



Analysis between Various Digital Watermarking Tools and Techniques

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Abstract: *Digital watermarking is an extension of steganography, is a promising solution for content copyright protection in the global network. It imposes extra robustness on embedded information. Digital watermarking is the science of embedding copyright information in the original files. The information embedded is called watermarks. The digital watermarking is a field of information hiding which hide the crucial information in the original data for protection illegal duplication and distribution of multimedia data. This paper presents a survey on the existing digital image watermarking tools. The results of various digital image watermarking tools have been compared. In the digital watermarking the secret information are implanted into the original data for protecting the ownership rights of the multimedia data. This survey elaborates the most important methods of spatial domain and transform domain and focuses the merits and demerits of these techniques.*

Keywords: *LSB, DCT, DFT*

I. INTRODUCTION

Digital watermarking is a technology for embedding various types of information in digital content. In general, information for protecting copyrights and proving the validity of data is embedded as a watermark. A digital watermark is a digital signal or pattern inserted into digital content. The digital content could be a still image, an audio clip, a video clip, a text document, or some form of digital data that the creator or owner would like to protect. The main purpose of the watermark is to identify who the owner of the digital data is, but it can also identify the intended recipient.[1]

Digital image processing is a rapidly developing area with various raising applications in Computer science and engineering. It is very important field for the research work because its Techniques are used in almost all kinds of tasks like human computer interface, medical visualization; image enhancement, Law enforcement, artistic effects, image restoration and digital watermarking for security purpose. Digital image processing has many beneficial properties over the analogue image processing.

Digital image processing is accomplishing variant computer operations on digital image for various purposes like enhancing image quality, filtering images from noise. A digital image is a representation of two-dimensional images as a finite set of digital values called picture elements or pixels. Therefore, processing a digital image by using a digital computer is called digital image processing. The digital communication technology, like internet technology confronts various troubles related to the privacy and security of the data. Security techniques are required because of illegal access of data without permission. Therefore, it is necessary to protect data in the internet technology. For providing the security of digital data various techniques are used like encryption, decryption, cryptography, steganography and digital watermarking. In this paper discusses about the digital watermarking. The digital watermarking is an application of the digital image processing.[2]

The digital watermarking is a process of information hiding. There are various techniques for hiding the information in the form of digital contents like image, text, audio and video. Basically digital watermarking is a method for embedding some secret information and Additional information in the cover image which can later be extracted or detected for various Purposes like authentication, owner identification, content protection and copyright protection, etc. Sometimes the scaling factor is also used for embedding the watermark in the cover image.

The digital watermarking is used for the security of the digital content and to protect the data from illegal users and provides the ownership right for the digital data. An important characteristic of digital watermarking is robustness and imperceptibility against various types

of attacks or common image manipulation like rotation, filtering, scaling, cropping and compression. The efficiency of digital watermarking algorithms is totally based on the robustness of the embedded watermark against various types of attacks. Digital watermarking is a method used to improve the ownership over image by replacing low level signal directly into image. Digital watermarking method is also used for the tamper proofing and authentication.

Digital watermarking is a very developing field and used in various applications which have been proved to be successful. The digital watermarking has been applied in a number of image processing techniques. The aim of every application is to providing security of the digital content. The digital watermarking applications are Broadcast Monitoring, Digital Fingerprinting, Transaction Tracking, Copyright protection, Temper Detection, Data Hiding and Content Authentication etc.[3]

