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An Overview: Watermarking Approach for Digital Images

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Abstract- In this paper, we study different watermarking approaches for digital images. a robust watermarking framework to embed a color watermark is presented. To perform a color image as watermark, The technology advances and easy access to multimedia tools with digital content have increased the number of issues in copyright procedures. Digital watermarks are a set of techniques that are used to protect the copyright of digital images. The color watermark is encoded in such a way that data to represent the colors are reduced.
Keywords – digital color image; color watermark; copyright protection; DCT; QIM

I. INTRODUCTION

The fast growth of technology has improved the access to more powerful low-cost computer and multimedia tools, with what digital content can be manipulated more easily, where sometimes the changes are undetectable, resulting in the illegal production or redistribution of digital content, violating the owner copyright. Hence, the research in protecting multimedia content has become important in recent years [1]. There are different methods for copyright protection of digital content that can be used for different purposes; one of the techniques most widely used is known as Digital Watermarks [2]. Digital watermarking techniques embed information in an original file to asseverate something about the owner, authenticity, file control, integrity check, etc. [3], [4]. The embedded data are known as watermarks, and usually they are represented by a binary pattern or a sequence of random numbers. Also, it can be embedded small logos or black and white images, besides text information. The watermark should provide precise and non-dubitable information about the author to establish the rightful ownership of the content that is protected. Depending on the purpose of the watermarking scheme, this should satisfy some characteristics such as robustness against the most common image processing techniques (digital compression, noise, copying); capacity to storage a great amount of data, and finally, it should be imperceptible to Human Visual System (HVS). Also, it is important that the embedding process does not degrade the original digital content.

II. CLASSIFICATION OF WATERMARKING TECHNIQUES

1. Watermarking techniques can broadly be classified based on their inherent characteristics: visible and invisible.
Visible watermarks**:** A visible alteration of the digital image by appending a "stamp" on the image is called a visible watermark. This technique directly maps to that of the pre-digital era where a watermark was imprinted on the document of choice to impose authenticity.
Invisible watermarks**:** By contrast, an invisible watermark, as the name suggests that this is invisible for the most part and is used with a different motive. While the obviousness of visible watermarking makes distinguishing legitimate and illegitimate versions easy, its conspicuousness makes it less suitable for all applications. Invisible watermarking revolves around such suitable factors that include recognizing authentic recipients, identifying the true source and nonrepudiation.

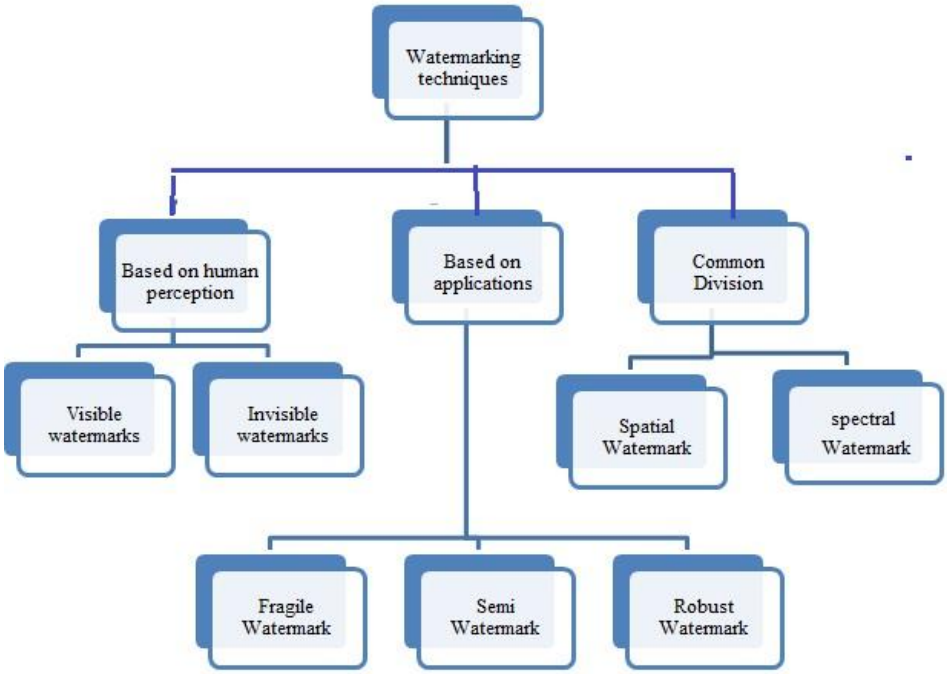

Figure 1. Classification of Watermarking Techniques.

2. Another way of classifying watermarking technique is a factor of its usage: fragile, semi-fragile, and robust [5].
Fragile watermarks**:** These are complementary to robust watermarks and are, as a rule, more change-sensitive than robust watermarks. They lose their mettle when they are subject even to the smallest changes. Their use lies in being able to pin-point the exact region that has been changed in the original watermarked image. The methods of fragile watermarking range from checksums and pseudo-random sequences in the LSB locate to hash functions to sniff any changes to the watermark [6].
Semi-fragile watermarks**:** These watermarks are a middle ground between fragile watermarks and fragile watermarks. They engulf the best of both worlds and are more resilient than fragile ones in terms of their robustness. They also are better than robust watermarks in terms of locating the regions that have been modified by an unintended recipient.
Robust watermarks**:** By hypothesis robust digital watermark repeal all types of attacking techniques on the watermark [7]. Watermarks can be used to hold knowledge of ownership. Such watermarks need to remain steadfast to the original image to do what they advertise. The intactness of the watermark is a measure of its robustness. These watermarks must be able to withstand normal manipulations to the image such as reduction of image size, lossy compression of image, changing the contrast of the images, etc.
3. Digital watermarks are also spatial and spectral watermarks.
Spatial watermarks**:** Watermarks that are applied to the "spatial domain of the image" are said to be spatial watermarks [8].
Spectral watermarks**:** These are watermarks that are applied to the "transform coefficients of the image" [8]. The rest of the paper is organized as follow. The ground rules for a good watermark will be laid down in the next section. After describing the various stages of the watermarking process, we will focus on various algorithms for watermarking, and analyze the algorithms.

