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A Comparative Study Of Digital Image Watermarking With Its Types And Techniques

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Abstract*—In this study, we presented a study of digital watermarking with its techniques and types. Image Watermarking is being seen as a forthcoming answer for security. At the present time, there is a wide range of watermarking plans have been proposed. This paper gives an exhaustive audit of the current calculations that have been produced and their usefulness.There is a key to check of the information and the proprietor. It hosts produced for pernicious gatherings to make open duplicates of copyrighted substance with any reward to the substance propriety.We focused on the watermarking techniques, types and its applications in this survey.
Keywords: Image Watermarking; Techniques; Watermarking Types; Applications

I. INTRODUCTION

The term advanced watermarking initially showed up in 1993, when Tirkel exhibited two installing techniques to emit the mystery information in the picture depictions [1]. In present years, as computerized media [3] are increasing more extensive prominence, their wellbeing joined inconveniences are proper a more noteworthy concern. Image watermarking is a method which permits a person to add patent notices or other confirmation mails to digital media. Image confirmation is one of the uses of computerized watermarking, which is utilized for confirming the advanced picture. The objective is not to protect the contents from being copied or stolen, but is to provide a method to authenticate the image and assure the integrity of the picture. The major disadvantage of digital signature is that it can identify if a picture has been customized, but it cannot situate the areas where the picture has been customized. To resolve this difficulty, many explorers have proposed watermarking based schemes for image authentication. The achievement of the Internet, savvy and prominent computerized recording and stockpiling gadgets, and the guarantee of higher data transfer capacity and nature of administration for both wired and remote systems have made it conceivable to make, duplicate, transmit, and circulate advanced substance in an easy way. The security and authorization of scholarly products to rights for advanced medium has turn into a noteworthy issue [3].

II. WATERMARKING PRINCIPLE

The digital watermarking system primarily characterized into three steps [2]
Embedding
Distribution
Extraction or Detection
In the procedure of implanting, it insider facts the information, i.e. both a photo or sound is dug in into a bearer information which might a picture or feature, utilizing a key. Then this dug in information is appropriated from side to side a lossless or lossy channel, which is known as a distribution. The third step is relying upon the creator, when the lifestyle of the spot sign can be distinguished through the host information with perceived key is known as a location. At the same time, when the marker information is improving from the discharged information utilizing the no doubt understood transporter information and key is known as extraction.

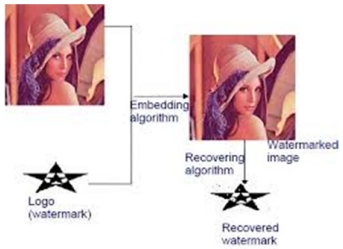

Fig1. (General Overview of Watermarking Process)

In this segment the computerized watermarks, highlights, their procedures and application are grouped and portioned into different classification:

A. Characteristics

1) Robust: Robustness watermarking is essentially used to sign copyright data of the advanced works, the implanted watermark can oppose the regular alter preparing, picture handling and lossy pressure, and the watermark is not decimated after some assault can at present be recognized to give confirmation. It opposes different assaults, geometrical or non-geometrical without influencing implanted watermark.

2) Fragile: Fragile watermarking is mostly utilized for uprightness assurance, which must be exceptionally delicate to the progressions of the sign. We can figure out if the information has been altered by condition of delicate watermark.

3) Semi Fragile: Semi delicate watermarking is fit for enduring some level of the change to a watermarked picture, for example, the expansion of quantization clamor from lossy compression.

B. According To Appended Media

1) Watermarking In Image: It is utilized to disguise the exceptional data into the photo and to thereafter notice and take out that unique data for the creator's proprietor.

2) Audio Watermarking: It is one of the largest parts of watermarking and hot problem due to internet music, MP3.

3)Text Watermarking: It adds watermark to the DOC, PDF and other content record stop the progressions made to the content. The watermark is installed in the text style figure and the space stuck in the middle of characters and line spaces.

C. Perceptivity

1) Visible Watermark: The watermark that is unmistakable in the computerized information like stamping a watermark on paper, (ex.) TV stations, as HBO, whose logo is obviously superimposed toward the edge of the TV picture.

2) Invisible Watermarking: There is learning available which can put in substance into a photo which can't be seen, yet can be cross-examined with the right programming. You can't obstruct the burglary of your pictures thusly, yet you can demonstrate that the photo that was stolen was yours, which is as high quality.

D. Requirement

1) Copyright Protection Watermarking: This implies, if the proprietor need others to see the characteristic of the picture watermark, then the watermark can be seen in the wake of adding the watermark to the picture, and the watermark still exists regardless of the possibility that it is assured.

