PBFO: An Enhancement in Digital watermarking Image Using Hybrid Approach

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Abstract- *Digital watermarking is a technique used for concealing knowledge about ownership of digital media. Multimedia copyrights such as video,audio, text, etc. were secured by watermarking strategies. For locations,sizes, dating, mill marks, and paper components, watermarks can be recycled, but are very useful in the investigation paper. DCT has broad use for multimedia compression and digital watermarking as a transforming coding method. DWT is a theory of information analysis and signal for a method of analysis of spatial - time scale, which has been very popular in recent years. Imaging processing is now an important part of medical science and as result, watermarking is necessary to ensure image protection as electronic medicine, telemedicine, online physician monitoring, and medical assessments are common. This paper used discrete transformation of wavelet, a discreet transformation of cosines, BFO (bacterial optimization of foraging) and optimization of a particulate swarm, and analyzed performances for medical watermarking images. C comparative performance of used algorithms has been demonstrated by the normalizing cross-correlation (NCC) value peak signal-to-noise ratio (PSNR). For successful message integration, PSNR and NCC value should be high.*

Keywords- Image Enhancement, Image Watermarking, Digital Watermarking, DCT, DWT, BFO, PBFO,PSO.

I. INTRODUCTION

Image is a very vital thing in gaining knowledge, communication, and describing anything in this world. Now a day's image capturing and storing become possible due to enhancement in technology nowadays, However almost no technical field is impaired in any way by image processing.
Image enhancement is one of the most desirable and simplest fields for digital image processing. The concept behind improvement methods is basically to highlight information that is hidden or to emphasize certain features of interest in an image. Over the past several years computer vision and analysis are attracting several researchers' attention and it motivated us to write this survey paper dealing with contemporary studies on the enhancement of Images. Image enhancement can be defined as information perception for humans to obtain and provide good input quality. This helps to adjust image attributes so that it becomes more relevant [1].

Watermarking is a procedure through which one can cover up helpful data by the utilization of any digital media. It is a procedure by which one can confirm the verification of the proprietor of a digital media. Watermarking is especially identified with Steganography. Since they both conceal messages inside a digital signal. The fundamental distinction between the two is: Watermarking tries to hide a message that is identified with the real substance of the digital flag. The watermark image is the valuable data that is to be avoided by the unapproved creator. The watermark image is valuable for the sender level and additionally for the accepting level [2].

Digital watermarking is derived from existing copyright laws for digital content as a process and tool for overwhelming limitations. the subject of a watermark is that even if it is copied, security work remains complete. The copyright or possession of watermark information is then verified and deleted. Removal or alteration of watermarks is difficult for counterfeiters. The actual owner always keeps his information safe and secure. [3].

II. IMAGE ENHANCEMENT

The technique of enhancing images is, for example, to make digital images more attractive for our eyes, making images smooth or sharp. This is an important subject in digital image processing. This will allow individuals and algorithms for computer vision to obtain accurate data from enhanced images.Visual quality and certain image properties, such as contrast, color accuracy, transparency, and brightness, edge sharpness has been enhanced through the enhancement process.

The process of image enhancement can be divided into two categories:

1. **Enhancement of spatial domain images**

The enhancement of a spatial domain image works directly on pixels. M much of space-based domain technology comes from being easy to comprehend and restricting such methods to prefer real-time complexity and execution. Again, it is possible to divide spatial domain techniques into two different categories.:

- **Point Processing operation:** Where the neighborhood is simply pixel itself, the simplest spatial domain operations occur. Used mostly for improvement of contrast.
- **Spatial filter operations:** To alter or enhance an image, filtering is used. Operation or filtering of spatial domains in which processed value depends on itself and surrounding pixels for current pixel value.

2. Domain image enhancement based on the frequency

Enhancing frequency-based domain image is a concept used for defining mathematical functional frequency analysis and for operating directly on image transformation coefficients such as Fourier transformation and discrete cosine transformation (DCT). This technique is fundamental to adjust an image by adjusting the coefficients of transformation. Frequency domain approaches can again be divided into three categories:

- Periodic Noise reduction by frequency domain filtering
- Image Sharpening
- Image Smoothing [4].

III. DIGITAL IMAGE WATERMARKING

Digital Image Watermarking is an engineering field with a new and potential reputation. It is referred to as a method of fixing copyright holder uniqueness within the work of digital image watermarking that is very difficult and impossible to remove. The process of embedding data into a digital signal is digital watermarking. For instance, photographs, audio, or video can be a signal. If a signal is unoriginal, then copy also carries content. the detail is visible in pictures or video invisible watermarking.

