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A Survey on Spread Spectrum Methods for Image Watermarking in Noisy Environment

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Abstract: Digital photos have a crucial role each in normal of living applications like resonance imaging, television, portable computer picturing, optical character recognition , Universal Product Code reader, Watermarking still as in areas of analysis and technology like geographical information systems and natural science. Watermarking is basically the maneuver of passing information, noted as a watermark, in a} very cover image. The aim of watermarking is to avoid drawing suspicion to the transmission of the watermark, whereas providing some tons of price to the covering media. Watermarking encompasses ways that during which of transmitting secret messages through innocuous cowl carriers in such the only technique that the really existence of the embedded messages is undetectable. inventive ways that within which are devised among the activity technique to cut back the visible detection of the embedded messages. Spectrum technique below discrete wavelet transform (DWT) Domain. Watermarking theme quality is set by transparency and capability.

I. INDRODUCTION

Digital image process is outlined because the processing of 2 dimensional pictures by a electronic computer [15, 18].An image is processed as quickly as we have a tendency to begin extracting facts from it. The facts of interest in seeing systems are those associated with the article underneath investigation. a picture typically goes through some enrichment steps, so as to enhance the extractability of attention-grabbing knowledge and alternative data. The term "Digital Watermark" was coined by saint Tirkel and Charles dramatist in Gregorian calendar month 1992. the primary winning embedding and extraction of a steganography unfold spectrum watermark was incontestable in 1993 by saint

Tirkel, Charles dramatist and Gerard political leader [15].

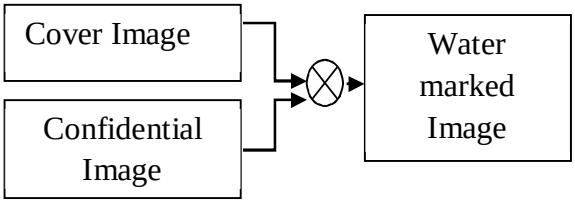


Fig 1: Basic Watermarking

A. Digital Watermarking

Like ancient physical watermarks, digital watermarks are sometimes exclusively perceptible below certain conditions, i.e. when victimization some rule.[14]

If a digital watermark distorts the carrier signal in a {very} very implies that it becomes simply perceivable, it's reaching to be thought of less effective depending on its purpose.[14] ancient watermarks is additionally applied to visible media (like photos or video), whereas in digital watermarking, the signal is additionally audio, pictures, video, texts or 3D models. a signal may carry several entirely completely different watermarks at the identical time.

Spectrum technique follows discrete wavelet Transform (DWT) Domain. Watermarking theme quality is decided victimization robustness, transparency and capability.

Transparency suggests that once insertion of watermark the first image should not be distorted . robustness is expounded to attacks. If watermark removal is hard to varied attacks like rotation, scaling, compression, noise then watermarking theme is powerful. capability suggests that the quantity of data inserted into the first image.

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B. Types of Watermarking

Watermarking can be broadly divided into 2 categories

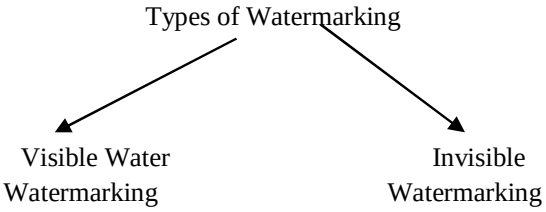


Fig 2 : Types of watermarking Technique

1) *Visible Watermarking:* Visible watermark is Associate in Nursing opaque or semi-transparent sub-image or image that's placed on prime of another image (that is watermarked) thus is evident to the viewer. Associate in Nursing example: a emblem placed by TV networks. sometimes performed at intervals the abstraction domain[11].



Fig 3: Visible watermark image

2) *Invisible Watermarking:* Invisible watermarks can't be seen with the attention but they'll be recovered with associate degree applicable secret writing formula. The property is assured by inserting them as visually redundant data (something that human sensory system doesn't perceive): watermarked image once top of the range JPEG compression and additionally the extracted watermark.



