



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 7, July 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Performance Analysis of Digital Image Watermarking Using Hybrid Transformation Techniques

Nagaveni G R¹, Rachana B R², Sanjana M P³, Priya R Sankpal⁴

U.G. Student, Department of Electronics and Communication Engineering, BNM Institute of Technology,
Banashankari, Bangalore, India¹

U.G. Student, Department of Electronics and Communication Engineering, BNM Institute of Technology,
Banashankari, Bangalore, India²

U.G. Student, Department of Electronics and Communication Engineering, BNM Institute of Technology,
Banashankari, Bangalore, India³

Assistant Professor, Department of Electronics and Communication Engineering, BNM Institute of Technology,
Banashankari, Bangalore, India⁴

ABSTRACT: The internet has evolved into a popular means for downloading multimedia information. Digital media can be easily copied, posing a security risk. One of the most effective ways to address these problems is through digital watermarking. Data hiding technique is called Steganography, and digital watermarking is one of the information hiding science. Steganography systems have the property to embed hidden information in the cover content so that it is not visible. Digital watermarking can be used to safeguard digital files from piracy, counterfeiting, and other types of unlawful access. It is used for copyright protection, authentication, and in digital image watermarking identification. The subject of the proposed paper is a review of the numerous assaults on the watermarked image using DWT_SVD algorithm.

KEYWORDS: Digital watermarking, DWT, SVD, Hybrid technique

I. INTRODUCTION

Digital watermarking is an idea of incorporating ownership data such as a logo or signature into multimedia files that may later be retrieved to show who actually owns the media. Some properties, including capacity, imperceptibility, security, and robustness, can be compared amongst information hiding systems. Spatial and frequency domains are the major types of watermarking domains. Spatial based watermarking deals with changing the pixels image subsets, while Frequency domain techniques incorporate the watermark into the image's coefficients. Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), Discrete Fourier Transform (DFT), and Singular Valued Decomposition (SVD) are some of the popular watermarking techniques. A mathematical method for the hierarchical breakdown of a picture is the Discrete Wavelet Transform (DWT). The transformation is based on breaking down a signal into wavelets, which are four frequency sub-bands, low-low [LL], Low-High [LH], High-Low [HL], High-High [HH] bands. A real or complex matrix is factorized through the Singular Value Decomposition (SVD). This hybrid approach increases security and robustness by expanding the host image's storage capacity.

II. RELATED WORK

Due to the ease of copying, distributing, and manipulating multimedia data, multimedia security is a crucial topic for internet technology. To avoid unauthorized copying and distribution of multimedia material, watermarking is an area of information hiding that conceals critical information in the original data[3]. Kumar et al[1] reported that the Hybrid transform domain approaches can improve SVD's robustness, imperceptibility, and ability to prevent false positive results. The combined techniques could increase the extracted watermark's resilience under the picture processing of



assaults The effectiveness of mixed strategies is to fulfil the required objectives based on proper transformation. Watermarks are included into low frequency components in the Discrete Wavelet Transform Based Watermarking Algorithm presented by Raval Mehul S. et al[2]. One could attain incredibly high resilience qualities by incorporating both watermarks within low frequency image components. Watermark-based DWT-SVD was proposed for embedding in an image watermarking technique by Pandey et al. [4]. Their method made use of an adaptive embedding strength value that was produced by perceptual optimization of the contents of the host picture and watermark image. The strength and interpretability of the watermarked image were preserved by their scheme. Chou and Wu et al[5] presented a less computationally complex color watermarking approach for the spatial domain in which the color watermark is incorporated into the color cover image utilizing quantization indices; however, the proposed scheme's robustness is not improved.

III. METHODOLOGY

The proposed method is carried out in four stages:

Stage-1: Watermark embedding, is a process in which the cover and watermark images are subjected to watermarking algorithm resulting in the watermarked image.