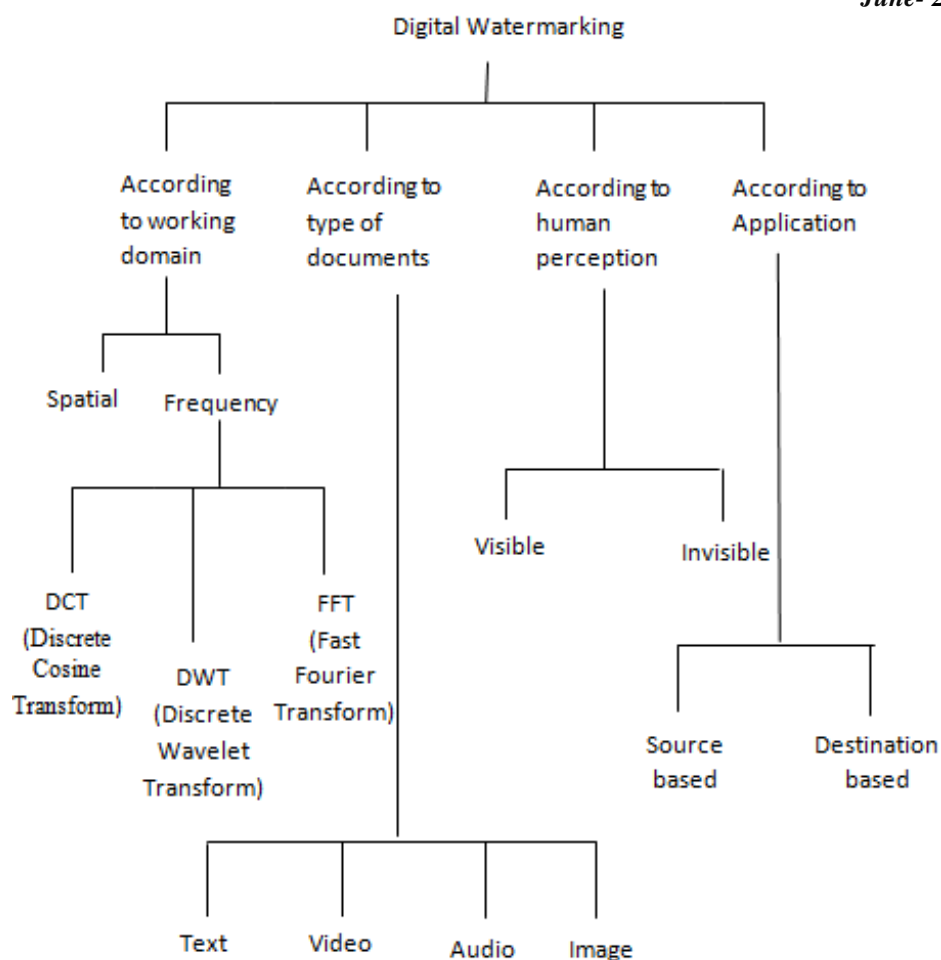


Figure 1 Types of Digital Watermarking

Every digital watermarking technique includes two algorithms: one as the embedding algorithm and other as the detecting algorithm. These two processes are same for all the type of watermarking techniques. Figure 1 shows the watermark embedding process in which the watermark is embedded in the cover image by using the embedding algorithm. And Figure 2 shows the watermark detection process in which the embedded watermark is recovered by using the detection algorithm. [4]

This paper is categorized in different sections. In Section 3, we have discussed working of digital image watermarking with the stages explanation. Section 3 defines digital watermarking techniques and Section 4 describes the experimental results of some important spatial domain or transforms domain techniques. Finally, Section 5 shows the conclusion.

II. DIGITAL WATERMARKING

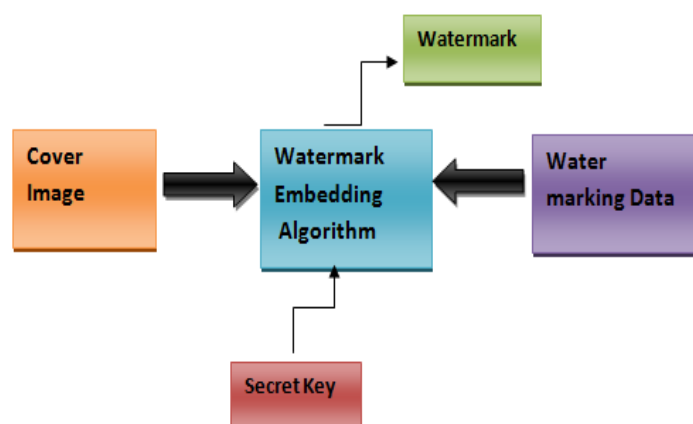


Figure. 2 Watermark Embedding Process

In the above figure 2, we have shown the watermark Embedding Process in Digital Watermarking Technique. In Digital Image Watermarking use digital image for embedding the hidden information, after embedding the watermarked image is generated and the watermarked image is more robust against attacks.

