EVALUATION OF DIGITAL IMAGE WATERMARKING TECHNIQUES

[1]Anil Jaswal, [2]Leena Jain, [3]Amit Puri, [4]Malti Puri, [5]Manbir Kaur, [6]Jyoti Sharma

[1,2,3,6] Department of Computer Applications, Global Group of Institutes, Amritsar (Punjab), India
[4] Department of Electronics & Communication Engineering, Global Group of Institutes, Amritsar (Punjab), India
[5] Department of Pharmacy, Global Group of Institutes, Amritsar (Punjab), India

***Corresponding Author: -**
Prof. (Dr.) Leena Jain
Head-Department of Computer Applications
Global Group of Institutes, Amritsar (Punjab)
Email id: Leenajain79@gmail.com

Abstract

The advancing world of digital multimedia communication is facing problems linked to security and authenticity of digital data. The data security term is described as protecting information or digital data against any attack that may be performed by utilizing different attacking technologies, methods and techniques. A watermark system is reported to be secure, if the hacker cannot take away the watermark without full knowledge of embedding algorithm, detector and composition of watermark. This paper has shown the survey on image watermarking and its various techniques. From the survey it has been concluded that none of the technique performs effectively in all fields.

Keywords— *CZT, DWT, Image Watermarking, Negative Selection Algorithm, SVD***.**

INTRODUCTION

Digital watermarking conceal the copyright data into the advanced information through certain calculation. The mystery data to be settled can be some content, creator's serial number, organization logo, images with some uncommon significance. This mystery data is settled to the computerized information to guarantee the security, information validation, distinguishing proof of manager and copyright insurance. The watermark can be covered up in the computerized information either noticeably or imperceptibly. For a solid watermark inserting, a great watermarking method is expected to be connected. Watermark can be implanted either in spatial or recurrence area. Both the areas are diverse and have their own upsides and downsides and are utilized as a part of distinctive situation.

Spatial domain: This area concentrate on changing the pixels of maybe a couple arbitrarily chose subsets of images. It straightforwardly stacks the crude information into the image pixels. Some of its calculations are LSB, SSM Modulation based strategy. Spatial calculations have low unpredictability and they are anything but difficult to execute.

Frequency domain: This method is additionally called change area. Values of specific frequencies are changed from their unique. There are a few normal utilized change space systems, for example, DCT, DWT, and DFT. The recurrence area watermarking has higher computational expense, it has ended up being more vigorous and impalpable than the spatial space watermarking. A watermarking framework is partitioned into three particular steps, inserting, assault and discovery. In inserting a calculation acknowledges the host and the data to be inserted, and produces a watermarked sign. The yield of the watermarking plan may be the watermarked image. A VLSI structural engineering is likewise utilized that may embed obvious watermarks in images.

FEATURES OF DIGITAL WATERMARKING

Various features of watermarking are as follows:

Robustness: Robustness refers to that the watermark fixed in data has the ability of existing after a variety of processing operations and attacks. Then, the watermark must be robust for general signal processing operation, geometric transformation and hateful attack.

Imperceptibility: Watermark can't be seen by human eye or not be heard by human ear, just be distinguished through uncommon transforming or committed circuits. It can be recognized by an approved office just. Such watermarks are utilized for substance or creator verification and for identifying unapproved copier.

Security: A watermark framework is said to be secure, if the programmer can't uproot the watermark without having full learning of installing calculation, locator and structure of watermark. A watermark ought to just be open by approved gatherings. Watermark data possesses the remarkable right sign to distinguish, just the approved clients can legitimately

recognize, concentrate and even adjust the watermark, and along these lines have the capacity to accomplish the motivation behind copyright assurance.

Verifiability: Watermark ought to have the capacity to give full and dependable proof to the responsibility for ensured data items. It can be utilized to figure out if the item is to be ensured and screen the spread of the information being secured, distinguish the genuineness, and control illicit replicating.

APPLICATIONS OF DIGITAL WATERMARKING

Copyright protection: Advanced watermarking is utilized to distinguish and secure copyright rights. Computerized substance can be inserted with watermarks portray metadata distinguish the copyright holders.