DWT algorithm is applied on 2D image decomposition with the help of Haar wavelet filter. The resultant coefficients are subjected to SVD algorithm with an embedding factor(e). The combined technique increases the extracted watermark's resilience under the picture processing of assaults.

Stage-2: Watermark extraction is the inverse process of embedding.

Stage-3: Result analysis, deals with the quality of the resultant image and is measured with the help of performance metrics.

Stage-4: Robustness evaluation is a significant trait in watermarking technique hence Attack analysis is performed to analyse how the watermarked image behaves for various attacks.

IV. EXPERIMENTAL RESULTS

The proposed algorithm has been executed by using MATLAB R2020a software with wavelet toolbox. This algorithm is tested for different host images of size 512 × 512 pixels. We consider the same size watermark image.

Fig 1: Images used for proposed work: (a) Pepper (b) Lena (c) Baboon (d) Cameraman (e) Watermark

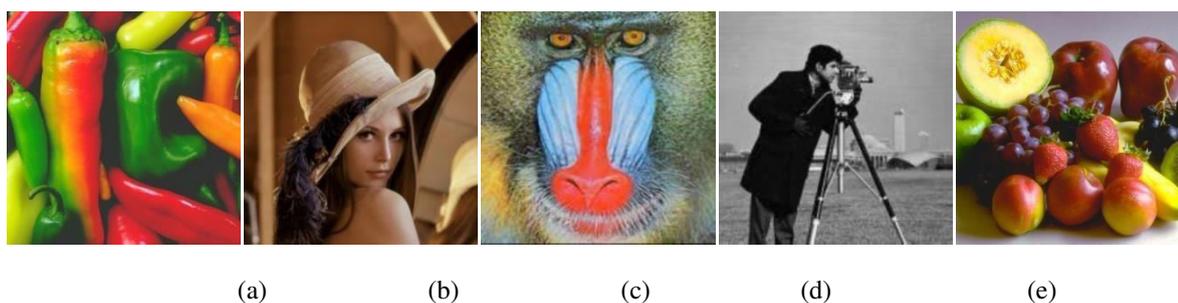


Table 1: Displaying Pepper cover image, Watermark image and the corresponding Watermarked image at individual frequency bands.

Frequency band	Cover image	Watermark image	Watermarked image
LL			

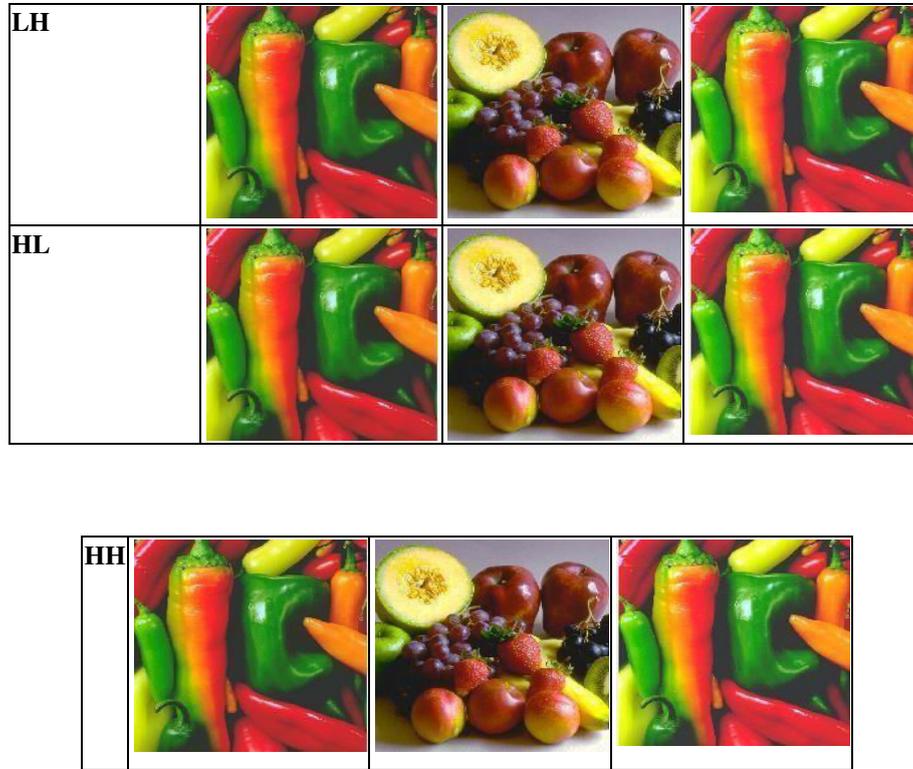
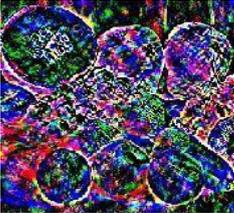
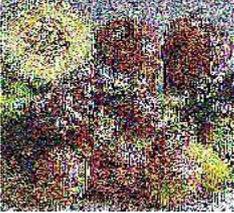