2) Anti-Counterfeiting Watermarking: It is added to the building procedure of the paper notes and can be distinguished subsequent to printing, examining, and different procedures.

3)Anonymous Mark Watermarking: It can cover up vital annotation of private information and limit the illicit clients to get secret information.

E. Types Of Watermarking

1) Noise Type: There are many types of noise: Gaussian repetitive sound, clamor and disorderly arrangements .

2) Image Type: There are paired picture, stamp, logo and name .

F. As Per Area/Domain:

Domain	Spatial domain	Frequency domain
Calculation Price	Low	High
Robustness	Fragile	More Robust
Computational complexity	Low	High
Execution Time	Less	More

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III. TYPES OF WATERMARKING

A digital image watermark is recognizing path data to be ensured .Watermarking systems can characterize into a few classifications (see in Fig2types of watermarking) for instance, watermarking can do in the spatial area and the recurrence space.

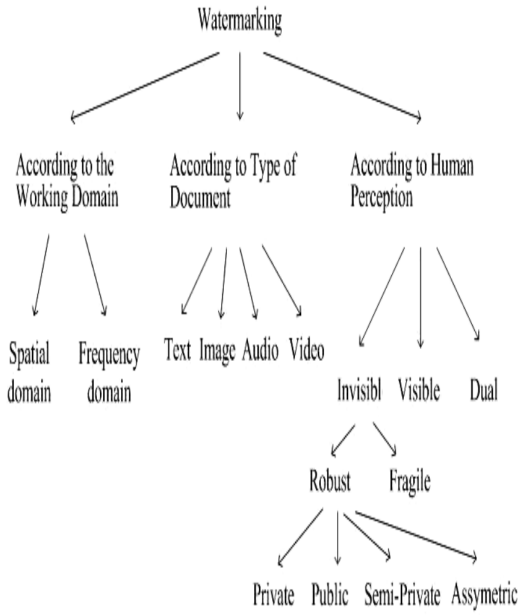

Fig2. Types of Watermarking

Watermarking procedures can order into the accompanying four classes as per the sort of the media report to watermark. As per the human observation, advanced watermarks can order into three distinct classifications like - Visible watermark, Invisible Robust watermark, Invisible Fragile watermark, Dual watermark.[4]

IV. TECHNIQUES OF DIGITAL WATERMARKING

The WDT (Discrete Wavelet Transform) parts a picture into four segments, a lower determination rough guess picture (LL) a level (HL), a vertical (LH) and a slanting (HH) subtle element part .The procedure can then be rehashed to figure different "scale" wavelet decompositions.One of the numerous points of interest of the wavelet change is that it is expected to additional precisely speak to parts of the Human Visual System when contrasted with the FFTor DCT. This permits us to utilize propelled vitality watermarks in zones that the Human Visual System is no doubt understood to be less defenseless to, for example, higher determination point of interest groups (LH,HL,HH).Embedding watermarks in these districts permit us to expand the vigor of our watermark, at next to zero included accident picture quality.

Singular Value Decomposition (SVD) deteriorates a grid C into one singular S and two orthogonal matrices - U and V - such that $UTU = I$, $V\,T\,V = I$ and S= diag(σ1, σ2, ...). Here, I represents identity matrix, (σ1, σ2, ...) is called the singular values of C, U are called left singular values of C, and V are called right singular values of C.

$$C = USV' \qquad (1)$$

There are several important and attractive properties of SVD, such as good stability, invariance to scaling, transpose, rotation and flipping. Inferable from these great properties, the watermark can be removed successfully from the possibly assaulted watermarked sign when it is aggravated by scaling, pivot and so forth.

Algorithms	Advantages	Disadvantages
Least Significant Bit	1. It is simple to implement and know 2. Little debasement of picture quality	2. Vulnerable to noise 3. Defenseless against editing, scaling .

Texture mapping coding	1. This technique conceals information inside of the ceaseless irregular surface examples of a photo.	1. This calculation is suitable for those zones with a substantial number of subjective surface pictures.
DWT	1. Permits great quality confinement similarly in time and spatial recurrence space 2. Higher compression ratio, which is pertinent to human recognition.	2 .Longer density time. 3. Noise near to edges of pictures or feature outlines.
SVD	It reduced the number of degrees of freedom in a complex system	Expensive

Table1. Comparative Analysis of Watermarking Techniques[5]

V. APPLICATIONS OF DIGITAL WATERMARKING

A. Content Labeling

Watermarks can be used to give more information about the cover object. This process is named as content labeling.