III. LITERATURE REVIEW: TECHNIQUES USED IN WATERMARKING FOR DIGITAL IMAGES

Digital watermarking is a technology that manages and assigns data authentication, security, and copyright security to the digital information. Digital watermarking algorithms are divided into two groups. One technique is spatial domain. In this techniques pixel values straightly works. The Second is frequency domain techniques employ several transforms, either local or global. Various widely recognized techniques are described consequently.
Spatial Domain Techniques**:** Watermark in spatial domain technique is inserted in the cover image and changing pixels value. Against the possibility of the watermark becoming visible the algorithm should carefully weight the number of altered bits in the pixels value [9].

Frequency Domain Techniques**:** Frequency-domain methods are more widely applied as compared to spatial - domain methods. The aim of watermarks in the spectral coefficients of the image is embedded. In frequency domain Mostly used transforms are the DCT (Discrete Cosine Transform), DFT (Discrete Fourier Transform), DWT (Discrete Wavelet Transform).For as much as the characteristics of the HVS (human visual system) are better captured by the spectral coefficients that's why watermarking in the frequency domain. For example, human visible system for low frequency coefficients is more sensitive, and for high-frequency coefficients it is less sensitive, also we can say that in troths, The LF (low frequency) coefficients are significant perceptually, that means distortion in the original image might cause by those components and high-frequency coefficients are insignificant considered. Thus, HF (high frequency) coefficients aggressively remove by processing techniques like compression. To get a balance between robustness and imperceptibility large algorithms embed watermarks in the midrange frequencies [10].

Discrete wavelet transform**:** Discrete wavelet transform (DWT) is a neoteric technique consecutive used in digital image processing, compression, digital watermarking etc. Discrete wavelet transform is more efficient than discrete cosine transform method. The image is dissolved into high and low frequency elements in two level discrete wavelet transform (DWT). The robustness with respect to divers attacks increases when the watermark is embedding in low frequencies gained by WD (wavelet decomposition). Now first digital media is segmented into frames, Then discrete wavelet transform is applied to luminance element of each frame which outcomes into discrete sub bands. Again these bands are dissolved into discrete components. Now covariance matrix is calculated for each component. Now watermarked luminance component of the frames are gained by applying inverse discrete wavelet transform. Ultimately watermarked digital media is gained by renewing the watermarked frame [11].

Digital Watermarking: It allows for verifying the authenticity of digital media, like images, music or videos. Digital watermarks are frequently used for copyright protection and identifying illegally distributed content technically, a watermark is attached to a medium by embedding a pattern into the signal of the medium, such that the pattern is imperceptible and inseparable. A particular challenge for this embedding is the robustness of the watermark, which should persist under common media processing, such as compression and denoising. There exist several approaches for creating robust watermarks and we refer the reader to the comprehensive overview [12].

As an example, Figure 2 shows a simple watermarking scheme where a random pattern is added to the pixels of an image. The induced changes remain (almost) unnoticeable, yet the presence of the watermark can be detected by corre-lating the watermarked image with the original watermark.

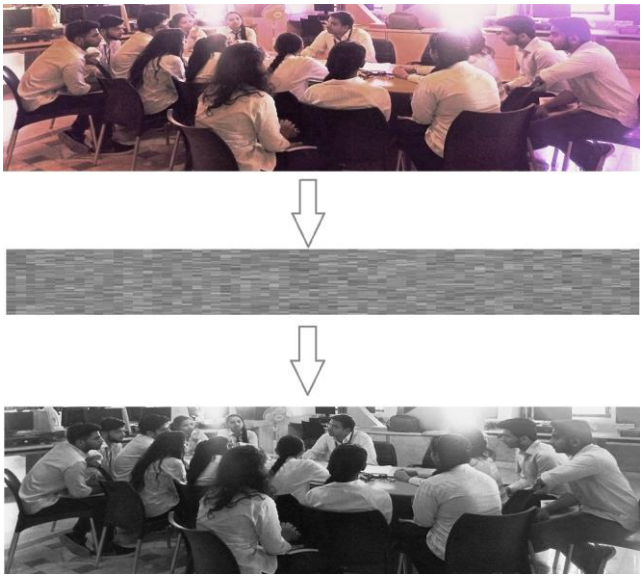

Figure 2. Example of a digital watermark. A random noise pattern is added to the image in the spatial domain. The pattern is not observable but detectable.

IV. CONCLUSION

Watermarking is a vast field and a lot of research is going on in this area. There are commercial players who are vying for dominance in this field. Though a clear-cut winner has not been declared yet, a combination of other cryptographic techniques (such as encryption) and watermarking together will definitely provide copyright protection for images. Depending on the intended requirements and the level of security required, an appropriate watermarking algorithm can be chosen.

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