Robust Hybridized Watermarking Using Walsh Hadamard Transform and SVD

V. Jai Kumar (M.Tech, P.Hd)[1], Sanneboyina Lavanya [2], Sanneboyina Surendra[3], Valeti Ajay[4]
Usurupati Udaykiran[5], Ragipindi Niranjan Lokesh[6]

[1]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail: vinayagam.jai@qiscet.edu.in

[2]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail:sanneboyinalavanya@gmail.com

[3]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail:ajaychowdary.s22@gmail.com

[4]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail:surisurendra760@gmail.com

[5]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail:uday.222o2@gmail.com

[6]*ECE dept., Qis College of Engineering & Technology, JNTUK University, INDIA*
E-mail:niranjanreddy673@gmail.com

ABSTRACT:

The development of Internet communications and multimedia technology depends on the security of digitized media, covering audio files, video content, voices, and pics. Actually, the watermarking strategy presents a practical response to this issue. This problem has a feasible fix in the watermarking approach. However, a number of important requirements must be met for data watermarking to be effective, including transparency, low computing cost, resilience, and safeguards. The hybridized technique of watermarking for medical photographs presented in this study is founded on the Walsh Hadamard Transform (WHT) and Singular Value decomposition (SVD). The watermark image and the host image both underwent adjustments to the singular values generated by the SVD encounter. The findings from the simulation show the suggested watermarking system's capability and efficacy in achieving an elevated peak signal-to-noise ratio.

Keywords- Watermarking, Walsh Hadamard Transform, SVD, SSIM, PSNR, Lena Image and Medical Image

1. INTRODUCTION:

A new problem with illegal data duplication has emerged as a result of today's growing use of multimedia in information interaction. This inescapably confirms the need for digital data protection with copyrights. Digital watermarking systems, sometimes known as "watermarking," are a method of concealing information that used as a promising tool for copyright protection to deal with these impending challenges.

In this project, we'll take two images as input they are: Lena image and watermark image. Host image is the image to which watermark is added With the help of image transformation technique i.e., "Walsh Hadamard Transform" and "SVD" the watermark image is embed into host image and forms watermarked image. In this watermarked image the watermark which contains valuable data may not be visible. This process is known as "Watermark Embedding", while the exact opposite process is known as "Watermark Extraction". This can be done by applying inverse Walsh Hadamard transform to the watermarked image.

2. LITERATURE REVIEW:

A watermarking and encryption-based "proposed security approach for digital communications and imaging in medicine" was created by MM. Abd-Eldayem. Medical gadgets increasingly produce digital representations of medical images, and In a computer network, hospital data management systems (HDMSs) are now used. To maintain picture fidelity and protect the privacy of patents, HDMS must share and safeguard these images in a secure

setting. The confidentiality and integrity of data can be shielded utilizing reversible watermarking techniques. This study recommends employing watermarking and encryption-based security for digital communications and photographs in medicine. Information secrecy and patient authentication are provided by Reversible watermarking., and information fidelity. From the image, a hash value based on encoded MD5 is generated. to achieve fidelity support at the sender side. The reversible characteristic is satisfied by computing the R-S-Vector from the picture [1].

K. Ben Mohammed created a "Blind image watermarking system built on discrete cosine domains and differential embedding in dwt". In this study, a new discrete wavelet transform (DWT)-based blind and trustworthy picture watermarking technique is presented (DCT). Two DCT-transformed sub-vectors are used to embed the bits of the watermark pattern in different ways. The approximate method is to subsample the original sub-vectors. coefficients of the host image's DWT transform. Just comparing the embedded watermark pattern will be visible when the matching the watermarked's sub-vectors picture are extracted. The provided method satisfactorily meets the imperceptibility criterion according to experimental findings, and it also offers outstanding resistance in comparison to various image-processing methods, including JPEG shrinkage, noise addition, low-pass filtering, the sharpening process and bit-plane removal. Additionally, our method effectively thwarts some geometrical assaults like scaling and cropping[3].

S.S. Kasana created "Dual hybrid medical watermarking utilizing Walsh- slantlet transform". The novel discrete wavelet transform presented in this research -based photo watermarking method that is reliable and blind is proposed (DWT). This study proposes a hybrid resilient lossless data concealing approach combining the Fast Walsh Transform (FWT), Slantlet Transform (SLT), and Singular Value Decomposition (SVD) for picture authentication. These changes produce increased embedding capacities of 1.8 to 7.5 bits per pixel thanks to their effective energy compaction and unique filtering. The proposed technique employs an Artificial Neural Network (ANN) and two distinct watermarks to identify regions of interest (ROI). After applying FWH, embedding is done by changing the highest coefficients of the SLT sub-bands and the SVD coefficients. The ROI is the first watermark in a dual hybrid embedding, and second watermark has three components: the patient's personal information, a distinctive biometric ID, and the encryption key[5].