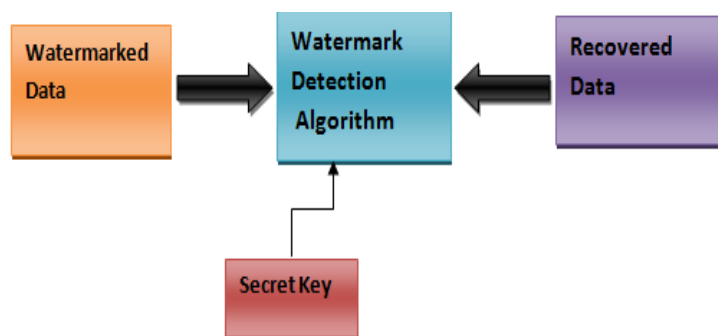


Figure 3. Watermark Detection Process

In the above figure 3, shown the watermark Detection Process of Digital Watermarking Technique in step wise step manner.

III. DIGITAL IMAGE WATERMARKING WORKING

Digital Watermarking is a technique which is used in the digital signal processing of embedding hidden information into multimedia data. This information is not usually visible, only dedicated detector or extractor can seen and extracts that information. Digital Image Watermarking use digital image for embedding the hidden information, after embedding the watermarked image is generated and the watermarked image is more robust against attacks. Figure 3 shows the stages of digital watermarking. Basically working of digital image watermarking can be divided in three stages[2]

A. Embedding Stage

The embedding stage is the first stage in which the watermark is embedded in the original image by using the embedding algorithm and the secret key. Then the watermarked image is generated. So the watermarked image is transmitted over the network.

B. Distortion/Attack Stage

In this stage, when the data is transmitted over the network. Either some noise is added with the watermarked image or some attacks are performed on the watermarked image. So, our watermarked data is either modified or destroyed.

C. Detection/Retrieval Algorithm

In the detection stage, the watermark is detected or extracted by the dedicated detector from the watermarked image by applying some detection algorithm and by using secret key. In addition to this, noise is also detected.[5]

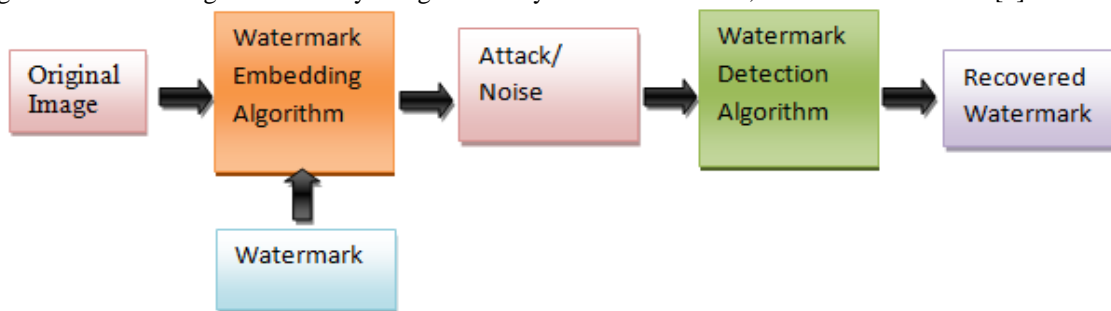


Figure 4. Stages in Digital Image Watermarking

In the above figure4, Digital Image Watermarking is shown which uses digital image for embedding the hidden or sensitive information, after embedding the watermarked image is generated and the watermarked image is more robust against attacks.

IV. DIGITAL IMAGE WATERMARKING TECHNIQUES

Digital watermarking is a fairly new research area and combines studies and results from other research areas, such as digital signal processing, communications, compression, information theory, and cryptography . The most important properties of any digital watermarking techniques are robustness, security, imperceptibility, complexity, and verification. Robustness is defined as if the watermark can be detected after media (normal) operations such as filtering, lossy compression, color correction, or geometric modifications. The following sections describe a few of the most common digital watermarking techniques.