Copy protection: Digital substance can be watermarked to determine that the advanced substance can't be unlawfully PC created. Gadgets equipped for duplicating can then distinguish watermarks and maintain a strategic distance from unapproved replicating of the substance.

Digital right management: Digital right management (DRM) can be characterized as ―the portrayal, recognizable proof, exchange, ensuring, checking, and following of all types of uses over substantial and impalpable property. It concerns the administration of advanced rights and the authorization of rights digitally.

Access control: Distinctive cost qualifies the clients for have diverse benefit (play/duplicate control) on the article. It is alluring in a few frameworks to have a duplicate and utilization control instrument to anticipate unlawful duplicate of the substance or cutoff the quantity of times of duplicating. A strong watermark can be utilized for such reason.

Medical application: Names of the patients can be imprinted on the X-beam reports and MRI outputs utilizing methods of unmistakable watermarking. The medicinal reports assume a critical part in the treatment open to the patient. In the event that there is a misunderstanding in the reports of two patients this could prompt a disaster.

Image and content authentication: In an image confirmation application the point is to distinguish changes to the information. The attributes of the image, for example, its edges, are altered and contrasted and the current images for contrasts. An answer for this issue could be enlisted from cryptography, where advanced mark has been examined as a message confirmation system. One sample of computerized mark innovation is utilized for image validation is the dependable advanced camera.

IMAGE WATERMARKING TECHNIQUES

Discrete Wavelet Transform (DWT)

Wavelet Transform is a cutting edge procedure typically utilized as a part of advanced image preparing, pressure, watermarking and so forth. The changes are in view of little waves, called wavelet, of shifting recurrence and constrained span. The wavelet change deteriorate the image into three spatial bearings, i.e. even, vertical and slanting. Henceforth wavelets mirror the anisotropic properties of HVS all the more particularly. Greatness of DWT coefficients is bigger

in the most minimal groups (LL) at every level of decomposition and is littler for different groups (HH, LH, and HL). The fundamental thought of discrete wavelet change in image procedure is to multi-separated break down the image into sub-image of diverse spatial space and autonomous frequencies.

Singular Value Decomposition (SVD)

Singular value decomposition is a direct variable based math method used to take care of numerous numerical issues. The hypothetical foundation of SVD procedure in image preparing applications to be perceived is:

a) The SVs (Singular Values) of an image has great consistency, which implies that when a little value is added to an image, it doesn't influence the quality with extraordinary variety.

b) SVD has the capacity ingeniously speak to the inherent mathematical properties of an image, where solitary values convey to the brilliance of the image and particular vectors reflect geometry attributes of the image.

c) An image medium has numerous little solitary values contrasted and the first particular value. Yet overlooking these little solitary values in the recreation of the image does not influence the nature of the remade image.

Chirp Z-Transform (CZT)

CZT is a calculation for assess the z-change of a sign. Z-area exchange capacities can be calculated into polynomials with posts and zeros as its roots, where shafts show the crest vitality amassing of the recurrence range and zeros model the troughs of the recurrence spectrum.CZT has the capacity of assessing the z-change at focuses both inside and outside the unit circle. It likewise has the capacity of recognizing the central recurrence, as it can zoom the examined recurrence range with a high determination.

The three principle utilization of peep z-change are:

1. Enhancement of poles.
2. High determination, tight band recurrence investigation.
3. Time addition or test rate evolving.

Negative Selection Algorithm

At the point when another antibody is created, the quality fragments of diverse quality libraries are haphazardly chosen and connected in an irregular request. The fundamental thought of this quality representation instrument is that an incomprehensible number of new antibodies can be produced from new mixes of quality portions in the quality libraries.

Notwithstanding, this component presents a basic issue. The new antibody can tie to unsafe antigens as well as to crucial self cells. Accordingly, the negative determination phase of the human insusceptible framework is critical to guarantee that the created antibodies don't to assault self cells.