N. Salem and S. Hussein created "Principal components analysis with data dimension reduction". One of the main difficulties that is addressed by studies in the disciplines of AI and ML is the development of computer programs that are capable of vast volumes of information and then apply this data intellectually to address a range of obstacles. For reading data with many variables in a meaningful way in many applications, It's crucial to keep the number of variables low and understand how the data is combined linearly. An unsupervised learning technique called Principal Component Analysis (PCA) complex mathematical ideas to reduce the dimensionality of massive datasets. In the areas of machine learning and data dimensional reduction, the goal of this study is to offer a full grasp of the sophisticated PCA. When PCA is developed using the covariance matrix, it gives a numerical justification and discusses its relationship with Singular Value Decomposition (SVD). Also, using MATLAB, the research demonstrates the value of PCA in describing and displaying the Iris dataset with fewer variables[7].

T. Khanam created "Fast Walsh-Hadamard transform, key mapping, and coefficient ordering for SVD-based image watermarking for ownership protection". Due to the multiple transmission channel attacks that might happen while employing distributed computing infrastructures, users that require proof of ownership for multimedia material are seriously in danger. In this study, a blind symmetric picture watermarking technique using the singular value decomposition and the fast Walsh-Hadamard transform (FWHT). The watermark picture is first scrambled using Gaussian mapping to prevent illegal detection. After that, the cover picture is subjected to FWHT with coefficient ordering. Two distinct keys are created from the single values of the FWHT blocks of the cover image to make the method of embedding resistive to and safe against severe assaults., which are maintained by the owner alone. The watermark is then extracted, and ownership is confirmed, using the generated keys. The simulation's outcome shows how extremely resilient against multiple attacks our suggested strategy is. Also, the comparison study confirms its superiority to other cutting-edge techniques[8].

The non-negative matrix factorization and quick Walsh-Hadamard transform are used in "A hybrid secure watermarking technique" created by E.E. and A.E. Abdallah. We provide a dependable and imperceptible safe picture watermarking technique using Fast Walsh-Hadamard Transform (FWHT) and Nonnegative Matrix Factorization (NMF). The four essential phases that make up the suggested strategy's central concept are as follows: The original cover image is composed of several pieces. The FWHT is used to calculate the weight matrix after each block has received a distinct application of the NMF. The watermark image's unique values are then scattered among the modified blocks. Unquestionably, the testing findings demonstrate improved visual concealment and outstanding defense against all types of attacks[9].

E.M. El. Houby and N.I. Yassin created "Genetic algorithm and decision tree dependent Wavelet-Hadamard relied blind picture watermarking". Copyright breaches have recently escalated due to regular Internet and

multimedia technology use. Digital watermarking is essential for preserving copyright for multimedia. The improved picture watermarking approach proposed in this research is depending on the Hadamard transform and discrete wavelet transform (DWT). The Genetic Algorithm (GA) is an optimal technique for striking a balance between imperceptibility and robustness. Blind property is carried out using the Decision Tree's estimate capabilities (DT). The host picture is first altered using second level DWT, and then a few chosen DWT sub-bands are subjected to the Hadamard transform. Using GA, adaptive numerous strength coefficients are derived. Using the learned DT, which does not use the original host picture for calculating the initial coefficients needed for the extraction procedure. Salt and pepper noise, histogram equalization, bending, distortion, scaling, drawing, and resizing are some of the assaults that the suggested method is tested against. The suggested watermarking technique is resilient against various attacks while maintaining good imperceptibility, according to experimental data. According to robustness, imperceptibility, and capacity, the suggested technique performs better than the techniques that were compared[10].

3. METHODOLOGY:

A. EXISTING METHOD:

A low-cost orthogonal function with just two values, +1 and 1, the Walsh Hadamard Transform (WHT), also referred to as the Walsh Fourier Transform, This is due to its characteristic sequence values, simplicity, and low computing complexity. It is widely used in speech and image processing.
The original image can be recovered and recreated using the inverse WHT, though Singular Value Decomposition (SVD) helps us to keep the crucial singular values that the image needs by dissecting a matrix A into the form.

