International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 05 | May - 2021 ISSN: 2582-3930

CHAOTIC SYSTEM BASED WATERMARKING ALGORITHM FOR IMAGE COPYRIGHT PROTECTION

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Abstract - With developing technologies, all the information are collected, stored and transmitted digitally. While transmitting the data through internet, there may be a chance for unauthorized access and copyright authentication. Chaotic system is a mathematical model or analytical technique which provides security for the information that is transmitted. In this paper, along with chaotic system watermarking technologies like DWT and SVD are used to improve security. DWT can embed data in all frequencies as it decomposes data into four bands. SVD is a compression technique and that can be used in wide range of applications where the data may be organized in matrix representation. SVD is suitable for watermarking applications since some largest singular values are sufficient to embed instead of using all singular values. Chaotic system generates a secret key without which extraction of the watermark is impossible. Baker's map is used to scramble the image and it will create optimized secret key for large set of possible keys naturally. Efficiency of the proposed system is evaluated based on PSNR value. The experimental result shows that the technique used is effective and robust against various image processing attacks.

Keywords: *Chaotic maps, DWT, SVD, PSNR and Baker's map.*

1. INTRODUCTION

Nowadays sharing the information becomes much easier due to the rapid development of digital networks. While transferring the images through digital media there may be a chance for unauthorized access **[1]**. The security of the information is one of the important issues in transferring and receiving the images. Watermarking is a process of embedding information into another signal. Watermarking gives a new technique that can be utilized to determine these issues and gives copyright assurance. Digital watermarking is classified into two type's namely spatial domain and frequency domain. In this project, frequency domain based DWT and SVD are used for providing better imperceptibility and robustness **[2]**. DWT has a many special advantages over other conventional transforms such as Discrete Fourier transform (DFT) and Discrete Cosine Transform (DCT). For increasing the security along with DWT and SVD chaotic maps are used. Chaotic system is used to develop efficient image encryption and decryption schemes. They exhibit sensitive dependence on initial conditions and unpredictable **[3]**. Extraction and embedding process are involved in digital watermarking technique. Embedding algorithm is the way towards inserting watermarked image into the original image. Extraction algorithm is the way of getting original image from watermarked image [4-5]. Image scrambling is the process of converting significant image into another image which is not identifiable by the unauthorized person. Chaotic system is used to generate location matrix at first in embedding process. Then it generates mapping image and watermark image for embedding process. Finally it performs extraction process for the key generated for location matrix. Baker's map is used to scramble the image and it will create optimized secret key for large set of possible keys naturally [6]. The security level of the image can be varied based on the number of iterations performed.

2. LITERATURE REVIEW

[1]Amir Anees and Iqtadar proposed a robust watermarking scheme for online multimedia copyright protection using chaotic maps. A unified watermarking algorithm using three distinct chaotic maps was used. It provides high security against several attacks.

[2]Asha Rani and Balasubramanian and Raman proposed Chaotic maps for image copyright protection was published. This system was proposed using visual cryptography, chaotic maps and SVD. It uses gray-scale image instead of binary image. The image is encrypted with secret watermark image. The performance can be analysed by calculating PSNR and MSE.

[3] BalasubramanianRamam and Sanjay proposed Fragile watermarking scheme for tamper detection using chaotic system. Chaotic system is used for high security and to avoid unauthorised access. Secret keys are generated for security. Without these keys, extracting the watermark becomes impossible. This scheme has the capacity to localize the modified region in the watermark image and provides high fidelity.

[4]Dhanalakshmi and Thaiyalnayaki proposed dual watermarking scheme based on DWT and SVD with Chaotic system. This hybrid technique is used for efficient and secured image encryption and decryption. Chaos encryption system is used to improve security and robustness. The quality of the image is measured using PSNR values.

[5]Gaurav Bhatnagar and Balasubramanian proposed DWT-SVD based Dual Watermarking Scheme. Dual watermarking scheme using DWT and SVD is used to improve the security and robustness. Reliable watermark extraction is used for the extraction of both primary and secondary watermark.

[6]Lingfeng Liu and Suoxia Miao proposed an image encryption algorithm based on Baker map with varying parameter. A parameter varying baker's map disrupt the phase of the system and resist the phase space reconstruction attack and estimate chaotic signal effectively. It provides high security and resists several attacks.

[7]Nasrin and Bee EeKhoo proposed a new robust and secure digital image watermarking scheme based on the integer wavelet transform (IWT) and SVD. This system is proposed for image copyright protection using IWT and SVD. Using SVD, the digital signature image is converted into watermarked image. To verify feasibility of this algorithm, MATLAB simulation is used and checked the robustness using various attack.