B. Tamper Detection

Fragile watermarks can be used to detect tampering in an image. If the fragile watermark degrades in any way, then we can say that the image or document in question has been tampered.

C. Digital Fingerprinting

This is a process used to detect the owner of the content. Every fingerprint will be unique to the owner.

D. Content protection

In this process the content stamped with a visible watermark that is very difficult to remove so that it can be publicly and freely distributed.

VI. LITERATURE REVIEW

Sheetal Sharma (2012), Inside organize to get better the forcefulness and effectiveness of the mechanism, a new embedding and extracting technique with DWT-SVD is proposed. The approximation matrix of the 3 stage of representation in DWT domain is customized with SVD to set in the remarkable importance of watermark to the extraordinary cost of DWT coefficient. The planned embed and extract technique was in employment to accelerate the mixture of DWT-SVD watermarking and to stay away from the giveaway of watermark. This mixture technique leads to optimize in cooperation the essentially incompatible necessities. The experimental outcome shows both the good robustness under numerous attacks and the high faithfulness. The instance needed to execute the agenda is greatly decreased. [6]

Ye Xueyi-In this system, the inscribed circle of the carrier picture matrix is chosen as the ZM computation region, and the four-

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sided figure of the inscribed sphere is chosen to implant watermark. First of all, the embedding area is conducted in one-level WDT and the low frequency WDT coefficient is separated into non-overlapping blocks; SVD is practical to each block. In the second step, a bit of the watermark is entrenched during small modifications of the singular value (SV) template in every chunk. In the last step, a number of chosen ZM of the embedded image are saved to detect and accurately the feasible geometric attacks. The model has proved that the proposed is not just has good resistance to rotation, scaling attacks, and as well, kinds of ordinary signal processing, and can attain blind extraction.[7]

Kazutake Uehira (2014)-In this paper, it describes a newly feature to evaluating the healthiness of the visual watermarking technique; it is an exclusive knowledge that can add watermarked info to the object picture taken the data with digital cameras lacking some unambiguous additional hardware architecture. On the other hand, since this equipment using the light with surrounded watermarked information, in this irradiated on object imagery, the truthfulness within embedded watermarked data can be detected. [8]

Ravinder Singh (2013)-in this paper Picture Watermarking is finished by selecting a shading of the picture, single shade element beginning RGB (Red, Green, and Blue) system shade of the picture. Which is Watermark embeds into any picked area and after that again and again converges with other component. The R (Red) Component shading assumes an essential part to the at hand the shading question far beyond it is difficult to the keep up data associated by the method for it. Accordingly, in this study, R (Red) module is wanted to disguise watermark. This proposed is more secure in light of the fact that the inserted watermark must be hauled out from the Red module subsequent to deteriorating Watermarked Image into RGB component, other instrument which is (i.e.Blue and Green) does not contain any data on the subject of the Watermark. [9]

Hao-Tang Chan (2013)-in this paper, it presented a novel reversible easily broken watermarking algorithm for hologram confirmation. In this paper algorithm, the watermark is implanted in the makeover field the noticeable hologram be subsequently stored the spatial playing field with a limited declaration stage. The declaration level is allowable to be prespecified for attaining dissimilar degree of intelligibility. The algorithm is based on Hadamard transform on behalf of in cooperation watermark embed and taking away. The Hadamard transform and its opposite is capable of operating through straightforward estimate, subtraction and re-allocate operations. Due to the effortlessness of the transform, a satisfactory condition on the declaration level of marked holograms is derivative for guarantee the reversibility of watermarking.[10]

Mr. Atul Barve (2014)-The paper proposed a color image embedding system based on the encrypted watermark with QR code and DWT. In this study, they are running on the protection enrichment of digital watermarking method with the latest QR codes. The proposed technique creation digital watermarking method more safe and robust addition encryption of watermark being fixed in the carrier figure. The benefits of this proposed algorithm are the watermark is totally unseen in the original image as well as the encryption procedure is quite easy but robust in the environment .The recovered watermark is about nearest the key watermark. The experimental results show that the proposed algorithm enhances the anti- attack ability and the concealed environment of the image, enhances the safety of the watermarking detection, and has highest robustness to cutting, random noise hit and JPEG compression. [11]

VII. PERFORMANCE EVALUATION

We will evaluate our proposed method by using the peak signal-to-noise ratio (PSNR) as the metric for image quality.
Let P be the original image and Q be the noise image with size $m \times n$. We define the mean square error (MSE) as follows, where i, j are image coordinates, $P(i, j)$, and $Q(i, j)$ is the pixel value (luminance value) at point (i, j).