B. PROPOSED METHOD:

- **Watermark Embedding:**

The cover image that will be protected will have watermarks added as part of the embedding process. A Lena image will be used as the watermark, and it will be embedded into the host image, also known as the cover image. The proposed algorithm for the watermark embedding process is shown in Fig. below. The algorithm's steps are as follows:

- Apply the WHT on the host image.
- Apply the SVD and convert the transformed matrix into three Uw, Sw, and Vw matrices.
- Apply the SVD on the watermark image and the obtained matrices are uu, ss, and vv.
- Find the singular values of the host image and then modify them by the singular values of the watermark image using the following equation:
- $S2 = Sw + 0.001*Ss$
- Apply the inverse SVD as follows:
- $nll2=Uw*S2*Vw'$
- Find the inverse WHT to acquire the watermarked image.
- Repeat all the above procedures for another watermark image
-

- **Watermark Extraction:**

The watermarked image is isolated from the original image during the extraction process. Fig. below shows the suggested method for extracting the watermark. Because it copies and uses both the original image and the watermark image that is embedded, which are required. This approach uses non-blind watermarking for the extraction. The steps in the process are as follows:

- Use the FWHT on the output image as well as the host image.
- Apply the WHT on the watermarked image and on the host image.
- Apply the SVD on the transformed watermarked image.
- Subtract the singular values of the host image from the singular values of the watermarked image, and divide with the scalar factor i.e., 0.001 this is as follows:

$$We1 = (S - Sw)/0.001$$

- Apply the inverse SVD to acquire the extracted watermark image, as follows:

$$We = uu*We1*VV'$$

4.PROPOSED MODEL FLOWCHART:

I. Watermark Embedding:

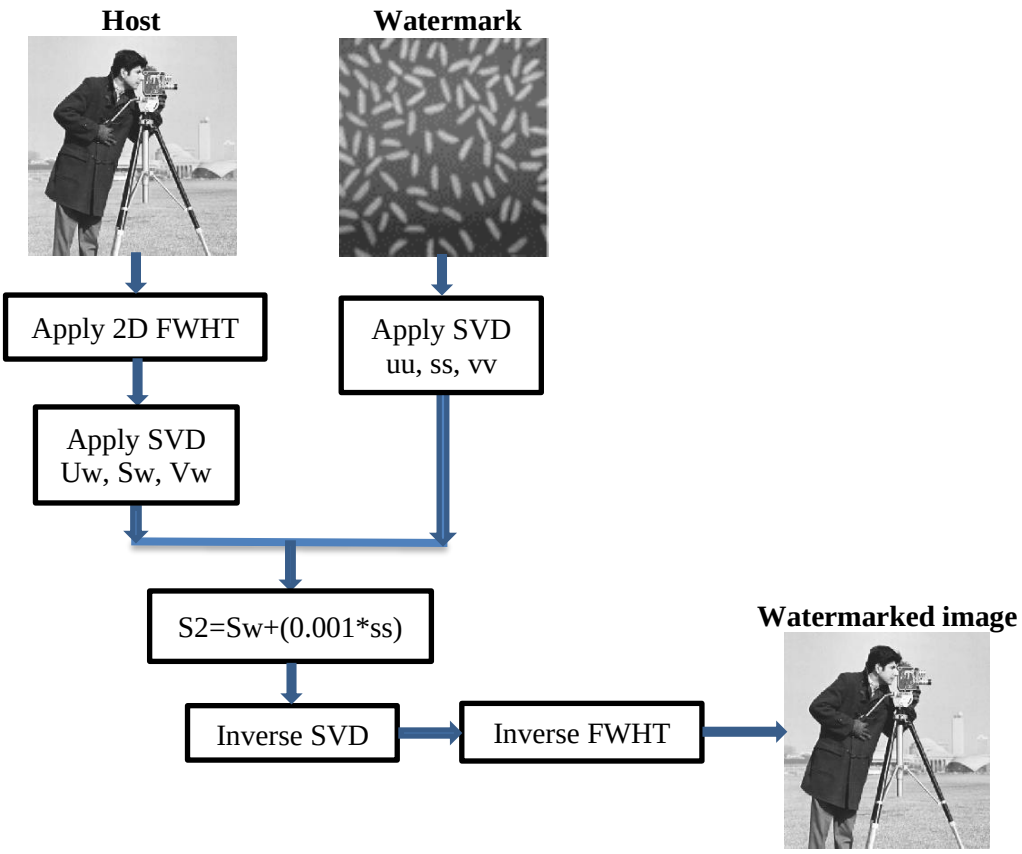

Fig. Watermark embedding algorithm

II. Watermark Extraction:

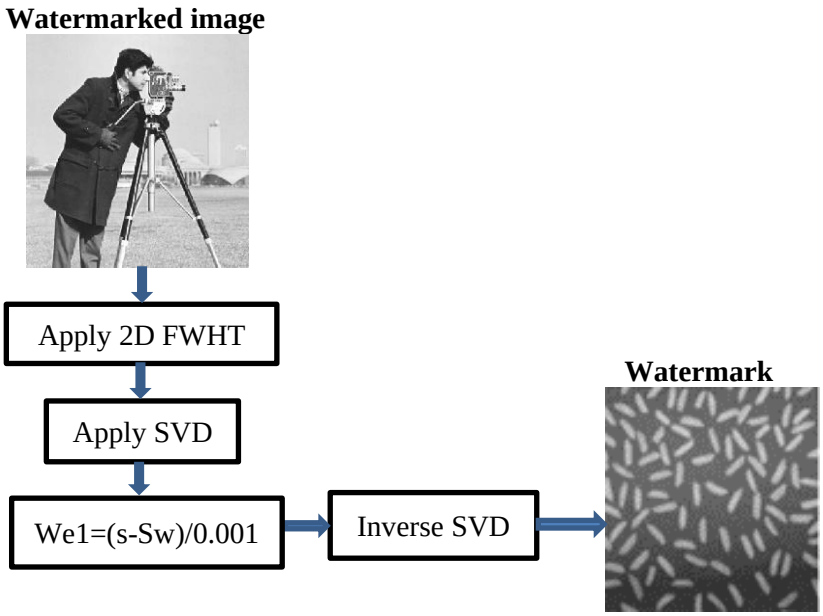

Fig: Watermark extraction algorithm

5.CONCLUSION:

Using the MATLAB R2016 software, the proposed algorithm's numerical simulation is carried out. As a test image we used a grayscale host image coupled with watermark picture. The image's dimensions were designed to be uniform for accurate comparison and better visualizing the results.

REFERENCES:

[1] M. M. Abd-Eldayem, A proposed security technique based on watermarking and encryption for digital imaging and communications in medicine, Egyptian Informatics Journal 14 (1) (2013) 1–13.

[2] S. Singh, R. K. Arya, H. Sharma, A robust deinterlacing multiple image watermarking technique in dwt, in: 2016 International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT), IEEE, 2016, pp. 8–13.

[3] A. Benoraira, K. Benmahammed, N. Boucenna, Blind image watermarking technique based on differential embedding in dwt and dct domains, EURASIP Journal on Advances in Signal Processing 2015 (1) (2015) 55.

[4] P. K. Dhar, T. Shimamura, A blind lwt-based audio watermarking using fast walsh-hadamard transform and singular value decomposition, in: 2014 IEEE International Symposium on Circuits and Systems (ISCAS), IEEE, 2014, pp. 125–128.

[5] R. Bamal, S. S. Kasana, Dual hybrid medical watermarking using walsh-slantlet transform, Multimedia Tools and Applications 78 (13) (2019) 17899–17927.

[6] S. M. Darwish, O. F. Hassan, A new colour image copyright protection approach using evolution-based dual watermarking, Journal of Experi-mental & Theoretical Artificial Intelligence (2020) 1–23.

[7] N. Salem, S. Hussein, Data dimensional reduction and principal components analysis, Procedia Computer Science 163 (2019) 292–299.

[8] T. Khanam, P. K. Dhar, S. Kowsar, J.-M. Kim, Svd-based image watermarking using the fast walsh-hadamard transform, key mapping, and coefficient ordering for ownership protection, Symmetry 12 (1) (2020) 52.

[9] E. E. Abdallah, A. F. Otoom, A. E. Abdallah, M. Bsoul, S. Awwad, A hybrid secure watermarking scheme using nonnegative matrix factoriza- tion and fastwalsh-hadamard transform, Journal of Applied Security Research 15 (2) (2020) 185–198.

[10] E. M. El Houby, N. I. Yassin, Wavelet-hadamard based blind image watermarking using genetic algorithm and decision tree, Multimedia Tools and Applications 79 (37) (2020) 28453–28474.

[11] M. K. Abdmouleh, A. Khalfallah, M. S. Bouhlel, A new watermarking technique for medical image using hierarchical encryption, arXiv preprint arXiv:1409.4587 (2014).

[12] Y. Wu, J. P. Noonan, S. Agaian, et al., Npcr and uaci randomness tests for image encryption, Cyber journals: multidisciplinary journals in science and technology, Journal of Selected Areas in Telecommunications (JSAT) 1 (2) (2011) 31–38.

[13] S. Thakur, A. K. Singh, S. P. Ghrera, M. Elhoseny, Multi-layer security of medical data through watermarking and chaotic encryption for tele-health applications, Multimedia tools and Applications 78 (3) (2019) 3457–3470.

[14] S. Thakur, A. K. Singh, S. P. Ghrera, A. Mohan, Chaotic based secure watermarking approach for medical images, Multimedia Tools and Applications 79 (7) (2020) 4263–4276.