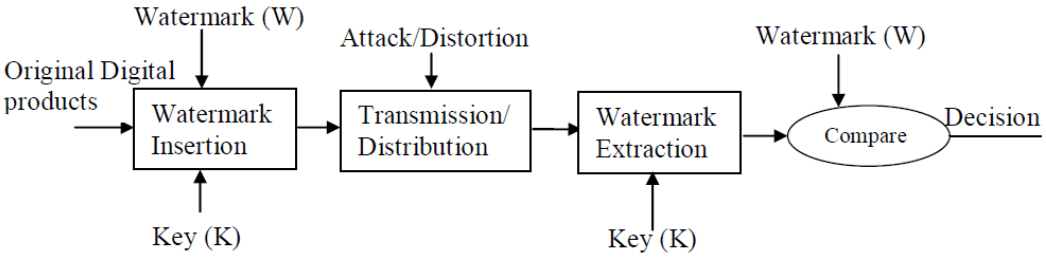


Fig: 1 Watermarking process

The whole process of digital watermark embedding is shown in above Figure.

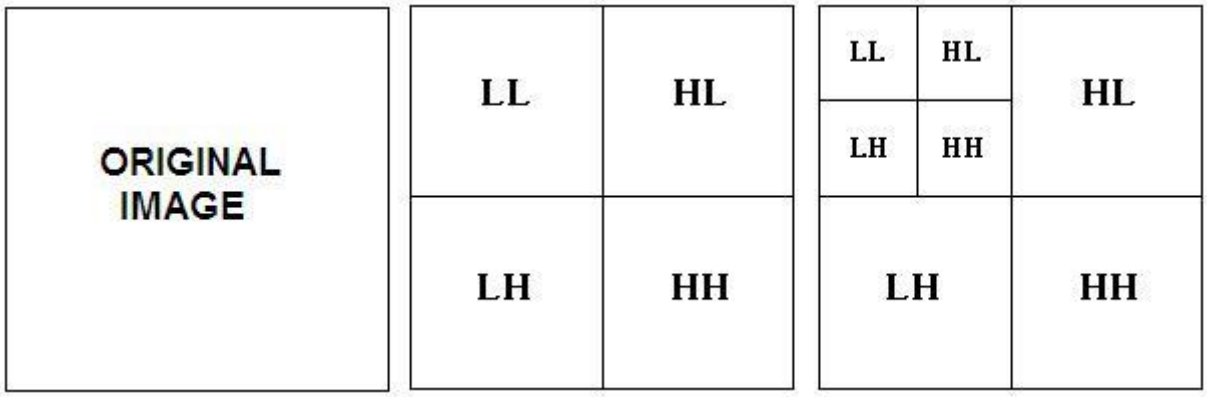
In first step, the original image is first transformed into a domain that facilitates data embedding. The watermark can be some binary data, a small image or a seed value, that would be inserted into the original digital products.

During transmission and distribution of the watermarked image, not only compression adds distortion to the original data, but also transmission errors and common image processing task, such as contrast enhancement, re-sampling, contribution error to watermarked image. Especially geometric images manipulation like scaling, rotation, cropping, filtering has been proved to be a very harmful to the embedded watermark.

In the next step, watermark Extraction/ Detection the watermark is extracted from the watermarked data. And at last in last step, watermark decision, water marking system analyses the extracted data. Depending on the type of the application and the nature of watermark, the decision stage can produce a number of different outputs, which can be in range from simple to more complicated answer.

V. DISCRETE WAVELET TRANSFORM (DWT)

Wavelet transform can decompose an image into two parts which are low-frequency approximation and high frequency detail signal. Low-frequency signal can be further divided into low-frequency signal and high frequency signals. High-frequency part includes three parts which are horizontal (HL), vertical (LH) and diagonal direction (HH), and each part can generate a sub graph, thus the size of each sub graph is a quarter of the original image.[6][7][8].



DWT Watermarking Embedding Process

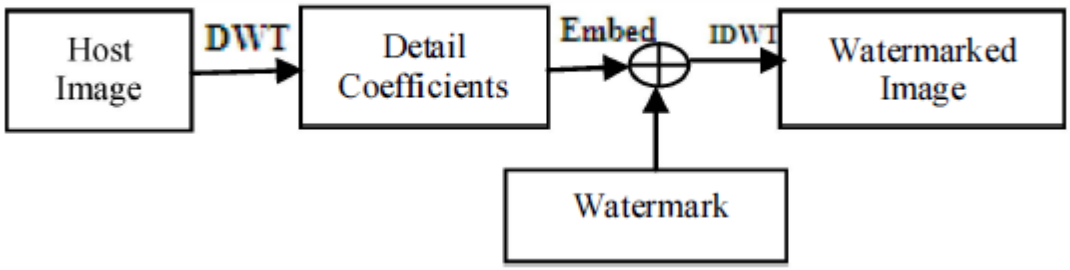


Fig:2 DWT Watermark Embedding Process

For embedding the watermark, we can follow the steps given below
Step 1. Read an original Image
Step 2. Wavelet Transform of the input image is performed.
Step 3 One level of decomposition is performed to get four sub bands.
Step 4. Key, which is the image to be embedded, is taken.
Step 5. That key is multiplied with weighting function and it is added to the sub band information.
Step 6. Perform the inverse of the DWT (IDWT) to obtain the watermarked image

