

Stationary Wavelet Transform and Singular Value Decomposition methods usage in Digital Image Watermarking

S.Arun, P. Rajeswari

Department of Electronics and Communications Engineering
Dhanalakshmi Srinivasan Engineering College, Tamil Nadu, India

ABSTRACT

In this paper, the digital photo watermarking approach is analyzed by way of using Discrete Stationary Wavelet Transform and Singular Value Decomposition. This method incorporates two processes, embedding, and the extraction process. In embedding, SVD coefficients of diagonal values of watermark photo are embedded in SVD coefficients of diagonal values of cover image by using the embedding equation. The extraction method is the reverse of embedding. The robustness of this approach is calculated through making use of the various attacks. The effectivity of this algorithm is measured with the aid of calculating PSNR.

Keywords: Watermarking techniques, SWT, SVD, and PSNR.

I. INTRODUCTION

In recent years communication is taking part in an important role. Communication is very important for each and every human being, without the verbal exchange existence will turn out to be difficult to lead. As computers and internet technologies are developed, more multimedia-based statistics is being transmitted over the internet and wi-fi networks. An image is a picture that has been created or copied and saved in the digital form. There are two kinds in photos which are a coloration photograph and grayscale photograph [1]. In the existing day's video, audio, pictures are reachable at any time, anywhere due to the fact of using the net and multimedia tools. So, security, copyrighting and authentication issues will arise. The solution to this hassle is the watermarking technique. The phrase "Watermark" was derived from the German time period "Westmark". The term "Digital Watermark" was once first determined in December 1992 with the aid of Andrew Tirkel & Charles Osborne [2]. A watermark is one type of identification marks. The first watermarks seemed at some point of the thirteenth century in Italy; however their use unexpectedly spread across Europe after the thirteenth century. The main case of innovation like advanced watermarking is a patent discipline in 1954 by means of Emil Hem Brooke [3]. In 1988 Komastu and Tominaga have all the watermarks of being the first to make use of the expression "computerized watermarking" [4].

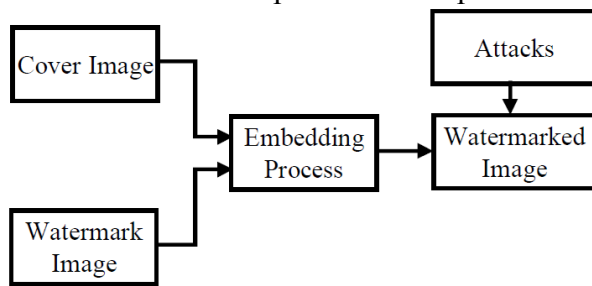


Fig. 1 Block diagram of embedding process

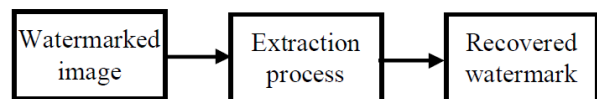


Fig. 2 Block diagram of extraction process

Watermarking is characterised as concealing the watermark photo into the cover picture. If the seal of the enterprise is present on the watermarked image is known as visible watermarking approach and it is perceptible to the human eye. If the seal of the corporation is hidden in cover photo and is no longer perceptible to the human eye is called an invisible watermarking technique.

Watermarking is consisting of two tactics which are embedding manner and extraction process. In the embedding process, the watermark photo is embedded in the cover picture after that it will shape the watermarked picture is showed in Fig. 1. In the extraction process, the watermark photo is eliminated from the watermarked image. To test the robustness assaults are applied to the watermarked image. The contrast of each unique and recovered watermark is taking location is shown in Fig. 2. The essential residences of undetectable watermarking are strength, robustness, restrict and safety are accomplished.

