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Digital Watermarking: Potential Challenges and Issues

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***Abstract*-In the era of technology, Editing, manipulation, copying of digital multimedia has become prevalent and becoming a serious issue in the present scenario. Digital watermarking is one of the solution to deal with this problem. It is a technique in which pattern of bits are embedded into the digital data in such a way that it do not hinder the actual data. Thus it maintains its reliability. Digital watermarking can be applied in the variety of application areas such as copyright protection, fingerprinting, broadcasting monitoring, copy protection, medical application. In the present review paper, the author is pointing out challenges and issues which occurred while this technique is applied.**

Keywords: **Digital Watermark, DWT, Imperceptibility, Robustness**

I .INTRODUCTION

Now-a-days, technology has made the transmission of data a walk in the park. Digital data transmission despite of becoming a boon for us in terms of high speed, low cost, easy editing of digital data, has also become a bane due to illegal copies. e.g.: unlimited number of illegal copies of movies, songs, photographs creates a serious threat to the rights of content owners. So one solution to protect intellectual Property right (IPR) is encryption. But this is not sufficient because encryption protects content only during the transmission of the data from the sender to receiver and after decryption, the data is no longer protected as it is freely distributed or manipulated. So Watermarking is another technique that complements encryption [17].Watermarking idea is implemented in bank currency notes, mark sheets, certificates, TV channel etc. in the visible form.

Digital watermarking is concealing of imperceptible data or watermark or pattern of bits or logo into digital file (Image, audio, video etc.). The basic principle behind the watermarking is that inserting watermark in such a way that it neither degrades the quality of media nor is perceptible. Watermarking is not only used for ownership protection but also used for tamper detection, content recovery and authentication.

Digital watermarking possess many characteristics. These are described as follow:

- Imperceptibility: change made to digital content is imperceptible. It do not loose visual quality.
- Robustness: Digital content is withstand against various attacks like rotation, scaling, translation, compression etc.
- Capacity: Amount of data is embedding in digital content.it is inversely related to robustness and imperceptibility.
- Security: capability of watermark is to withstand against malicious attack.

Digital watermarking is technique in which pattern of bits is embedded into original image or cover image or host signal with the help of algorithm called embedding algorithm and resultant is called watermarked image or stego image which is further attacked either intentionally or unintentionally that results in distorted image . At the receiver side, watermark is extracted with the help of extraction algorithm and get the extracted image. Quality is measured in terms of PSNR (peak signal to Noise ratio).

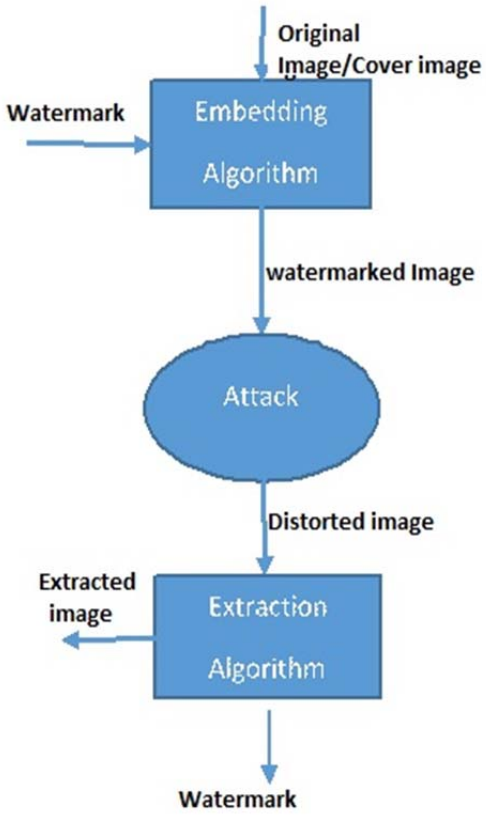

Fig 1: Digital Watermarking System

II. CLASSIFICATION OF DIGITAL WATERMARKING

Digital watermarking can be categorized into different ways and these are:

A. According to Domain

These are divided into two category.

- Spatial domain: watermark is actually placed in pixel value of cover signal.
- Frequency domain: watermark is inserted into transformed cover signal.

B. According to Extraction

These are segmented into three different categories.

- Blind Watermarking: Original image is not required at time of extraction of watermark. It is also called public watermarking,
- Non blind Watermarking: At the time of extraction, original watermark is required. it is also called private watermarking
- Semi blind: No requirement of original data for detection.

C. According to Human Perception

These are classified into three categories.

- Robust watermarking: embedded watermark (robust watermark) resist various attacks like cropping, image compression. It is used for copyright protection.
- Fragile watermarking: fragile watermark is destroyed if watermark content is slightly tampered. Absence of watermark symbolizes modification. [16]It is used in authentication, tamper detection. It is traditional authentication (hard, exact).
- Semi fragile watermarking: It resist against unintentional attacks but fragile against malicious attack. It do the selective authentication (soft authentication).It differentiate between malicious attack and non-malicious attack [14].

D. According to Data

These are classified into four categories.

- Text: watermark information embedded is in text data.
- Image: watermark is to embed is image.
- Audio: watermark is inserted in audio like mp3etc.
- Video: watermark is inserted in video files etc.

E. According to Vision

These are divided into two category.

- Visible: watermark is observable on digital media. e.g.: logo on mark sheet, bank currency note, on channel
- Invisible: watermark is not seen in host data.