A. PROPERTIES OF WATERMARKING

The digital watermarking technique has three main Properties.

a) **Translucency or Fidelity:**After it is watermarked, the digital watermark should not impact the content of a cover image. Watermarking does not present visible alterations because it deteriorates the commercial value of the image if such distortions are presented

.

b) **Robustness**: Simple image processing activities, such as improving contrast or brightness, gamma correction, etc., can remove watermarks accidentally or intentionally. These attacks should also be robust with watermarks.

c) **Data Payload or Capacity:** This property indicates how much data is to be integrated into the watermark during extraction. To denote the distinctiveness of the image, Watermark should be able to use sufficient information. Different systems have different payload specifications [5].

B. APPLICATIONS OF THE IMAGE WATERMARKING

For various applications, image watermarking can be used, and some of the applications are described below:-

a) **Tamper detection:** For tamper detection, an image watermark is used, it recognizes watermark in the image to degrade or destroy and that material is not trusted.

b) **Telecast monitoring:** This form of monitoring is used to ensure, in particular in advertising, that content is transmitted as a contract between the advertising firm and consumer.

c) **Software clipping:** In this, customers will see software before purchasing it, some of the program's functionality such as saving it, or printing it is disabled before they buy the registration key to use watermarking for this purpose.

d) **Copyright protection:** Essentially, image watermarking is used for the protection of copyright. copyright details or information can be incorporated into an image as a watermark and can, if necessary, be extracted to display the company's ownership.

e) **Authentication and authenticity validation:** You can use the watermark to detect whether an image is changed or not. Image integrity can be checked by the use of weak watermarks with low robustness.

f) **Medical applications:** In medical images, image watermarking can also be used. It can be used to keep data of patient private so that an unauthorized person can not access it. [6].

IV. LITERATURE REVIEW

DJie, S., et al. [2020]This paper uses discrete cosin transformation (DCT) and discerning wavelet transformation

(DWT) techniques to propose new robust video watermarking algorithms. This paper uses Video frames that are selected randomly first, followed, by the DCT algorithm for video frames selected. The first video frames column selected is screwed by Arnold's algorithm. Also, each column with 4 DC coefficients is reshaped and transformed into four different DWT sub-bands. Approximation (LL) is then fitted with a watermark. It is easy to implement the proposed algorithm since it provides random frames without accurate video frame specifications. Experiments show that this algorithm can withstand various kinds of watermarking attacks, including Gaussian philter attack and an attack with sharpening. Also, it shows that the algorithm proposed beats every algorithm of watermarking.[7].

S. Bharati [2018]Image processing now has a major role in the field of medical sciences and watermarking is required to guarantee security for telemedicine-based images, electronic medicine, a medical evaluation by doctors online are becoming more and more common. Also, watermarking is essential to ensure the safety of images. In this paper, for purposes of medical image watermarking, discrete wavelet transformation, discrete cosine transformation, bacterial foraging optimization (BFO), and particle swarm optimization were used and their output was analyzed. To display the comparative performance of applied algorithms, Peak signal to noise ratio (PSNR) value, normalized cross-correlation (NCC), and image fidelity (IF) were measured. For efficient message integration, PSNR and NCC values must be high. [8].

Mehta, R., & Agarwal, N. (2018) This paper proposes a novel approach for image splicing in light of statistical Markov characteristics of the computerized frame. The innovation of this paper is that Markov's properties are combined on basis of all three separate domains in fields of space, DCT, and DWT. Authors have identified features in previous work by combining one or more dominates, both spatially and in DCT[or by combining less accurate DCT and DWT, TPR, and TNR domains. Also, our breakthrough lies in the option of classification that we use here, and we have not checked any paper using the ensemble classification of those techniques. Former methods used SVM for PCA classification that increases algorithm computational complexity. Earlier methods used SVM for PCA classification, which increases algorithm machine complexity Nsemble classification not only reduces the machine complexity of an algorithm, they also deliver good TPR, TNR, and accurate results even when all three domains are combined, i.e. spatial, DCT, and DWT characteristics, without using PCA.[9].