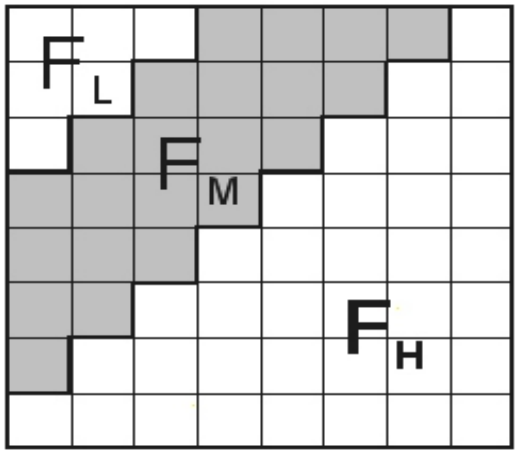
How it works:

This algorithm comprises of three stages: characterizing self, producing finders and checking the event of abnormalities. It sees the profiled typical examples as "self" examples. The second stage, it creates various irregular examples that are contrasted with every self example characterized in the first stage. On the off chance that any arbitrarily created example coordinates a self example, this example neglects to turn into a locator and accordingly it is uprooted. Else, it turns into a "finder" example and screens ensuing profiled examples of the observed framework. Amid the checking stage, if an "indicator" design coordinates any recently profiled example, it is then viewed as that new abnormality more likely than not happened in the checked framework.

Discrete Cosine Transform

Discrete Cosine Transformation (DCT) changes a sign from the spatial to the recurrence space by utilizing the cosine waveform. DCT separate the information vitality in the groups with low recurrence and DCT fame in information pressure strategies, for example, for instance JPEG and MPEG. The DCT permits a photo to be divided into diverse recurrence groups, which makes it simpler to install watermarking data into the inside recurrence groups of the image. FL is utilization to indicate the best recurrence parts of the square, while FH is utilized to signify the bigger recurrence segments. FM is picked while the inserting locale as to supply extra imperviousness to lossy pressure systems [3]. DCT speaks to information concerning recurrence space. DCT based watermarking procedures are powerful in correlation to spatial space methods. DCT area watermarking could be ordered into Global DCT watermarking and Block based DCT watermarking. The Discrete Cosine change has been broadly helpful for source coding in connection of JPEG and MPEG and was later additionally considered for the utilization of installing an email inside images and feature.

Figure 1: Discrete Cosine Transform regions



The significant profits of DCT incorporate its high vitality compaction properties and accessibility of quick calculations for the reckoning of change. The vitality compaction property of the DCT brings about change coefficients with just couple of coefficients having values,

hence making it appropriate for watermarking. Installing principles in DCT area are more hearty to JPEG/MPEG.

LITERATURE SURVEY

Chandra Mohan, B. et al. (2008) [2] proposed an unsighted watermarking plan taking into account the discrete wavelet change (DWT) and particular worth disintegration (SVD). Particular qualities (SV's) of high recurrence (HH) band are utilized to enhance perceptual clearness and forcefulness requirements. Albeit the majority of the SVD-based plans end up being hearty, little focus has been paid to their security highlight. Thusly, presented a mark based verification component at the decoder to enhance security. Coming about unsighted watermarking plan is secure and vigorous [2]. A standardization based hearty image watermarking plan which incorporates solitary worth deterioration (SVD) and discrete cosine change (DCT) procedures has proposed by Foo, S.W., et al. (2010) [6]. For the proposed plan, the host image has initially standardized to a standard structure and partitioned into non-covering image squares. SVD has connected to every piece. By connecting the first solitary qualities (SV) of neighboring pieces of the standardized image, a SV piece is acquired. DCT has then done on the SV pieces to deliver SVD-DCT squares. A watermark bit has implanted in the high recurrence band of a SVD-DCT obstruct by forcing a specific relationship between two pseudo-haphazardly chose DCT coefficients. A versatile recurrence veil has used to modify neighborhood watermark implanting quality. Watermark extraction includes basically the backwards transform. The watermark removing system has visually impaired and productive. Trial results have been demonstrated that the quality corruption of watermarked image brought on by the installed watermark has outwardly straightforward. Results likewise demonstrated that the proposed plan has strong against different image transforming operation and geometric assaults [6].The fundamental motivation behind adding to an image-watermarking method needs to fulfill both indistinctness and vigor necessities. To attain to this reason, a half and half image-watermarking plan in view of discrete wavelet change (DWT) and SVD is proposed by Lai, C.,Tsai et al. (2010) [8]. In this approach, the watermark has not implanted specifically on the wavelet coefficients but instead than on the components of particular estimations of the spread image's DWT sub bands. Test results have been given to exhibit that the proposed methodology has the capacity survive an assortment of image-transforming assaults [8]. Dejey, D., Rajesh, et al. (2011) [5] Combined discrete wavelet change fan shaft change (DWT-FBT) has been investigated as another conceivable area for shading image watermarking. The two plans proposed in the consolidated area are (i) wavelet fan shaft watermarking on luminance and chrominance and (ii) wavelet fan pillar watermarking on chrominance alone. After the use of DWT on the host image and after cautious choice of the suitable band of wavelet coefficients for applying FBT, watermarking has done by modifying the fan bar changed coefficients [4]. Anjum, S.R. et al. (2012) [1] demonstrated that if the logo has coded utilizing slip revising codes before being inserted into the watermarked image the vigor of the watermark has expanded. Distinctive codes that have looked into in this paper are Hamming and cyclic codes. Here the encoded and inserted watermarked