[8]Peng Zhu and Ming-sheng Zhao proposed a Chaotic System Based Watermarking Algorithm for Image Copyright Protection. This algorithm uses chaotic system to generate location matrix at first. Then it generates mapping image and watermark image for embedding process. Finally it performs extraction process for the key generated for location matrix. Using this algorithm, copyright of image has good protection ability.

[9]Safa Ahmed Abed Alabass, Mortada Abdulraheem Hayder, Zaid Salah Abdulsattar, Ola Hamza Rasool and Marwah Adil Hasan proposed Color Image Encryption and Decryption by Using Chaotic Baker Map Bit Interleaved. The encryption of image is improved while applying chaotic baker map on the image because of that it provides high efficiency.

[10]Shafali Agarwal proposed a Review of Image Scrambling Technique Using Chaotic Maps. The various chaotic map based scrambling methods are performed and values like correlation coefficient, NPCR and UACI are observed. Based on the analysis, chaotic map based image scrambling provides better security and computational complexity.

3. METHODOLOGY

3.1 EMBEDDING PROCESS

In embedding process, DWT is applied on the cover image and LH sub band is chosen SVD is applied on the LH sub band. After scrambling the watermark image DWT is applied and LH sub band is chosen. SVD is applied on the LH sub band and then embedding algorithm is performed. Inverse DWT and inverse SVD is applied to get embedded watermarked image. Flowchart for embedding process is shown in figure 3.1.

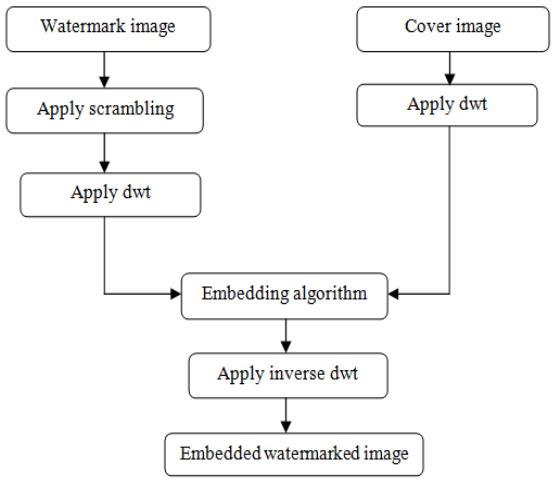


Figure 3.1: Flow chart for embedding process.

3.2 EXTRACTION PROCESS

In extraction process, DWT is applied on the embedded watermarked image and extraction algorithm is performed. Inverse DWT is applied and descrambling the image is done to get the extracted watermarked image. Flowchart for extraction process is shown in figure 3.2.

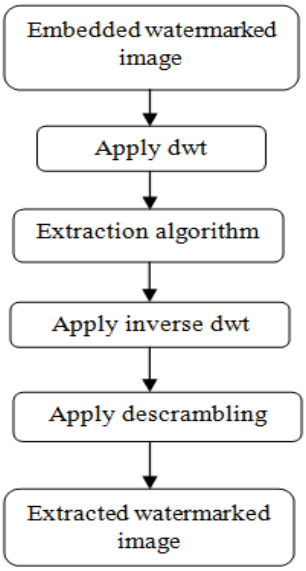
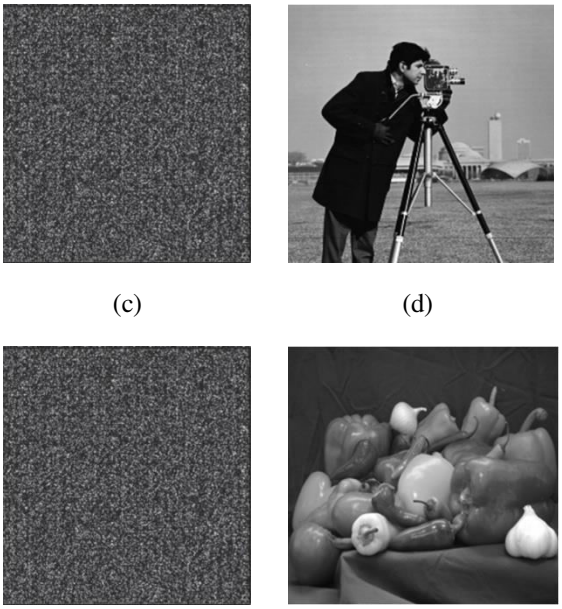


Figure 3.2: Flow chart for extraction process

4. RESULT AND DISCUSSION

This system provides small modifications to the original images and provides good invisibility for watermark images. Extraction of a watermark does not require original image. Efficiency of this system can be analyzed by calculating PSNR value. The quality of the image as well as the high security of the image can be achieved by using this technology. While transferring the image through this technique there won't be any unauthorized access.