1. According to working domain

Most watermarking techniques themselves can be distinguished into two approaches, those in the spatial domain and those in the Frequency domain. The main difference between these approaches is their robustness. Spatial techniques were the initial development in the field. Spatial domain watermarks are being developed today, since their techniques

are relatively cheap and for more trivial examples they can quickly create a watermark with Little effort. The main area of focus with this form of watermarking is in the randomized key. If the key follows a pattern, then the human mind is more likely to pick up on the imperfection and so it will be easier to notice and therefore remove. Techniques applied in the Frequency domain are more robust than those applied in the spatial domain. This explains in part why the bulk of current research is directed towards the exploration of Frequency based techniques.

The spatial domain represents the image in the form of pixels. The spatial domain watermarking embeds the watermark by modifying the intensity and the colour value of some selected pixels. The strength of the spatial domain watermarking is

- Simplicity.
- Very low computational complexity.
- Less time consuming.

The spatial domain watermarking is easier and its computing speed is high than transform domain but it is less robust against attacks. The spatial domain techniques can be easily applied to any image. The most important method of spatial domain is LSB.

Limitations of spatial domain watermarking:

The spatial domain watermarking is simple as compared to the transform domain watermarking. The robustness is the main limitation of the spatial domain watermarking. It can survive simple operations like cropping and addition of noise. Another limitation of spatial domain technique is that they do not allow for the subsequent processing in order to increase the robustness of watermark.

A. Spatial Domain watermarking

a) LSB Watermarking Technique:

LSB watermarking describes a straightforward and basic way to integrate watermark information in digital documents. Considering a basic grey scale image, the pixel and its values can be sliced up into significant and irrelevant levels. Because the significant levels merely represent a digital noise pattern, it could be easily used for digital watermarking. In changing selected pixel values of the noise pattern using a special or key-based algorithm, the watermarking information can be easily integrated. However, such technique is very insecure because the watermark can be easily destroyed. On the other hand, such technique can be useful in copy control and authenticity applications.

The LSB is the simplest spatial domain watermarking technique to embed a watermark in the least significant bits of some randomly selected pixels of the cover image. Example of least significant bit watermarking:[9]

Image:

10010101 00111011 11001101 01010101....

Watermark:

1 0 1 0.....

Watermarked Image:

10010101 00111010 11001101 01010100.....

The steps used to embed the watermark in the original image by using the LSB:

- 1) Convert RGB image to grey scale image.
- 2) Make double precision for image.
- 3) Shift most significant bits to low significant bits of watermark image.
- 4) Make least significant bits of host image zero.
- 5) Add shifted version (step 3) of watermarked image to modified (step 4) host image.

The main advantage of this method is that it is easily performed on images. And it provides high perceptual transparency. When we embed the watermark by using LSB the quality of the image will not degrade. The main drawback of LSB technique is its poor robustness to common signal processing operations because by using this technique watermark can easily be destroyed by any signal processing attacks. It is not vulnerable to attacks and noise but it is very much imperceptible.

B. Frequency Domain watermarking

a) Discrete Cosine Transform:

Discrete Cosine Transform (DCT) used for the signal processing. It transforms a signal from the spatial domain to the frequency domain. DCT is applied in many fields like data compression, pattern recognition and every field of image processing. DCT watermarking is more robust as compared to the spatial domain watermarking techniques. The main steps which used in DCT:

- 1) Segment the image into non-overlapping blocks of 8x8.
- 2) Apply forward DCT to each of these blocks.
- 3) Apply some block selection criteria (e.g. HVS).
- 4) Apply coefficient selection criteria (e.g. highest).
- 5) Embedded watermark by modifying the selected Co-efficient.
- 6) Apply inverse DCT transform on each block.[10]

In DCT, for embedding the watermark information, we divide the image into different frequency bands. In Figure 4 FL denotes the lowest frequency component of the block, while FH denotes the higher frequency component and FM denotes the middle frequency component which is chosen as the embedding region. The Discrete cosine transform achieves good robustness against various signal processing attacks because of the selection of perceptually significant frequency domain coefficients.[8]

b) Discrete Fourier Transform

Fourier Transform (FT) is an operation that transforms a continuous function into its frequency components. The equivalent transform for discrete valued function requires the Discrete Fourier Transform (DFT). In digital image processing, the even functions that are not periodic can be expressed as the integral of sine and/or cosine multiplied by a weighing function. This weighing function makes up the coefficients of the Fourier Transform of the signal. Fourier Transform allows analysis and processing of the signal in its frequency domain by means of analyzing and modifying these coefficients.