T. Koya et al. [2017]New algorithm is introduced in this paper, which reduces bytes available in pictures. Dividing image into component RGB proposes a solution, component YCbCr separately, and component CMY individually and by adding each component to DCT and DWT, and the resulting arithmetic coding will be used and compression ratios will then be specified. It compares the performance of hybrid encoder based on DCT and DCT-DWT. DCT-DWT approach exceeds the DCT-based arithmetic coding technique. The efficiency of the hybrid DCT-DWT encoder-based image compression method is also found to be highest when testing YCbCr components. Similar results are given by RGB and CMY component-based. This method is also opposed to the DCT-based color picture compression algorithm using a different data structure. [10].

Min Lei [2016]This paper offers a novel algorithm based on DWT (discrete transform wavelet), DCT (discreet transforming cosine), and SVD (singular decomposition of value). To prevent data changes and host signal decomposition, Watermark is recorded to carry out SVD on coefficients delivered by DWT and DCT. The simulation results show that the proposed zero-watermarking algorithm is extremely strong for typical signal processing methods such as necessity, low-pass filtering, MP3 compression, white Gaussian noise addition as well as resampling. [11].

Hu, H.-T., & Hsu, L.-Y. (2015) This paper presents a new method based on feature parameters, including DWT (discrete wavelet transformation),singular value decomposition (SVD), and discrete cosine transformation (DCT), Eligible to use blind image watermark derived from composite domain multiple bits can be incorporated it into image block by adjusting basic parameters with progressive quantization index method for modulation. In functional parameters of domain DWT-SVD-DCT, calculation leads to efficient mining of watermarks without mention of original images. Experimental findings demonstrate the surprise of image compression susceptibility of integrated watermarking with JPEG and JPEG2000 standards. [12].

V. RESEARCH METHODOLOGY

A. PROBLEM STATEMENT

The aim of taking "Image Watermarking" as a subject for this project was to take photos on the web vulnerable to illegal image duplication without the owner's consent. To solve this, watermarking was suggested so that watermark is concealed as a token of ownership in the picture. But to destroy the watermark without harming the image much, the intelligent attacker carried out various attacks on the image.

This prompted us to consider ways of proposing a robust algorithm that prevents a variety of attempts, noise added, such as JPEG compression, and cutbacks. We decided to work on DCT-based watermarking schemes after further research. We found that these schemes had several changes. But before that, after making slight image changes, we needed to put some details about the reaction of the image to different attacks. In later chapters, these will be explored in depth. The purpose of this project is to assess the efficiency of color channels in the DCT-based watermarking process and offer a robust algorithm that prevents several attacks, including JPEG Compression, capacity, and crop attacks. We use Dct+dwt+pbfo to enhance the outcome of our algorithms and to improve the image much better and to increase low psnr in the case of dwt alone.

B. PROPOSE METHODOLOGY

To avoid duplication of images, image watermarking is important and in the old dwt system, only the result of watermarking is lower than watermarking using DWT+DCT now we are also using pbfo combination to increase result as u can see in our result that combination of DWT+DCT+PBFO performs much better than the previous method. In general, watermarking using DWT and DCT showed positive results in both invisibility and robustness.

C. PROPOSED TECHNIQUES

The following techniques are given below which is used in the proposed:

1. DWT (DISCRETE WAVELET TRANSFORM)

DWT is a space and time scale analytical information processing theory and signal that has recently become very popular. It provides several space and frequency scales that continuously decompose from small to high-resolution images. Also, in the watermarking area, the DWT algorithm is widely applied. A DWT is a transformation wavelet for which wavelets are individually evaluated in mathematical analysis and functional analysis. Dynamic exploration, as with other wavelet transformations, has a fundamental advantage over Fourier transformations: it seizes knowledge of both frequency and position. In mathematics, physics, computer science, and engineering, discrete wavelet transformation has a large number of applications. [13,14].

2. Discrete Cosine Transform (DCT)

In summation of cosine functions fluctuating at diverse frequencies, DCT records the minimum order of data points. The process of cosine is acute for sine function rather than for compression so that it produces rare cosine functions to estimate representative signals, but special higher boundary conditions are expressed in cosines of differential equations. DCT is a discrete Fourier transform (DFT)-related Fourier-related transform, which then absorbs actual individual numbers. DCTs are typically often correlated with Fourier Series constants and correspondingly extended order, whereas DFTs are often extended order interrelated to Fourier Series coefficients. DCT is a coding method of transformation that is commonly used in a multimedia compression and digital watermarking [15,16].