II. RELATED WORK

The watermarking approach is categorized into spatial and frequency area [4]. In spatial space through modifying pixel fee hiding of watermark image is taking location [5] and in the frequency area by way of the use of the seriously change strategies each photos are first converted into special frequencies then modification of the watermark is done. The watermarking of the color picture [6] is through the use of the block-based likelihood in the spatial domain. From secrete key and grey code, the sequence numbers are generated these are used in binary watermarking technique [7]. The records of the watermark picture is inserted in busy areas of the cowl picture in LSB watermarking [8]. The non-blind digital picture watermarking [9] includes hybridization of Discrete Wavelet Transform and Discrete Cosine Transform which is imperceptible in nature. In DCT primarily based watermarking [10] embedding is completed in the middle section of the cover image. The PLU decomposition [11] is a secure watermarking technique. In block based totally watermarking [12] more than one watermarks are embedded in the cowl picture due to the fact it having greater space. Insecure watermarking method [13] DWT-Singular Value Decomposition is used to get more strong in nature. The nature of watermarked picture assessed assistants of PSNR esteem.

III. METHODOLOGY

In prospect of offering the strong watermarking, this algorithm makes use of a Stationary Wavelet Transformation technique combined with the SVD. The entire watermarking consists of two parts embedding system and extraction process. The flowchart of the embedding technique and extraction method is proven in Fig. 5 and Fig. 6 respectively. SWT is the transformation technique in the digital image processing in which wavelets are discretely sampled. SWT includes each frequency and area information. SWT is an extended shape of DWT. It is designed to overcome the lack of translation invariance of the DWT. The LL, LH, HL and HH bands are bought after making use of the SWT to the cover image and watermark photograph is proven in

Fig. 4 Here every band is consisting of a complete spectrum of the complete image.

LL band consists of approximate low frequency component.

HL band incorporates horizontal middle frequency component.

LH band incorporates vertical middle frequency component.

HH band includes diagonal excessive frequency component.

The color image is made up of three components red, green and blue. These colours are added together to produce array of colours is showed in Fig. 3.



Fig. 3 RGB color components

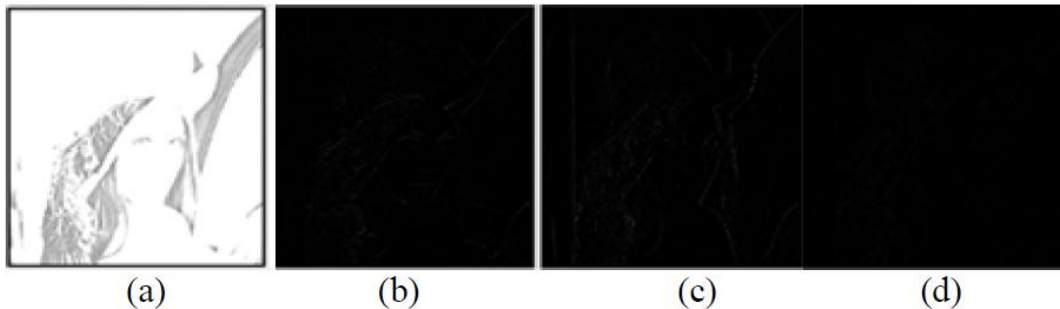


Fig. 4The second level of SWT decomposition

SVD is a straight algebraically numerical strategy. SVD is applied to an image it will give three lattices U, S and V.

Where diagonal matrix S and orthogonal matrices are U and V is given by equation 1.

$$A = USVT \dots\dots\dots (1)$$

U – Unitary matrix having size M x M

V – Unitary matrix having size N x N

S – Diagonal matrix having size M x N

S matrix is containing singular values and these values are arranged in ascending order. The singular values are very much stable. S values are non-negative numbers. SVD is used in image watermarking to maintain the quality as well as stability.