image has thought to be experiencing an AWG commotion while transmission. This paper watched that the SNR and PSNR of the watermarked image even in AWGN channel have better when logo has coded before implanting. Likewise this paper watched that Hamming codes SNR and PSNR has substantially more better than cyclic codes [1]. CA half and half watermarking plan for check has been exhibited, which show forcefulness against different assaults. Because of the distinctive way of channel and geometrical assaults, two separate watermarks have utilized as a part of this plan byE., Xenos et al. (2012) [3] . The first has dug in recurrence space consolidated with a disorganized capacity notice has in light of the connection strategy. The second watermark has settled in radiance histrogram of the image. Thusly, this crossover watermarking plan joined the forcefulness of disordered space against sifting, clamor and pressure assaults with the forcefulness of histrogram area against geometrical assaults [3]. K. M. Singh et al. (2012) [7] represents a crossover advanced image watermarking taking into account Discrete Wavelet Transform (DWT), Discrete Cosine Transform (DCT) and Singular Value Decomposition (SVD) in a wind request. From DWT pick the high band to install the watermark that administrations to include more data, gives more imperceptibility and forcefulness against a few assaults. For example geometric assault. Wind strategy has connected to guide DCT coefficients into four quadrants that speak to low, mid and high groups. At last, SVD has connected to every quadrant. Liu, G., Dong, Z., Yang, et al. (2012) [9] has been examined a few characters of CZT about precision for monotone recurrence signals. The CZT slip diminishes when the inspecting time expands, and changes occasionally and diminishingly until achieves the determination. The mistake dispersion has identified with the starting period of the examined signal. The ghastly results have give or take symmetrical for two orthometric signs. Another recurrence examining strategy, orthometric normal tweet z change (OACZT), has exhibited to dissect the force crucial recurrence all the more precisely. Reenactment results have been demonstrated that the precision of OACZT has around 0.003Hz with inspecting time of 0.2s, better than CZT with an exactness of around 0.1Hz. H. Miyatake et al. (2013) [4] has been introduced a strong mixture watermarking technique apply to shading image for check, which displays forcefulness against a few twisting. Because of the diverse way of regular sign preparing and geometrical assaults, two separate systems for set in a same watermark are utilized as a part of this strategy. In the first, the luminance part data has used to set in the watermark bit grouping into the extent of the center frequencies of the DFT. In the second one, a chose area of 2D histrogram balanced by blue-distinction and red-contrast chrominance segments has changed by watermark bit succession. The trial results have demonstrated that the proposed system gives durability against a few geometric contortions, sign handling operations, consolidated contortions and photograph altering. The correlations with the prior reported techniques in view of distinctive methods have likewise given. Mary Agoyi., et al. (2014) [10] presents a novel watermarking plan taking into account the discrete wavelet change (DWT) in mix with the twitter z-change (CZT) and the particular quality deterioration (SVD). Firstly, the image has decayed into its recurrence sub groups by utilizing 1-level DWT. At that point, the high-recurrence sub band has changed into z-space by utilizing CZT. Subsequently by SVD, the