3. BACTERIA FORAGING OPTIMIZATION

The Bacteria Foraging Optimization algorithm is novel like optimization algorithms. GAs(Comparable Genetic Algorithm),ES(Evolutionary Strategies), Evolutionary Programming (EP) optimization algorithms have dominated the supremacy of optimization algorithms, inducing their creativity from growth and normal genetics. Particle Swarm Optimization (PSO) has been similar in recent times to natural swarm stimulated algorithms, and Ant Colony Optimization (ACO) has proven and demonstrated its effectiveness in this dominance. The critical concept of the new algorithm is the use of assembly search techniques to optimize the role of E. coli bacteria swarm. Exploration of bacteria for nutrients in system achieved per unit time to exploit resources. Separate bacteria, via transfer signals, often communicate with others. A bacterium later proceeds to search decisions considering two earlier factors.[17].

4. Particle swarm optimization (PSO)

Dr. Eberhart introduced in 1995 PSO as a stochastic method of optimization, promoted by choosing birds or the social effects of fish schooling. PSO has various connections to evolutionary computational approaches, such as genetic algorithms (GA). With a population with casual findings and target explorations, the approach is revised by telling generations. On other hand, with different PSOs, such as limits and changes, GA does not have development operators. By producing current optimal components, Particles so-called, potential hypotheses, Difficult space flying is PSO. In contrast to GA, PSO benefits from casual use of PSO equipment and uncommon conditions for alteration.[8].

D. PROCEDURE

In the first step we are going to browse the cover image and then the message that is going to hidden and then we will find the bits of the cover image and after that, we will

apply the dwt watermarking and then we will going to apply the combination of DWT_DCT that will improve the accuracy and now we are going to apply the PBFO techniques.

E. FLOW CHART

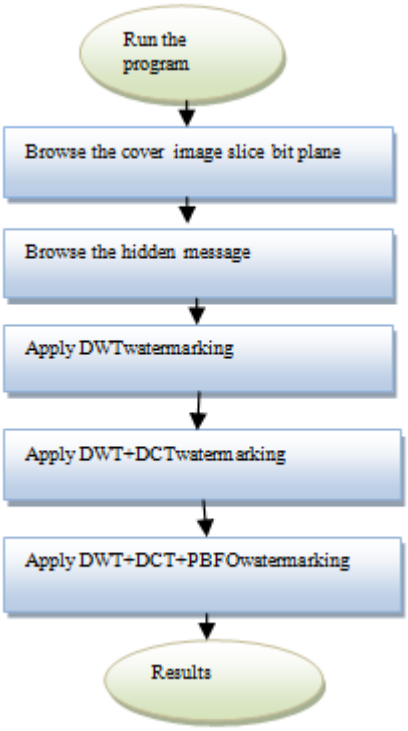

Fig 1: Flow chart on proposed work

VI. RESULTS AND DISCUSSION

A. DESCRIPTION

The analysis methods selected for this study will be presented by MATLAB 2018. For scientific computing, it is a highly skilled language. This involves a basic environment in which.. Math terminology defines problems and responses in programming, visualisation, or computation.