c) Discrete Wavelet Transform

Wavelet Transform is a modern technique frequently used in digital image processing, compression, watermarking etc. The transforms are based on small waves, called wavelet, of varying frequency and limited duration. A wavelet series is a representation of a square-integral function by a certain ortho-normal series generated by a wavelet. Furthermore, the properties of wavelet could decompose original signal into wavelet transform coefficients which contains the position information. The original signal can be completely reconstructed by performing Inverse Wavelet Transformation on these coefficients. Watermarking in the wavelet transform domain is generally a problem of embedding watermark in the sub bands of the cover image[9]

2. According to human Perception

A. Visible and Non-Visible

Techniques In order to detect the watermark information, blind and non blind techniques are used. If the detection of the digital watermark can be done without the original data, such techniques are called blind. Here, the source document is scanned and the watermark information is extracted. On the other hand, non blind techniques use the original source to extract the watermark by simple comparison and correlation or interconnected procedures. However, it turns out that blind techniques are more insecure than non blind methods.[10]

V. ANALYSIS BETWEEN VARIOUS DIGITAL WATERMARKING TOOLS

In this section, different tools are shown which are available on internet with their properties. These tools helps to save a file with the digital watermarking as well as edit the picture. Below are the tools that are paid as well as it can be use online after registering to the website for the first time.[11]

S.No	Tool	Type	Feature	Advantage
1	UMark	Free	Fully customizable watermark choose the font, font size, style and color, set custom transparency level, add shadow or rotate watermark to your taste.	1.Batch Watermarking supports Watermark hundreds of photos in one go. 2.Can save watermark for later use 3.Availablefor windows as well as MAC
2	MassWaterMark	Free	Automated Batch Image watermarking in a simple, fast and unified water flow, and can watermark !00s of photos within minutes with few clicks	1. Retouch your image before watermarking with unique image optimizer. 2.Supports Wide Range of image formats JPEG, PNG, BMP, TIFF and GIF.
3	Aoao photo	Paid	It provides professional photo protection solutions for digital photos	1. Fast Speed 2. it can watermark more than 300 photos in less than 1 minute. 3. more than 150 free watermark are available. 4.Photo conversion also possible like JPG, GIP, PNG etc.
4	VisualWatermark	Free	It has 12 built-in watermark template and appearance options help you to get the watermark look you want.	1. Watermark 100 photos in just 1 minute. 2. It can use logo and text in any combination. 3. it can runs on Windows and MAC.
5	Arclab Watermark Studio	Paid	It is easy to use image watermarking tool by adding a true-transparency watermark with custom opacity.	1. Watermark or logo can be added to any location. 2. Can add watermark on multiple positions.
6	WatermarkLib	Free	This photo watermark software places very strong watermarks that no one can remove.	1. Add date and Time stamp. 2. Edit watermarks in convenient interface.