DWT Watermark Extraction Process

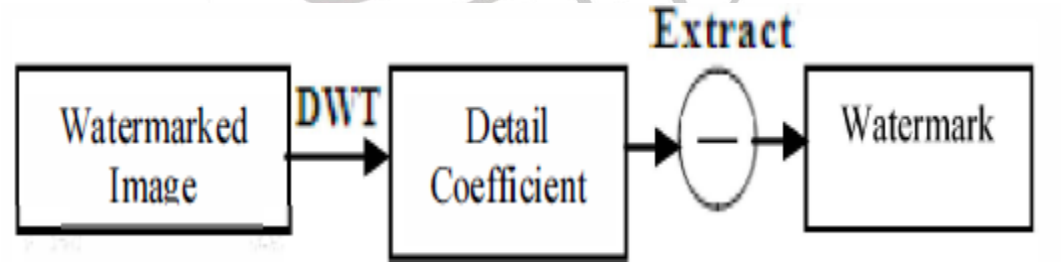


Fig: 3 DWT watermark Extraction Process

For extracting the watermark, we can follow the steps given below:
Step l.Forward wavelet transform of the watermarked image is taken.
Step 2. Subtracted from the wavelet coefficients of the original image.
Step 3. Extract a watermark image.

VI. PROPOSED SCHEME

In Proposed System first we are applying 2 level DWT on cover image as well as 2 level DWT on watermark image. For decomposition of image haar wavelet is used. Haar is the basis of wavelet decomposition. After decomposition of both the image we are applying watermarking process. And applying IDWT to get our watermarked image.

Embedding Process:

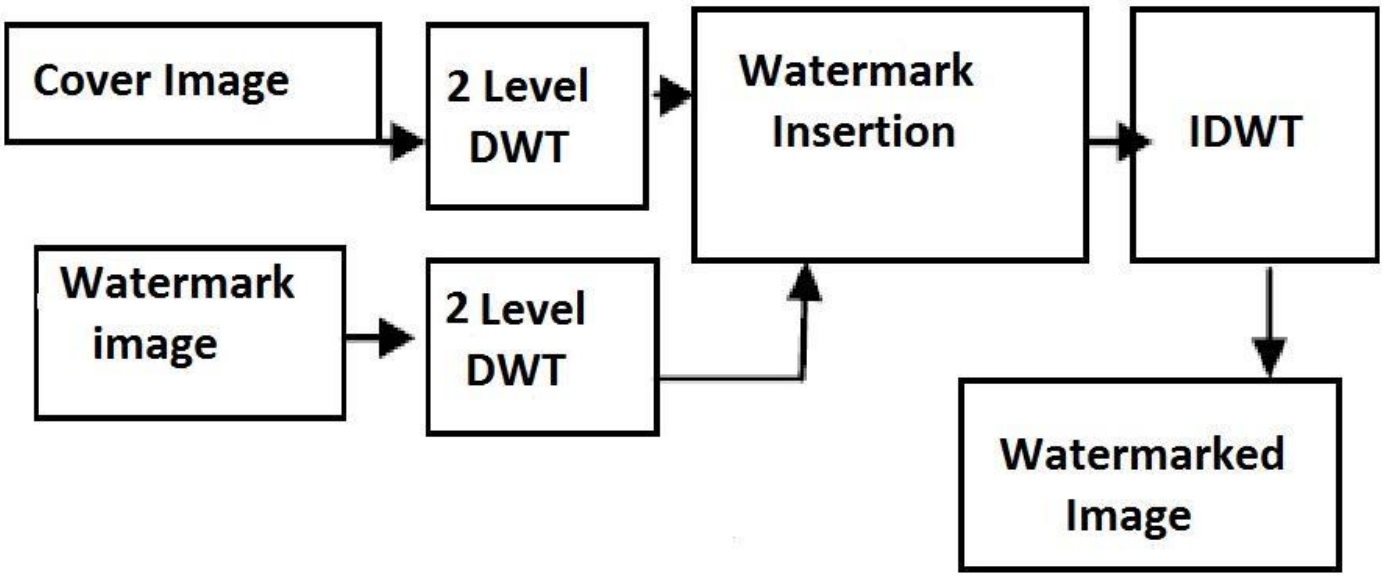


Fig:4 2nd level DWT embedding process with watermark decomposition

Extraction Process:

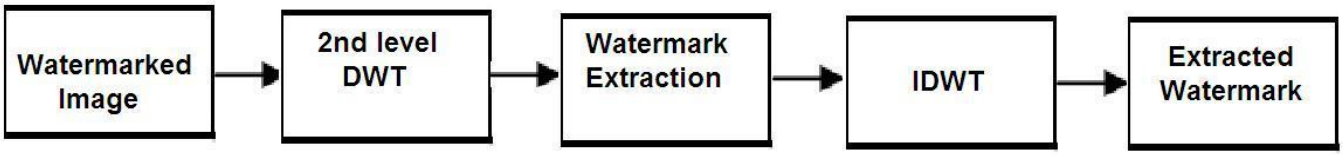


Fig:5 2nd level DWT extracting process with watermark decomposition

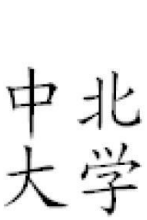
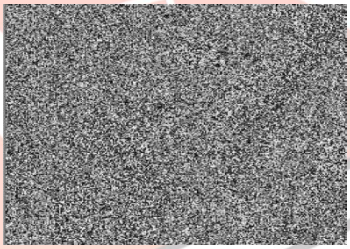
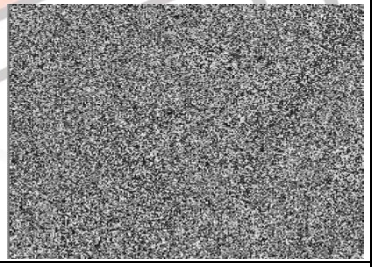
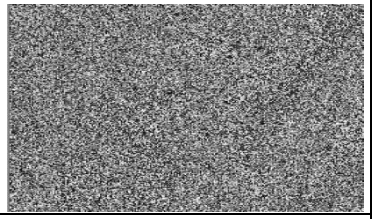
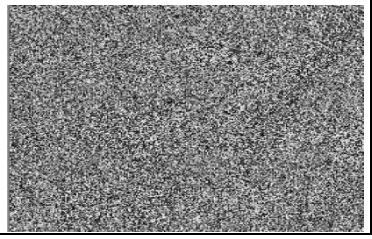
Proposed Algorithm:

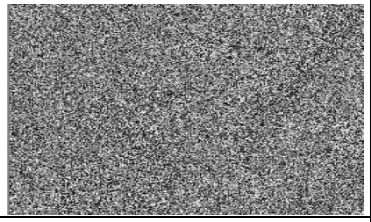
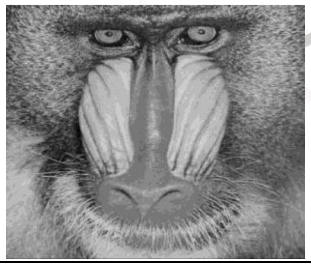
Step 1. Read an original Image
Step 2. Wavelet Transform of the input image is performed.
Step 3 Two level of decomposition is performed to get four sub bands.
Step 4. Watermark Image is taken
Step 5 Two level of decomposition is performed on watermark image to get four sub bands.
Step 6. That key is multiplied with weighting function and it is added to the sub band information.
Step 7. Perform the inverse of the DWT (IDWT) to obtain the watermarked image.

VII. EXPERIMENTAL RESULTS

SR NO.	Cover Image	Watermark Image	PSNR	MSE
1.			106.2571	2.4669e-005
2.			107.4022	1.9789e-005

		Best		
3.		Best	**108.2382**	**2.0626e-005**
4.		Best	**106.9783**	**2.3127e-005**
5.		Best	**103.3453**	**3.2505e-005**
6.		中北 大学	**111.9123**	**1.8559e-005**
7.		中北 大学	**106.3379**	**2.7367e-005**
8.			**108.9366**	**2.0473e-005**

				
9.			**115.9045**	**2.9953e-006**
10.			**104.6597**	**3.0433e-005**
11.			**115.0277**	**1.0262e-005**
12.			**118.8584**	**6.2935e-005**
13.			**117.6038**	**8.0848e-006**
14.			**117.2159**	**8.3081e-006**

				
15.			**113.9652**	**1.1239e-005**
16.			**106.0463**	**2.5195e-005**
17.			**107.3741**	**1.9841e-005**
18.			**109.8048**	**1.9062e-005**
19.			**106.8553**	**2.5987e-005**
20.			**108.3672**	**2.1239e-005**

VIII. CONCLUSION

Watermarking is a technique which is useful to detect our original copies of the protected digital content. As compared to the other technique the main advantage of watermarking is that we can add our digital content permanently into our digital image. During this dissertation work we have studied different frequency domain technique like DCT and DWT for image watermarking and by analyzed with this method we can say that DWT is better than DCT. And we have implemented 2nd level DWT without watermark image decomposition and 2nd level DWT with watermark decomposition and by obtaining results of these two methods we can say that 2nd level DWT with watermark decomposition gives more accurate results than other.

IX. FUTURE WORK

In future we can try to implement the next level of DWT that is 3rd level with watermark image decomposition and try to match this result with our existing scheme.

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