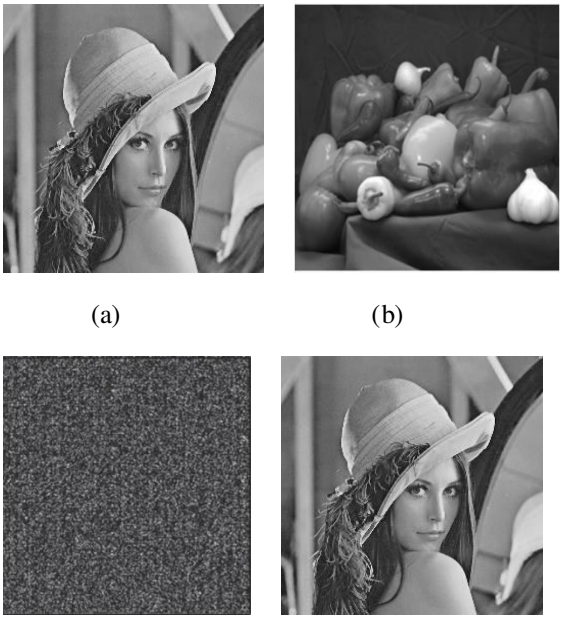
(a) (b)



(c) (d)

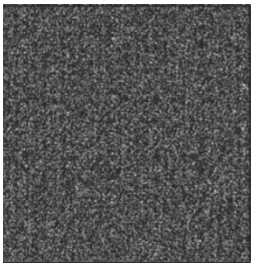
(e) (f)

The above fig 4.1 (a), fig4.1 (b), fig 4.1 (c), fig 4.1 (d), fig 4.1 (e) and fig 4.1 (f) shows that input image 1, watermark image, scrambled image, watermarked image, extracted watermarked image and descrambled image.



(a) (b)

(c) (d)




(e) (f)

The above fig 4.2 (a), fig 4.2 (b), fig 4.2 (c), fig 4.2 (d), fig 4.2 (e) and fig 4.2 (f) shows that input image 2, watermark image, scrambled image, watermarked image, extracted watermarked image and descrambled image.

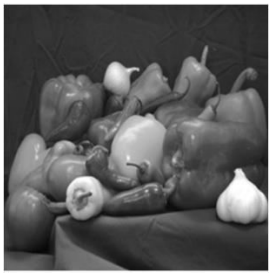
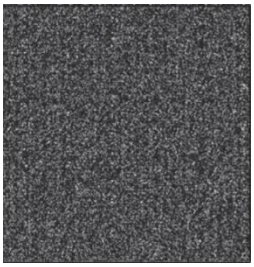
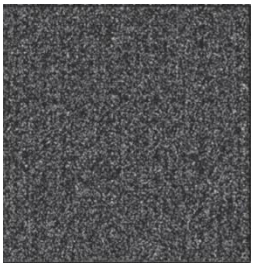



Fig 4.14 Fig 4.15

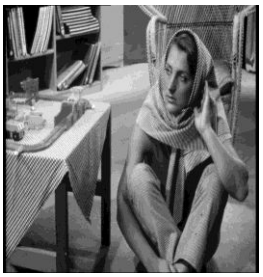
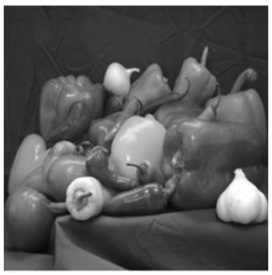



(c) (d)

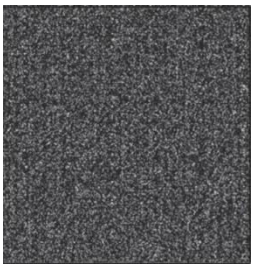



(e) (f)

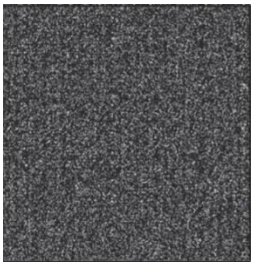
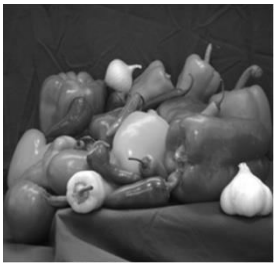
The above fig 4.3 (a), fig 4.3 (b), fig 4.3 (c), fig 4.3 (d), fig 4.3 (e) and fig 4.3 (f) shows that input image 3, watermark image, scrambled image, watermarked image, extracted watermarked image and descrambled image.