7	Alamoon	Paid	It is a powerful watermarking for protecting and enhancing your image.	1. It is a simple yet effective software helps you to watermark thousands of photos/image in seconds.
8	TSR Watermark	Paid	This watermark create solid watermark that are hard to remove.	1. Simple and quick watermarking 2. Batch watermark thousands photos without user action.
9	Kigo Image Converter	Free	Kigo Image converter is easy to use image converter for windows users.	1. it is designed to change image format, scale image size, compress image add watermark by batch.
10	cdWorks	Free(trial)	cdWorks Photo Helper will let you edit camera metadata.	1. rotate pictures, and add a copyright watermark with just a few mouse clicks
11	Water Marquee	Free	The work you put into Marquee is protected.	1. simple and fast 2. Used in windows and MAC
12	Squiggle Mark	Application	Squiggle Mark is a watermarking application that was designed with simplicity and ease of use Use it to watermark and resize multiple pictures at a time.	1. Fast and Use it to watermark and resize multiple pictures at a time.
13	PicMark.com	Online	In Pic Mark.com Online Software we can add text watermark to any image or photo.	1.Prevent unauthorized use of images 2. Protect copyright, add comments, timestamps, your logo to images.
14	Star-Watermark.com	Online	Star- Watermark.com is used to watermark photo as well as pdf	1. used in windows and MAC. 2. you could built your company brand, by having logo on all your images. 3. it supports multiple languages.
15	PicGhost	Free	Edit your images online quickly .	1. With PicGhost you can edit all your images online, no software or installations required.
16	Watermark.ws Tool	Online	Watermark tool is that lets you quickly and easily generates watermarks for your images.	1.Prevent unauthorized use of images 2. Protect copyright, add comments, timestamps, your logo to images.
17	Watermark-online.com	Online	Innovative service for online watermarking photos that offers a multitude of new possibilities..	1. Protect your photos and brand them with a few clicks
18	Image.com	Free	Free Batch Image watermarking tool to help you watermark and protect your images before you get them online.	1. Supports selection of font properties, transparency and special effects.
19	Picture Stamper	Free	Picture Stamper is an application that allows you to watermark with an intuitive and easy to use user interface. You can add as many photos as you want and stamp all of them at once.	1. It can add many photos as you want and stamp all of them at once. 2.Your last stamp design is always saved for later use so you don't need to redesign from scratch each time you run Picture Stamper
20	JACO Watermark tool	Free	JACO watermark easy to use interface,	1.batchimage processing supports formats: GIP, BMP, JPG, PNG.

VI. CONCLUSION

In this paper we have studied different types of digital watermarking and illustrated various digital watermarking tools that are free as well as paid available on the internet used to add watermark in the photo. From the above summarized analysis concludes that Picture Stamper is an application that authorize to watermark with an intuitive and easy to use user interface also can add as many photos as you want and stamp all of them at once.

REFERENCES

- [1] Prabhishek Singh, R S Chadha, "A Survey of DigitalWatermarking Techniques, Applications and Attacks", International Journal of Engineering and Innovative Technology (IJET) Volume 2, Issue 9(March 2013).
- [2] Mohammad Ibrahim Khan1, Md. Maklachur Rahman2 andMd. Iqbal Hasan Sarker(May 2013) Digital Watermarking for Image Authentication Based on Combined DCT, DWT and SVD Transformation, IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 3, No 1, ISSN (Online): 1694-078.
- [3] Remya Elizabeth Philip1, Sumithra M.G.2(January - February 2013) Development Of A New Watermarking Algorithm For Telemedicine Applications, Vol. 3, Issue 1, January -February 2013, ISSN: 2248-9622.

- [4] Ensaf Hussein, Mohamed A. Belal(7, September – 2012) Digital Watermarking Techniques, Applications and Attacks Applied to Digital Media: A Survey, International Journal of Engineering Research & Technology (IJERT), Vol. 1 Issue 7, September – 2012, ISSN: 2278-0181.
- [5] Dr. Ajit Preeti, Kalra Sonia, Dhull (4, April 2013), DIGITALWATERMARKING,International Journal of Advanced Research in Computer Science and Software Engineering Volume 3, Issue 4, ISSN: 2277 128X.
- [6] Dr. Vipula Singh, “Digital Watermarking: A Tutorial”, Geethanjali College of Engineering and Technology, Hyderabad India (2011)..
- [7] Vinita Gupta and Mr. Atul Barve “A Review on Image Watermarking and Its Techniques”, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 1, January 2014..
- [8] Anupma Yadav, Anju Yadav ,“Comparison of SVD Watermarking and LSB-Watermarking Techniques”,International Journal of Computer Science and Mobile Computing, Vol.3 Issue.5, May- 2014, pg. 495-499.
- [9] Vikas Kumar 1, Ram Lautan 2, MHD Faisal 3, Krishna Mohan Pandey(9, September - 2013) Dwt and Particle Swarm Optimization Based Digital Image Watermarking, International Journal of Engineering Research & Technology (IJERT),Vol. 2 Issue 9,ISSN: 2278-0181.
- [10] Dilip Kumar Sharma1*, Vinay Kumar Pathak2 and G.P. Sahu-(30 December 2014).
- [11] <http://listoffreeware.com/17-best-free-software-add-watermark-pdf-files-windows/>