Fig 4: Invisible watermark image

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II. LITERATURE SURVEY

The purpose of literature survey is to explore all the past analysis works performed at intervals the concerned analysis topic; therefore new ideas area unit typically generated for future work. . In log-2-spatio domain, the variance of the information is reduced considerably[3]. This improves the potency and strength of unfold spectrum technique. Low intensity and mid-band regions area unit elite to enter the info thus on guarantee Associate in Nursing invisible watermark in addition as a results of the strength to JPEG compression. Simulation results show that the embedded information still survive up to the JPEG compression relation of fourteen.7 [1].A secure (tamper-resistant) algorithm for watermarking footage, and the way for digital watermarking that is ready to be generalized to audio, video, and transmission knowledge. we've got an inclination to tend to advocate that a watermark ought to be created as associate freelance and identically distributed (IID) mathematician random vector that is unnoticeably inserted in a very spread-spectrum-like fashion into the perceptually most vital spectral parts of the info. [2]. Watermarking is also a very active analysis field with several applications. although it is a relatively new field, it's created very important algorithms for activity messages into digital signals. a pair of broad categories for these models were diagrammatic throughout this essay[6]. A portable computer data system and the way to grasp the protection of the information in it with digital watermarking. the way for unfold spectrum watermarking is given and its realization with MATLAB 0.5 twelve.5 [9].Then we've got an inclination to embed the watermark within the work on image or within the transformation coefficients. Finally, we've got an inclination to require the inverse work on to induce the watermarked image [7]. usually used work on domain ways area unit separate function work on (DCT), separate riffle work on (DWT), and separate Fourier work on (DFT) [7]Image quality assessment is also a standard downside for many applications along side image restoration, coding, additional as watermarking. Image quality metric area unit typically classified into full reference (FR), reduced reference, and no reference, keep with the availability of the distortion free image [8], which might be used as a result of the connation price the distorted counterpart. The Fr metric can offer the plenty of reliable assessment relating to the annoyance introduced by watermark. PSNR and weighted PSNR (WPSNR) [9,10,11] area unit presently the foremost usually used for watermarking, due to their simplicity. A new approach supported spread-spectrum technique at a lower place separate riffle domain has been introduced. Chen et. al. [12] planned a watermarking technique supported the frequency domain. A changed algorithmic program is conferred to enhance the defect of the JPEG quantification so as to scale back the bit error rate (BER) of the retrieved watermark. additionally, 2 parameters known as dominant factors area unit wont to alter the worth of the DCT constant so as to trade-off the qualities between the watermarked pictures and retrieve watermark. Moreover, the planned algorithmic program is style as a blind mechanism. Thus, the first image and watermark aren't required for extracting watermark. Frequency domain techniques have established to be simpler than spacial domain techniques in achieving high strength against attacks and might insert a lot of bits of watermark. a short description of some frequency domain techniques for image authentication is represented below. Wang H. et al.[13] planned a chaotic watermarking theme for authentication of JPEG pictures. The quantity DCT coefficients when entropy secret writing area unit mapped to the initial values of the chaotic system, and so the generated watermark info by chaotic iteration is embedded into JPEG compressed domain. Requantization operation doesn't invalidate tamper detection because of direct modification of DCT constant when quantization. Extraction is additionally performed within the compression domain.

Extraction is quick and complexness of methodology is claimed to be low. Kannammal et.al.[14] planned a digital watermarking framework during which the medical instrument (ECG) and Patients demographic text ID act as double watermarks. By this methodology the medical info of the patient is protected and mismatching of diagnostic Communication-based models area unit typically extra divided into people who use side-information and other people that don't. Chen et al. [15] planned 2 DWT-based audio watermarking algorithms that one in every of them is predicated on improvement theme mistreatment group-amplitude quantization and therefore the alternative embeds info by energy-proportion theme.

Therefore, normalized energy is employed rather than likelihood that rewrites the entropy in scientific theory as energy proportion operate. Preda et al. [16] planned 3 DWT-based video watermarking approaches during which the watermarks used area unit binary pictures. Although, in one in every of them a unfold-spectrum technique is employed to spread the ability spectrum of the watermark knowledge, within the 2 others, watermarking ways area unit supported a mixture of unfold spectrum and quantisation. Deng and Jiang [17] planned a DWT-based image watermarking algorithmic program during which the code-division multiple access (CDMA) encoded binary watermark, adaptively is embedded into the third level detail sub-band of DWT domain.One example system was accustomed illustrate non-side-information models, and a couple of example systems were accustomed illustrate side-information models. [19,20].

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III. WATERMARKING METHODS

There are some ways within which at intervals which we'll model a watermarking methodology. [13]

A. *Communication-Based Models*

Communication-based models describe watermarking really suggests that very nearly just like the ancient models of communication systems. Watermarking is in fact a way of human activity a message from the watermarking embedded to the watermarking receiver.

B. *Checksum Technique*

In this approach [1], a watermark is formed from the checksum value of the seven most significant bits of all pixels. A checksum is the modulo-2 addition of a sequence of fixed length binary words which is a type of hash function. This technique randomly chooses the locations of the pixels that are to contain one bit of the checksum. The pixel locations of the checksum together with the checksum value form the watermark which must be kept secret. To verify the watermark, the checksum of a test image is obtained and compared to the watermark.