$$\text{MSE}=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[P(i,j)-Q(i,j)]\text{ ^2} \quad (2)$$

$$\text{PSNR}=10\log_{10}\frac{MAX(P)}{MSE} \quad (3)$$

VIII. CONCLUSION

In this paper, we provide a comprehensive survey on various digital watermarking techniques, their requirements, their properties, types and applications. Digital watermarking research has commonly concerned with two types of watermarks, friable and strong. In the robust watermarks, they are made to be detected even after trying to remove them. Friable watermarks are used for verification purposes and are able of detecting still minute variations of the watermarked content. When allowing for "information preserving" transformations which reserve the sense or the appearance of the information transformations which change the look of the content. For solving this type of difficulty a semi fragile watermark has imagery that can identify content altering transformations yet after the secreted info is subject to information preserving alterations has to be used.

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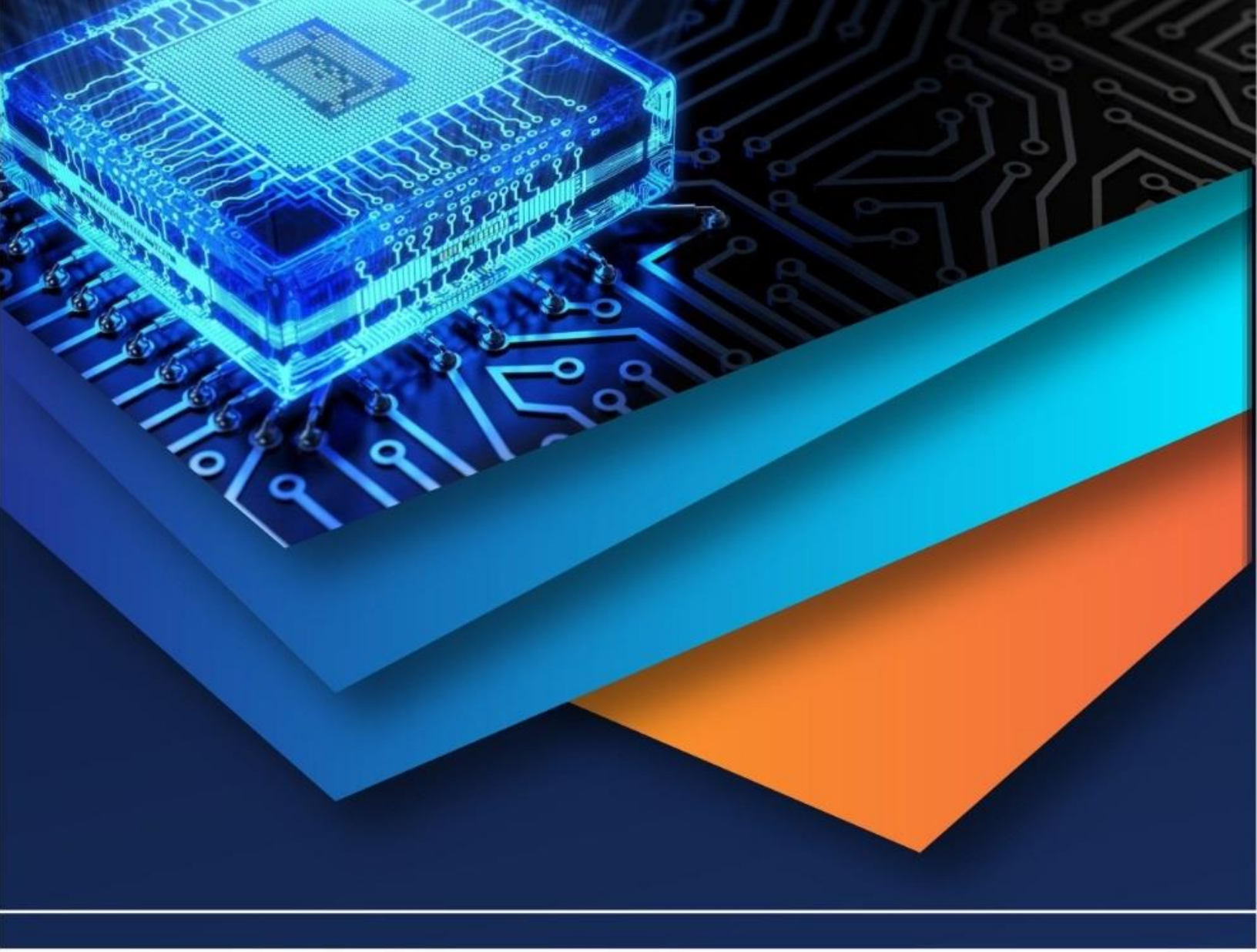

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