Table 2: Displaying Extracted watermark image from the Pepper watermarked image at individual frequency bands.

Frequency band	$e = 0.001$	$e = 0.01$	$e = 0.1$
LL			
LH			
HL			

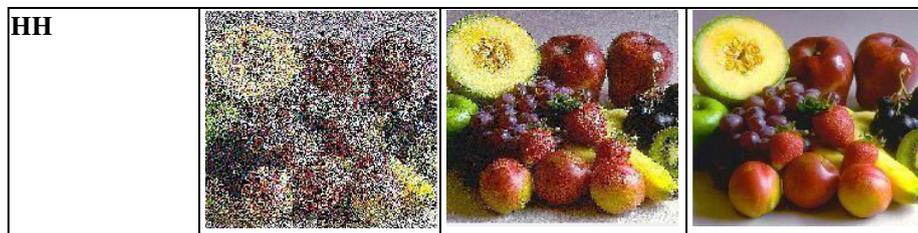


Fig 2: Images show the results of introducing artifacts to watermarked pepper image. (a) Salt and Pepper, (b) Gaussian noise, (c) Blur attack, (d) Rotation attack, (e) Crop image

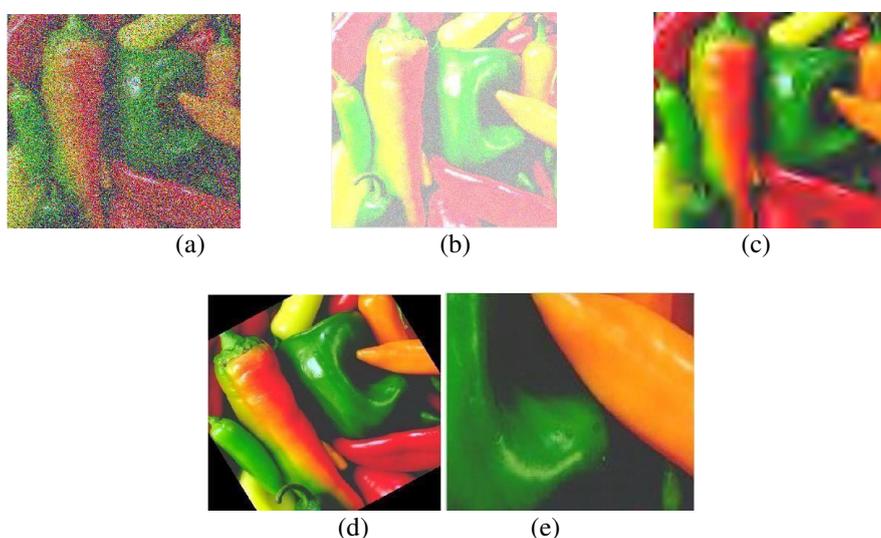


Table 3: Displaying performance metric values for 4 different Cover images with Watermark embedded image and Original watermark with Extracted watermark at individual frequency bands.