C. *Wavelet Transform based Watermarking*

The wavelet transform based watermarking technique divides the image into four sidebands – a low resolution approximation of the tile component and the component's horizontal, vertical and diagonal frequency characteristics. The process can then be repeated iteratively to produce N scale transform.

D. *Blind Embedding And Linear Correlation Detection*

This system is Associate in Nursing example of blind embedding, that doesn't exploit the primary image statistics to implant a message during a image. The detection is completed exploitation linear

E. *Watermarking with side-Information*

Some of the weaknesses of systems that don't exploit side-information were known by the blind embedding example system. The lustiness and effectiveness of the watermarking methodology is also greatly increased by taking advantage of the initial image information throughout the.

F. *Predictive Coding Schemes*

Predictive coding scheme was proposed by Matsui and Tanaka in [18] for gray scale images. In this method the correlation between adjacent pixels are exploited. A set of pixels where the watermark has to be embedded is chosen and alternate pixels are replaced by the difference between the adjacent pixels.

G. *Least Significant Bit Coding (LSB)*

LSB coding is one of the earliest methods. It can be applied to any form of watermarking. In this method the LSB of the carrier signal is substituted with the watermark. The bits are embedded in a sequence which acts as the key. In order to retrieve it back this sequence should be known. The watermark encoder first selects a subset of pixel values on which the watermark has to be embedded. It then embeds the information on the LSBs of the pixels from this subset.

H. *Spread Spectrum Technique*

Spread spectrum technique has been used for watermarking in [1]. For convenience, we tend to use the identical image printed in [1]. according to [1], to introduce barely sequence of m bits, the image is equally metameric to m reciprocally exclusive regions. each region responses to store one bit knowledge. as an example, if the length of the bit sequence is four, the image are visiting be divided as shown in Figure one. The jth little of the bit sequence, diagrammatic by the image aj, is printed in eqn. 1: The image aj, is then unfold by associate degree large issue number twenty four, noted because the clip rate, to induce the unfold sequence bi: The unfold sequence is modulated with a binary pseudo-random sequence pi and amplified by a component aj, yielding the watermark sequence wi: The watermark sequence is then any to the image vi, to make the watermarked image : The watermark embedding technique are usually pictured in Figure 6.

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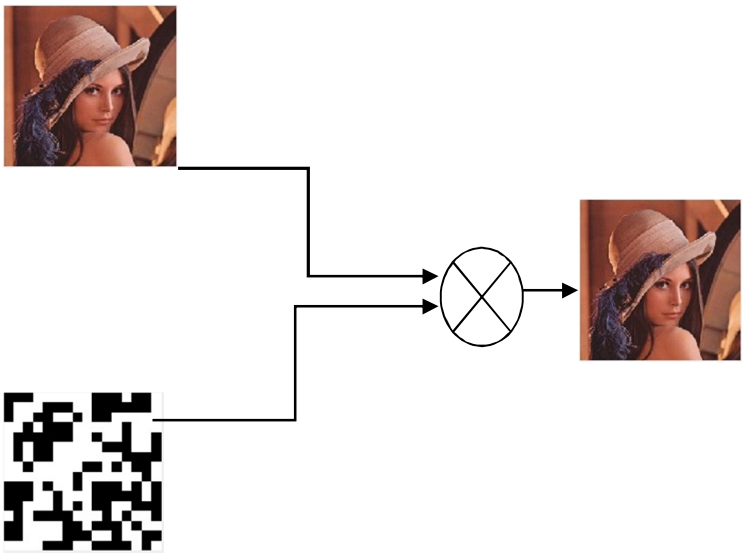


Figure 6: Visualization of the embedding process

The embedded bit are usually decoded by just figure the sign of the correlation total between the watermark sequence and thus the corresponding pseudonoise sequence. The decoded jth bit, denoted by , is figure by the next eqn. To decipher the correct knowledge, the amplification issue a j should be large enough that the second term is larger than the first term in Eqn. seven therefore on make sure the decoded bit is that the identical as a result of the embedded bit. However, associate degree outsized aj implies low signal/noise quantitative relation ratio (SNR). as a result of the amplitude of the embedded watermark is freelance of the intensity of thepixels, the SNR are usually really low for those pixels with low intensity. Moreover, if the watermark sequence is embedded among the regions with high frequency, the watermark may even be removed once the compression method. As a result, the embedded bit sequence may not survive if the watermarked image is compressed at low bit rate. to resolve this drawback, we've got an inclination to projected to embedded the bit sequence within the log-2-spatio domain within the regions consisting in the main of mid-band frequency[5].