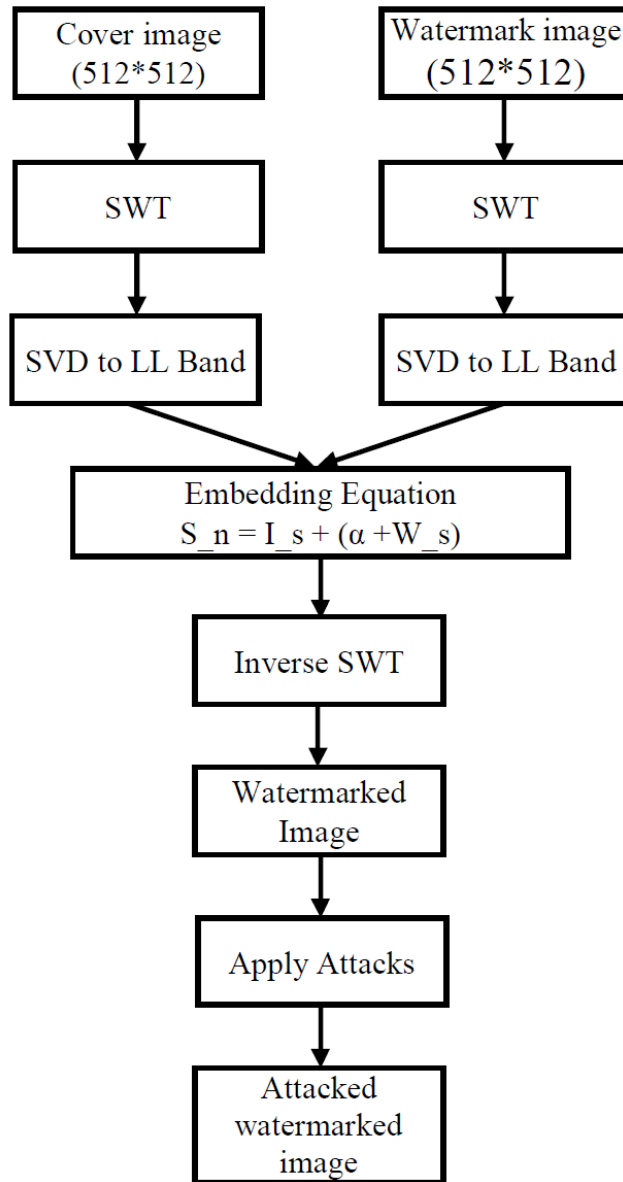


Fig. 5 Flow chart for embedding process

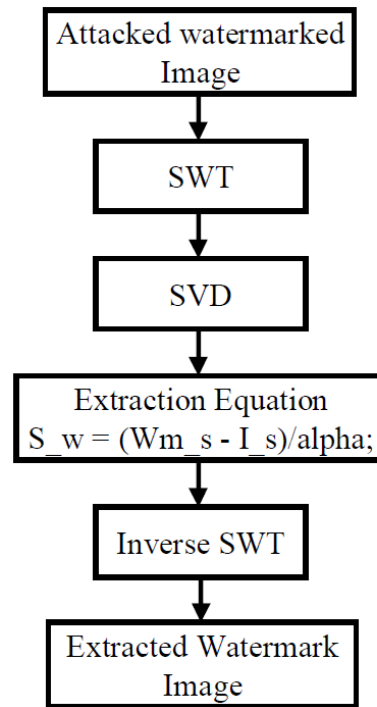


Fig. 6 Flow chart for extraction process

In embedding technique first study the cowl and watermark image. Then practice SWT to both cover and watermark picture both will decomposes into 4 subbands. Then we have to apply SVD to LL bands of both images. By the usage of the embedding equation embed the watermark photograph into a cowl image. Then practice inverse SWT to get the watermarked image. The various attacks are utilized to test the robustness of the watermarked image.

In the extraction method study the attacked watermarked image. Then follow SWT to watermarked photo and then SVD to the LL band of the watermarked image. By the use of extraction equation extract the watermark picture from the watermarked image. Then apply inverse SWT to get get better watermark image.