B. SCREENSHOTS OF SIMULATED RESULT

Figure 2: First window when you run the program

Figure 3: Now browse the cover image

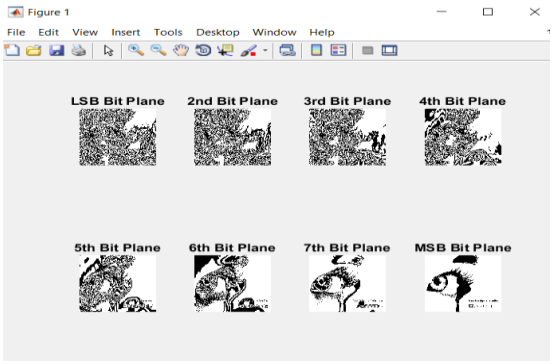

Figure 4: Bit-plane slicing of the cover image

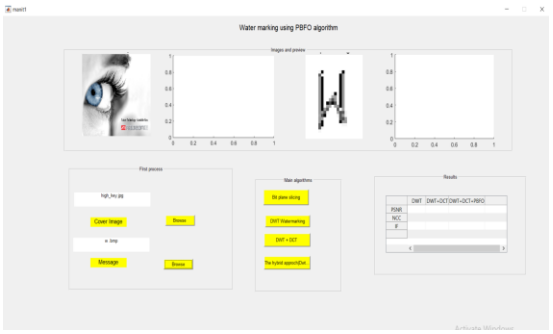

Figure 5: Now browse the message u want to hide

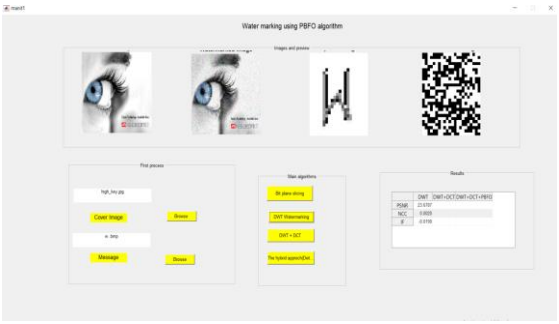

Figure 6: now apply the dwt (discrete wavelet transform) watermarking

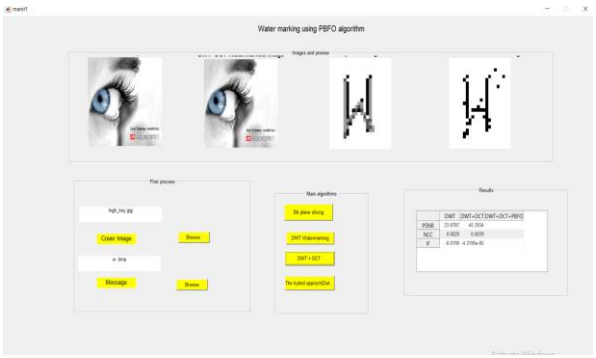

Figure 7: now apply dct+dwt watermarking

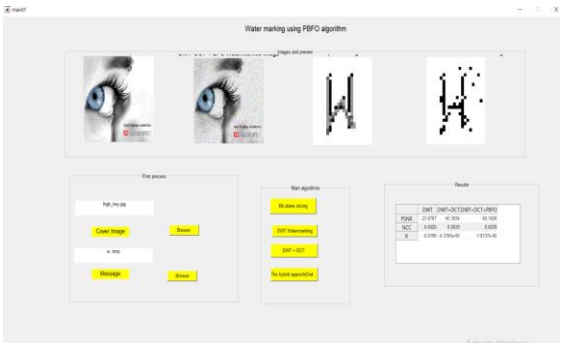

Figure 8: Now apply Dwt+DCT+PBFO that is our enhancement technique

C. Comparison Graphs Proposed & Base Results

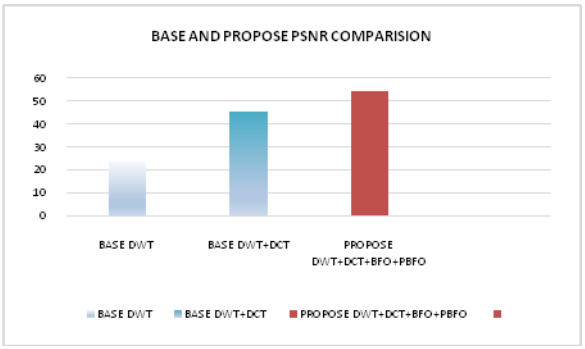

Figure 9: Propose & Base PSNR Comparision

DWT & DWT+DCT are the base techniques and the remaining are the proposed techniques.

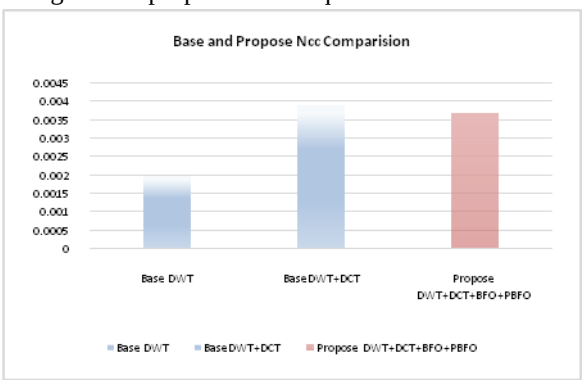

Figure 10:Propose & Base NCC Comparision

Values Represent NCC (normalized cross-correlation)

VII. CONCLUSION

Image watermarking is an effective way to hide data in the image. For efficient communication, it is a safe method. A code that is inserted into an image is digital watermarking. Digital watermarking is a form of marker such as audio or image data embedded in the noise-tolerant signal. Usually, digital watermarking is used to classify ownership of the publication of such signals. A still image watermarking scheme with high robustness in the frequency domain is implemented in this work. The proposed scheme only measures images rather than audio or video. In several applications, such as authentication and copyright security, this algorithm can be used for data hiding. A general coding-type framework that offers useful and constructive instruments in the analysis and design of the watermarking method is used in this dissertation. This especially demonstrates the effectiveness of an approach to watermarking in achieving design objectives such as robustness, protection,capacity, and efficiency of implementation.