To insert a watermark among the frequency domain of an image we tend to should always initial apply DCT (Discrete cosine Transformation). this can be often an everyday due to represent an image in frequency domain [9]



Figure7: Original image without watermark



Figure 8: Image with watermark using spread spectrum technique

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IV. CONCLUSION

Watermarking could be a terribly active analysis field with lots of applications. Spread-spectrum technique below separate ripple domain has been introduced. The experimental results show that PSNR has been improved which implies higher quality watermarked image has obtained. 2 dimensional modulation mistreatment P Northogonal sequences permits to get high strong system with extremely reconciling system with combination of used domain and embedding areas so as to face up to the bulk of attack and guarantee the copyright protection. As we will see that digital watermarking is incredibly helpful technique for digital information authentication. It ensures the protection of copyright and authentication. This paper offers associate degree overall analysis of assorted sorts of digital watermarking strategies and recommends the use of spread spectrum water marking in noisy environment.

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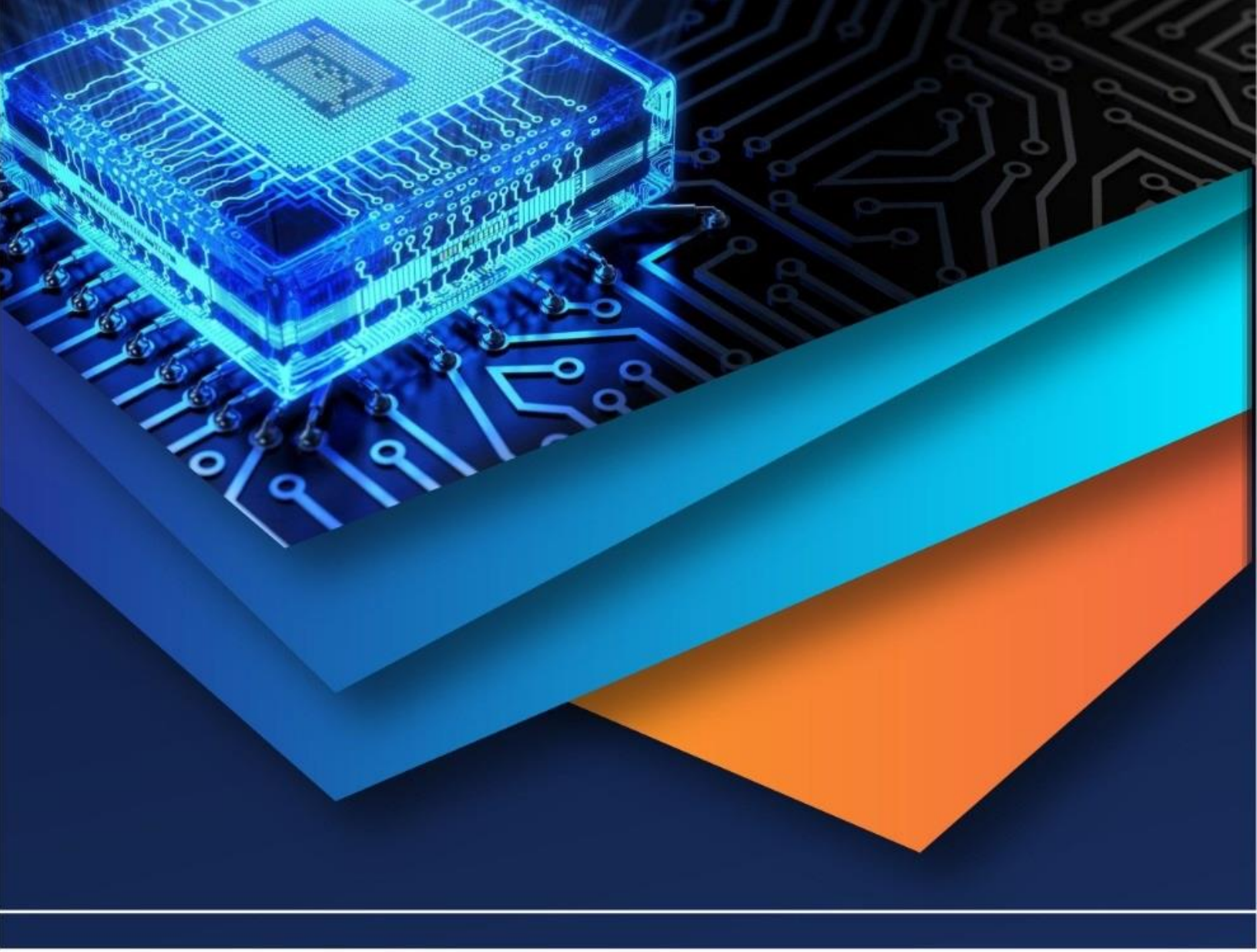
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