F. According to Key

These are classified into two categories.

- Symmetric key: Same Key used is at the both site i.e. Embedding and Extraction.
- Asymmetric key: Different key is used at both ends.
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III. LITERATURE REVIEW

In this section we look into the review of digital watermarks used for digital media. It describes the previous work which had been done on digital watermarking by using techniques, including the analysis of various watermarking schemes and their results.

Giri et al. (2014) presented channel wise watermarking scheme for colored image based on DWT. In algorithm, level one DWT is applied on each distinguished color channel. The algorithm is robust against various attacks like Gaussian noise, JPEG compression, salt and pepper noise [1].Khanduja et.al (2014)[2] proposed robust multiple watermarking technique for relational database. He not only did ownership protection but also recovered the information .In 2014, Eswaraiah et.al [3] presented fragile ROI based medical image watermarking technique with tamper detection and recovery. In his algorithm Fragile watermark is stored in LSBs of ROI region and tempered information of ROI part is recovered without any loss. Run length encoding scheme is used to enhance the embedding capacity. Limitation of this algorithm is RONI part is not reversible.Joshi et al. (2014) [4] presented paper on secure medical image watermarking. In his paper he embed dual watermark. For the embedding, DWT and Arnold transform is used. It is used only on gray scale images. Both DWT and Arnold transform enhances the security.

Kaur et .al. (2013) [5] reviewed paper on image watermarking Using LSB. She worked on spatial domain technique. Philip et.al (2013) [6] evaluated Development of a New Watermarking Algorithm for Telemedicine Applications. Embedding of watermark is done in both DCT and DWT transform and their performance is evaluated. DCT and DWT is compared by taking different value of alpha. Watermark embedding is done in different decomposition level and analyzed. Ghosh et.al (2012)[7] evaluated a novel digital watermarking technique for copyright protection of video. In this paper he embedded both the invisible and visible watermarks. This increases robustness.DWT is used for embedding. This worked on gray scale and on video of uncompressed .avi format.[7].Naseem et.al (2012)[8]proposed robust watermarking technique for medical images which is resistant to Geometric attacks like rotation,scaling,translation.In his work main focus is on robustness rather than imperceptibility. In the algorithm, firstly image is made invariant against by statistical moment normalization then watermarked image is scrambled.

Bamatraf et. al. (2011) presented a new digital watermarking algorithm using combination of Least Significant Bit and inverse bit. He inversed the watermark data and embedded in image by taking different combination of LSB bits. This improves quality of image. [9]

Sridevi et.al. (2010) presented paper on secure watermarking based on SVD and wavelets. In this paper, after applying DWT, SVD is applied to middle frequency band and embedded watermark data by modifying singular values and robustness is improved [10]. In 2010, Sathik et.al. [11] presented **"**An Improved Invisible Watermarking Technique for Image Authentication". In this method, a

binary watermark pattern is constructed from host image itself and is disordered with the help of Arnold Transform. It provide imperceptibility, capacity and robustness. Watermark is robust against common image processing attacks such as additive noises, filtering, intensity adjustment, histogram equalization, JPEG compression, Scaling and rotation. Watermark extraction scheme is blind [11].A.M. Kothari et al. (2010) analyzed performance of Combined DWT–DCT over individual DWT.In this paper we reviewed an imperceptible and a robust combined DWT-DCT digital image watermarking algorithm. The combination of the two transforms improved the watermarking performance considerably when compared to the DWT-Only watermarking approach. [12]

Ping Dong et al. IEEE (2005) presented "Digital Watermarking Robust to Geometric Distortions. In this two watermarking approaches are described that are robust to geometric distortions. The first approach is based on image normalization, which is invariant against affine transform attack is public watermarking scheme and blind. The second approach is based on a watermark resynchronization scheme invariant against random nonlinear bending attacks is private watermarking scheme and non-blind. Numerical experiments demonstrate that the proposed watermarking schemes are robust to a wide range of geometric attacks [13].

IV. POTENTIAL CHALLENGES AND ISSUES

First issue is to maintain balance between imperceptibility, robustness and capacity as increasing one factor adversely effect on other and a good digital watermarking system possess above feature. To achieve good imperceptibility, watermark should be embedded in high frequency component whereas robustness occurs in low frequency component [18].

Other issue is Human vision system. In RGB color images, only blue color is less sensitive to hiding watermark. So, basically why only blue color not others.

Another one is in fragile watermarking, content recovery against cropping is challenging issue. As in fragile watermarking, slightly distortion results in destruction of watermark.

Next one is payload size, payload size is how amount of information it carries. As more is payload size, it compromises with the imperceptibility. So, issue is how to maintain equilibrium [15].

Next issue is robustness in spatial domain [15]. As in spatial domain, there is change in pixel values. It is hardly resist against various attacks like JPEG compression, high pass filtering, low pass filtering, cropping etc.

Other issue is computational cost i.e... Cost of inserting and detecting watermark that should be minimized [17]

Next issue is false positive Rate which is important property of digital watermarking system.

Other issue is to design universal technique for all the digital media that is robust against various type of attacks.

V. CONCLUSION

In this paper, Firstly review of classification of Digital watermarking is done based on different criteria like domain, extraction, application, data, vision, key and the previous work is evaluated. It mainly emphasized on challenges and issues while applying the digital watermarking techniques. This helps in providing the information about digital watermarking to researchers.

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