REFERENCES

[1] G.Ruth Rajitha Rani," A Survey on Image Enhancement Techniques", *International Journal of Computational Engineering Research (IJCER),* ISSN (e): 2250 – 3005, Volume, 09, Issue, 3,March– 2019

[2] Neha Mahant," Study of security enhancement strategies in digital image processing",*IJARSE*,Vol.06, ISSN: 2319-8354,Dec-2017

[3] Bharati, S., Rahman, M. A., Mandal, S., &Podder, P. (2018). Analysis of DWT, DCT, BFO & PBFO Algorithm for Medical Image Watermarking. *2018 International Conference on Innovation in Engineering and Technology (ICIET).* DOI:10.1109/ciet.2018.8660796

[4] Rashmi Choudhary, SushoptiGawade," Survey on Image Contrast Enhancement Techniques", *International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET*), ISSN 2455-4863 (Online), Volume: 2 Issue: 3 | March 2016

[5] M.Hariharalakshmi," Survey of Digital Watermarking Techniques for Data Security", *International Journal of Innovative Research in Computer and Communication Engineering*, Vol. 5, Issue 3, March 2017

[6] Dr.B.Hari Krishna," A survey on Digital Image Watermarking", *International Refereed Journal of Engineering and Science (IRJES),* ISSN (Online) 2319-183, Volume 1, Issue 4 (December 2014), PP.49-53.

[7] Jie, S., Qi, L., & Chun-Lin, S. (2020). Robust Video Watermarking Using a Hybrid DCT-DWT Approach.

Journal of Electronic Science and Technology, 100052. DOI:10.1016/j.jnlest.2020.100052

[8] S. Bharati, M. A. Rahman, S. Mandal, and P. Podder, "Analysis of DWT, DCT, BFO & PBFO Algorithm for Medical Image Watermarking," 2018 *International Conference on Innovation in Engineering and Technology (ICIET*), Dhaka, Bangladesh, 2018, pp. 1-6, DOI: 10.1109/CIET.2018.8660796.

[9] Mehta, R., & Agarwal, N. (2018). Splicing Detection for Combined DCT, DWT, and Spatial Markov-Features Using Ensemble Classifier. *Procedia Computer Science, 132, 1695–1705*. DOI:10.1016/j.procs.2018.05.143

[10] T. Koya, S. Chandran, and K. Vijayalakshmi, "Analysis of the application of arithmetic coding on dct and dct-dwt hybrid transform of images for compression," *2017 International Conference on Networks & Advances in Computational Technologies (NetACT), Thiruvanthapuram*, 2017, pp. 288-293, DOI: 10.1109/NETACT.2017.8076782.

[11] Min Lei, Yu Yang, XiaoMing Liu, MingZhi Cheng, and Rui Wang, "Audio zero-watermark scheme based on discrete cosine transform-discrete wavelet transform-singular value decomposition," *in China Communications*, vol. 13, no. 7, pp. 117-121, July 2016, DOI: 10.1109/CC.2016.7559083.

[12] Hu, H.-T., & Hsu, L.-Y. (2015). Exploring DWT–SVD–DCT feature parameters for robust multiple watermarking against JPEG and JPEG2000 compression. *Computers & Electrical Engineering, 41, 52–63*. DOI:10.1016/j.compeleceng.2014.08.001

[13] D. Sundararajan, "Discrete Wavelet Transform: A Signal Processing Approach," John Wiley & Sons, 2016.

[14] T. T. Takore, P. R. Kumar, and G. L. Devi, "A modified blind image watermarking scheme based on DWT, DCT and SVD domain using GA to optimize robustness," *in Proc. of Intl. Conf. on Electrical, Electronics, and Optimization Techniques, Chennai*, 2016, pp. 2725-2729.

[15] Vladimir Britanak, Patrick C. Yip, K. R Rao, "Discrete Cosine and Sine Transforms General Properties, Fast Algorithms and Integer Approximations," *Elsevier*, 2010.

[16] C. Song, S. Sudirman, and M. Merabti, "A robust region-adaptive dual image watermarking technique," *Journal of Visual Communication and Image Representation*, vol. 23, no. 3, pp. 549-568, Apr. 2012.

[17] S. Dehuri, A.K. Jagadev, M. Panda, "Multi-objective Swarm Intelligence: Theoretical Advances and Applications," *Springer*, 2015.