watermark has added to the particular network of the changed image. At long last, the watermarked image has gotten by utilizing opposite of CZT and converse of DWT. This calculation joined the points of interest of every one of the three calculations. The exploratory result has demonstrated that the calculation is subtle and strong to a few assaults and sign transforming operations. Ashish Kamble., et al. (2019) [11] proposed an algorithm to embed fractal images in wavelet domain using LWT (Lifting Wavelet Transform). Fractal image is generated from Quad tree decomposition and converted into binary image. This binary image is used as watermark. Cover image is converted into RGB components and binary watermark is inserted into mid frequency bands of cover image to protect information from attackers. Watermark is implanted in the blue component of RGB image. The PSNR, SSIM, and NC values obtained in this research show that the method is imperceptible and robust against signal distortions such as contrast enhancement, gamma correction, image sharpening, Gaussian filter, etc. Alvin., et al. (2019) [12] proposed Discrete-Haar Wavelet Transform (DHWT) method and (LSB) steganography method for digital watermarking. As a demonstration of concept, an application is developed for watermarking color images. The testing and evaluation results show that the average PSNR for images with 512x512 pixels resolution is 76.918 dB, for images with 1024x1024 pixels resolution is85.065 dB, and for images with 2048x2048 pixels resolution is 85.15 dB. It shows that the bigger resolution of host image allow larger resolution of watermark image to be embedded. The extracted watermark will also be more clear compared to the smaller host resolution. Host image with the dominant color of blue produces lower watermark quality with higher PSNR value. Table 1 shows the comparison of the various techniques.

Table 1: Comparison of the various techniques

References	Authors	Year	Technique	Feature	Limitations
[2]	Chandra Mohan, B., Srinivas Kumar, S.	2008	Unsighted Watermarking Scheme	Improve Security	The effect of the multiple attacks on a given watermarked image has been neglected
[6]	Foo, S.W., Dong, Q.	2010	Normalization-Based Robust Image Watermarking Scheme	Image Processing Operation & Geometric Attacks	Most of the researchers had used Standard SVD, the use of improved or modification SVD has been ignored
[8]	Lai, C.,Tsai, C.	2010	Hybrid Image-Watermarking Scheme	Image-Processing Attacks	The use of the other watermark scrambling has also been ignored
[5]	Dejey, D., Rajesh,	2011	Discrete	Colour Image	The effect of the

	R.S.		Wavelet Transform-Fan Beam Transform (DWT-FBT)	Watermarking	multiple attacks on a given watermarked image has been neglected
[3]	Chrysochos, E., Fotopoulos, V., Xenos,M., Skodras, A.N.	2012	Hybrid Watermarking Scheme	Geometrical Attacks	Most of the researchers had used Standard SVD, the use of improved or modification SVD has been ignored
[7]	Kansal, M., Singh, G., Kranthi, B.V.	2012	Hybrid Digital Image Watermarking	Geometric Attack	The use of the other watermark scrambling has also been ignored
[4]	Cedillo-Hernández, M., H.M.	2013	Robust Hybrid Watermarking Method	Geometric Distortion, Signal Processing Operations, Combined Distortions	The effect of the multiple attacks on a given watermarked image has been neglected
[11]	AshishKamble, Sushama S. Agrawal	2019	Wavelet Based Digital Image Watermarking Algorithm Using Fractal Images	Embed fractal images in wavelet domain using LWT (Lifting Wavelet Transform)	Contrast enhancement, gamma correction, image sharpening,Gaussian filter
[12]	Alvin, AryaWicaksana, Maria IrminaPrasetiyowati	2019	Discrete-Haar Wavelet Transform (DHWT) method and (LSB) steganography method for digital watermarking.	An application is developed for watermarking color images.	Digital watermarking implementation in other applications such as for face recognition as in and plagiarism detection.

CONCLUSION

In this paper, a survey on various image enhancement techniques has been conducted. From the survey, it has been accomplished that the consequence of the multiple attacks on a given watermarked image has been ignored by the most of the presented researchers. Moreover most of the researchers had used Standard SVD, the use of improved or modification SVD has been ignored in the most of existing research. Also the usage of the other watermark scrambling has also been ignored in the majority of the existing research. Therefore in near future, a new watermarking technique based on the DWT in combination with the CZT and negative selection algorithm based SVD may be proposed to enhance the results.

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