IV. RESULT AND DISCUSSION

The digital photograph watermarking using SWT and SVD is simulated with the aid of using the modern-day model of MATLAB. The fashionable sizes of pics are taken to study the impact of robustness of this algorithm. After applying the embedding and extraction algorithm will get the watermarked image. Salt and Pepper noise, Speckle noise, Gaussian noise, Rotation attack, and Median filters are applied to the watermarked image to take a look at the robustness. The effectivity is evaluated with the aid of calculating the PSNR values. Peak Signal to Noise Ratio PSNR is used to measure the great of the image. The amplify in the value of PSNR shows the greater the pleasant of the image. The value of PSNR is given through equation 2.

$$PSNR = 10 \log \frac{255^2}{\frac{1}{MN} \sum_{M=0}^{M-1} \sum_{N=0}^{N-1} (C(m,n) - WD(m,n))} \dots \dots (2)$$

V. CONCLUSION

In this paper, a SWT-SVD algorithm used to be analyzed for digital photograph watermarking technique the usage of SWT and SVD. We have showed the methodology of embedding and extraction process. The assessment parameter PSNR is measured to check the robustness of the watermarked image. This algorithm is simulated by using the state-of-the-art model of MATLAB. Different sorts of attacks are utilized to watermarked image to test the robustness. In future algorithm will be modified to enlarge the degree of robustness of watermarked picture by using the usage of the exclusive transformation techniques.

REFERENCES

- [1] Yusof, Yusnita, and Othman O. Khalifa. "Digital watermarking for digital images using wavelet transform." Telecommunications and Malaysia International Conference on Communications, 2007. ICT-MICC 2007. IEEE International Conference on. IEEE, 2007.
- [2] Liu, Jian, and Xiangjian He. "A review study on digital watermarking." Information and Communication Technologies, 2005. ICICT 2005. First International Conference on. IEEE, 2005.
- [3] Petitcolas, Fabien AP. "Watermarking schemes evaluation." IEEE signal processing magazine 17.5 (2000): 58-64.
- [4] Licks, Vinicius, and Ramiro Jordan. "Geometric attacks on image watermarking systems." IEEE multimedia 12.3 (2005): 68-78.
- [5] Tay, R., and J. P. Havlicek. "Image watermarking using wavelets." Circuits and Systems, 2002. MWSCAS-2002. The 2002 45th Midwest Symposium on. Vol. 3. IEEE, 2002.
- [6] Potdar, Vidyasagar, Song Han, and Elizabeth Chang. "A survey of digital image watermarking techniques." 3rd IEEE International Conference on Industrial Informatics (INDIN 2005). IEEE, 2005.
- [7] Maity, Santi P., and Malay Kumar Kundu. "Robust and Blind Spatial Watermarking In Digital Image." ICVGIP. 2002.
- [8] Nasir, Ibrahim, Ying Weng, and Jianmin Jiang. "A new robust watermarking scheme for color image in spatial domain." Signal-Image Technologies and Internet-Based System, 2007. SITIS'07. Third International IEEE Conference on. IEEE, 2007.
- [9] Arya, Ranjan Kumar, Shalu Singh, and Ravi Saharan. "A Secure Non-blind block based Digital Image Watermarking technique using DWT and DCT." Advances in Computing, Communications and Informatics (ICACCI), 2015 International Conference on. IEEE, 2015.
- [10] Verma, Rajni, and Archana Tiwari. "Copyright protection for watermark image using LSB algorithm in colored image." Advance in Electronic and electric engineering 4.5 (2014): 499-506.

- [11] Muhammad, Nazeer, and Nargis Bibi. "Digital image watermarking using partial pivoting lower and upper triangular decomposition into the wavelet domain." *IET Image Processing* 9.9 (2015): 795-803.
- [12] Mahajan, Palak, and Ajay Koul. "CEET: A Compressed Encrypted & Embedded Technique for Digital Image Steganography." *IOSR Journal of Computer Engineering* 16.2 (2014): 44-52.
- [13] Maheshkar, Sushila. "An efficient dct based image watermarking using rgb color space." *Recent Trends in Information Systems (ReTIS), 2015 IEEE 2nd International Conference on. IEEE, 2015.*
- [14] Agarwal, Rashmi. "Block based digital watermarking using singular value decomposition on color images." *Computing, Communication & Automation (ICCCA), 2015 International Conference on. IEEE, 2015.*
- [15] Saini, Lalit Kumar, and Vishal Shrivastava. "Analysis of attacks on hybrid DWT-DCT algorithm for digital image watermarking with MATLAB." *arXiv preprint arXiv:1407.4738* (2014).