Frequency Band	Cover Image	Original cover image vs Watermarked image in dB			Watermark image vs Extracted watermark image in dB		
		SNR	PSNR	MSE	SNR	PSNR	MSE
LL	Pepper	20.2817	26.5428	144.1454	11.0255	18.5323	911.6915
	Lena	18.8022	26.0479	161.5448	25.9653	32.0601	40.4642
	Baboon	21.4842	26.2061	155.7651	20.1930	26.7192	138.4085
	Cameraman	21.1244	26.0285	162.2660	25.6283	31.6911	44.0525
LH	Pepper	29.2272	36.2270	15.5016	25.5871	31.6142	44.8397
	Lena	38.0147	46.3055	1.5224	26.7097	32.7357	34.6343
	Baboon	34.0851	39.5252	7.2536	27.2075	33.2320	30.8944
	Cameraman	43.3914	49.0697	0.8056	26.8085	32.8340	33.8598
HL	Pepper	29.2143	36.2142	15.5476	25.4399	31.4671	46.3845
	Lena	37.9904	46.2809	1.5310	26.8236	32.8494	33.7399
	Baboon	34.0860	39.5261	7.2522	26.5949	32.6212	35.5596
	Cameraman	43.3071	48.9851	0.8214	26.9964	33.0218	32.4266



HH	Pepper	29.2550	36.2549	15.4026	26.0255	32.0503	40.5559
	Lena	38.1115	46.4026	1.4887	27.3837	33.4070	29.6744
	Baboon	34.1825	39.6232	7.0918	26.9710	32.9949	32.6277
	Cameraman	43.6017	49.2805	0.7674	27.3613	33.3851	29.8245

Table 3 conveys that LL band is not a better choice to perform watermarking as it contains the approximate parts of cover image with lesser SNR, PSNR values, whereas other three bands contain the details of the cover image with an accepted range of performance metrics.

Table 4: Displaying PSNR values in decibel (dB) for 4 different host image with embedded watermark with combination of two frequency bands at 0.1 embedding strength.

Cover Image	LL_LH	LL_HL	LL_HH	LH_HL	LH_HH	HL_HH
Pepper	26.5418	26.5377	26.5402	36.1882	36.2194	36.2069
Lena	26.0450	26.0385	26.0505	46.1702	46.2974	46.2788
Baboon	26.2020	26.1995	26.2052	39.4376	39.5156	39.5251
Cameraman	26.0280	26.0227	26.0307	48.7608	49.0433	48.9841

Table 5: Displaying PSNR values in decibel (dB) for 4 different host image with embedded watermark with combination of three frequency bands at 0.1 embedding strength.

Cover Image	LL_LH_HL	LL_LH_HH	LL_HH_HL	HL_HH_LH
Pepper	26.5348	26.5425	26.5371	36.1710
Lena	26.0400	26.0463	26.0434	46.1515
Baboon	26.1936	26.1976	26.2006	39.4154
Cameraman	26.0209	26.0233	26.0213	48.7106

Table 6: Displaying PSNR values in decibel (dB) for 4 different host image with embedded watermark with all the four frequency bands together at 0.1 embedding strength.

Cover Image	LL_LH_HL_HH
Pepper	26.5335
Lena	26.0386
Baboon	26.1891
Cameraman	26.0184

Table 4, Table 5 and Table 6 summarize the same information as Table 3, ie quality of watermarked images is better when watermark is embedded at high frequency bands. Human vision is less sensitive to any variation in the high frequency bands and hence, is considered for hiding data.

V. PERFORMANCE ANALYSIS

The important aspect of identifying an image-based object is its quality. The performance of watermarked image quality is obtained by calculating SNR, PSNR and MSE. In general PSNR value lies in the range of 30 db to 60 db, SNR value lies in the range 20 db to 50 db and MSE value less than 10 (ideally 0) for an image of good quality.