(a) (b)




(c) (d)

(e) (f)

The above fig 4.4 (a), fig 4.4 (b), fig 4.4 (c), fig 4.4 (d), fig 4.4 (e) and fig 4.4 (f) shows that input image 4, watermark image, scrambled image, watermarked image, extracted watermarked image and descrambled image.

Alpha value	PSNR for extracted watermarked for image 1
0.01	84.8343
0.05	40.4559
0.10	37.2096
0.15	36.9236
0.20	36.8162

Table 4.1 Result for without attack

The above table 4.1 shows that the result for image without any attacks.

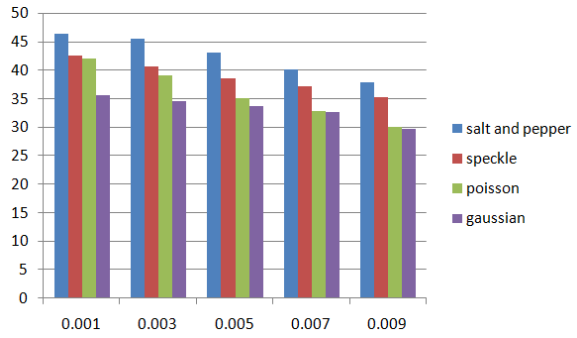


Fig 4.5 Bar graph for input image (1) for various attack.

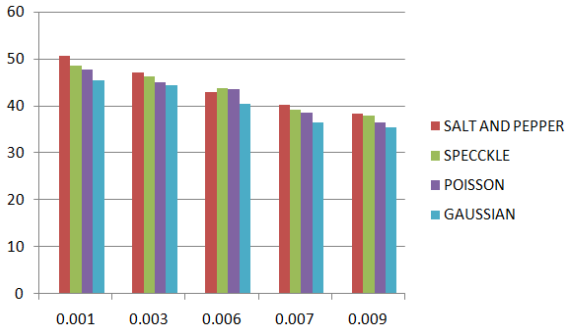


Fig 4.6 Bar graph for input image 2 for various attack.

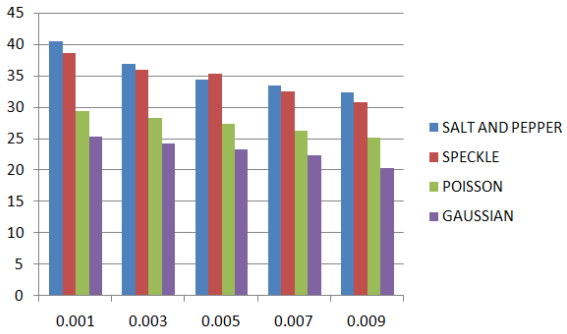


Fig 4.7 Bar graph for input image 3 for various attack.

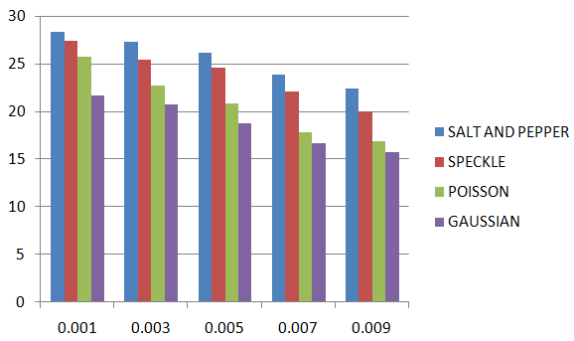


Fig 4.8 Bar graph for input image (4) for various attack.

The above fig 4.5, fig 4.6, fig 4.7 and fig 4.8 shows that the bar for image 1, bar for image 2, bar graph for image 3 and bar graph for image 4 using different type of attacks.

5. CONCLUSION

In this watermarking based on DWT and chaotic system is used for high security and copyright protection for watermarking. In this system, there are only minor changes to the original image and watermark image has better invisibility. This system provides better robustness and high imperceptibility. DWT is used for the compression of the image which has good PSNR while reconstructing the image and chaotic map is used for efficient encryption of the image. Various attacks have been applied to the image in order to verify the performance of the proposed system. In future chaotic system based watermarking can be implemented for videos.

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