.....(1)

S =the average received signal power, N =the average noise power.

$$\text{PSNR}=10 \log_{10}$$

(C_{max}^2)(2)

$$\text{MSE}=\frac{1}{MN} \sum_{x,y} (S(x,y)-C(x,y))^2$$

M, N = dimensions of the image, (x,y)= image coordinates, S= Generated Stego image at x, y, C= Cover image at x, y.

VI. CONCLUSION

The proposed DWT–SVD-based hybrid method is a better mechanism when compared to other algorithms. This method is applied to four different cover images along with the watermark image and the obtained results are analysed.

Authenticity and robustness are obtained at an acceptable range for the images using the proposed method. The imperceptible property of watermarking is also justified. Efforts would be taken in future for further improvement of the robustness and imperceptibility by combining more watermarking algorithms to the proposed method.

ACKNOWLEDGEMENT

We express our heartfelt gratitude to the college management of BNM Institute of Technology, Bengaluru for enabling us to carry out the project work with all the resources and subsequent publication. Also, we express our sincere gratitude to Visvesvaraya Technological University (VTU), Belagavi for providing us this platform.

REFERENCES

1. C. Kumar, A. K. Singh, and P. Kumar, "A recent survey on image watermarking techniques and its application in e governance," *Multimedia Tools Appl.*, vol. 77, no. 3, pp. 3597–3622, Feb. 2018.
2. Raval, M. S., and P. P. Rege. "Discrete wavelet transform based multiple watermarking scheme." *TENCON 2003. Conference on Convergent Technologies for the Asia-Pacific Region. Vol. 3. IEEE, 2003.*
3. Preeti Parashar and Rajeev Kumar Singh "A Survey: Digital Image Watermarking Techniques" *International Journal of Signal Processing, Image Processing and Pattern Recognition* Vol. 7, No. 6 (2014), pp. 111-124.
4. P. Pandey, S. Kumar, and S. K. Singh, "Rightful ownership through image adaptive DWT-SVD watermarking algorithm and perceptual tweaking," *Multimedia Tools Appl.*, vol. 72, no. 1, pp. 723–748, Sep. 2014.
5. Chou CH, Wu TL "Embedding color watermarks in color images" *EURASIP J Appl Signal Process* 2003:32–40.
6. Ensaf Hussein and Mohamed A. Belal, "A Comparative Study of Digital watermarking Techniques in Frequency Domain", *International Journal of Computer Applications*, Volume 52– No.20, August 2012.
7. Sharma, Preeti, and Tapan Jain. "Robust digital watermarking for coloured images using SVD and DWT technique." *Advance Computing Conference (IACC), 2014 IEEE International. IEEE, 2014.*
8. Akshya Kumar Gupta and Mehul S Raval, "A robust and secure watermarking scheme based on singular values replacement", *Sa`dhana`* Vol. 37, Part 4, August 2012, pp. 425–440. *c Indian Academy of Sciences.*
9. P. Mishra and R. Ahuja, "Review of Secured, Robust and Imperceptible Digital Watermarking Scheme," 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 2021. Yang, Chun-Ling, Wen-Rui Gao, and Lai-Man Po. "Discrete wavelet transform-based structural similarity for image quality assessment." *Image Processing, 2008. ICIP 2008. 15th IEEE International Conference on. IEEE, 2008.*
10. K. M. Hosny, M. M. Darwish and M. M. Fouda, "Robust Color Images Watermarking Using New Fractional- Order Exponent Moments," in *IEEE Access*, vol. 9, pp. 47425-47435, 2021.
11. R. Wang, C. Lin, Q. Zhao and F. Zhu, "Watermark Faker: Towards Forgery of Digital Image Watermarking," 2021 IEEE International Conference on Multimedia and Expo (ICME), 2021.
12. W. H. Alshoura, Z. Zainol, J. S. Teh, M. Alawida and A. Alabdulatif, "Hybrid SVD-Based Image Watermarking Schemes: A Review," in *IEEE Access*, vol. 9, pp. 32931-32968, 2021.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details