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Improved Quality of watermark image by using integrated SWT with GA and PSO

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Abstract

Digital watermarking enables one to protect the document; it is the kind of material authentication. The major problem in hypermedia technology is attacks on digital watermarking.In digital watermarking single attack on a given watermark image has effective outcome but multiple attacks on a given watermarked image and other watermark scrambling need to be improved. This paper purposes a new watermarking technique using integrated approach of SWT with GA and PSO for watermarking scrambling is used. The proposed methodology enhances imperceptibility and robustness in the watermarked image which has result in improving the visual quality of watermark.

Keywords: Watermarking; Watermarking Techniques; DCT; SVD; ABC; SWT; GA; PSO

1. INTRODUCTION

With the quick worldwide extension of web, the development of computerized advances has turned into an essential requirement, and these innovations give various preferred standpoint to exchanging information over the web. The propelling universes of computerized interactive media confront issues connected to safety and legitimacy of computerized information. The data safety time period is portrayed as ensuring data or advanced information against any assault that might be performed by using distinctive assaulting advances, strategies and techniques. Digital watermarking

is the way toward hiding important data in computerized medium. A watermark framework is accounted for to get protected, if the programmer couldn't take away the watermark lacking of packed information of inserting algorithm, detector plus structure of watermark. A watermark ought to just be available to authorized parties [18].

A. Watermarking Algorithm

Watermarking algorithms split into spatial and frequency domain algorithm [20].In Spatial Domain the watermark is embedded within computerized content through pixel modification by using spatial algorithm. Mostly least significant bit (LSB) is utilized as a part of spatial domain. Spatial algorithm is easy to implement because of their low complexity and they probably insert little information. In Frequency Domain the frequency domain has similar to distribute the range transmission which inserts watermark with the adjusting the size of the coefficient in the digital material as per the embedding technique. Therefore frequency domain watermarking offers more calculating value which ensures more quality and intangible than the spatial domain watermarking.

B. Watermarking Techniques

1. Discrete Cosine Transform (DCT)

DCT converts or switches a signal from spatial domain into a frequency domain. Thus, breaking up the high-frequency DCT coefficient and using the lighting advancement in the low–volume DCT coefficient, it'll acquire and cover the edge information from satellite images. FL is usually utilized in order to represent the minimum frequency aspects of the actual block, whilst FH stands for greater frequency components. FM is usually preferred because it which provide an extra ability to resist against lossy compression techniques. The increased picture is reconstructed by utilizing inverse DCT and it is likely to be sharper with excellent contrast. **[4].**

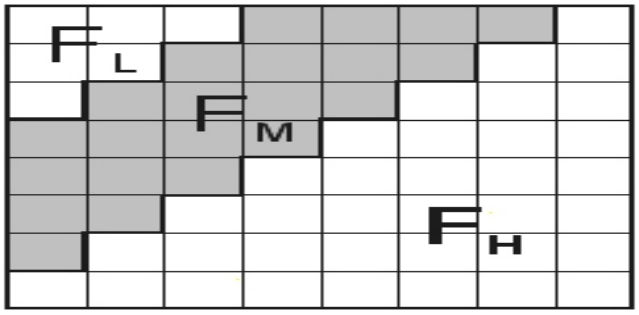


Fig1: Discrete Cosine Transform regions [4]

2. SINGULAR VALUE DECOMPOSITION (SVD)

SVD is algebraic method for many of the applications.

A picture of N× N splits into three matrices by using SVD transformation. Let A be picture now the

SVD of A written in equation (1)

[USV] = SVD (A)

$I = USv^t$ (1)

Now, U and V will be orthogonal matrices using compact singular value, as well as S will be diagonal matrix comprises greater singular value records of the picture. [20]

3. DISCRETE WAVELET TRANSFORM (DWT)

A signal divides in to a pair of elements, generally higher frequencies as well as lower frequencies. DWT is widely used because it offers both special localization and a frequency spread of the watermark among the cover image. The signal is spilt into high and low frequency it doesn't stops until signal entirely decomposed. The reconstruction process called the inverse DWT (IDWT).

3.1 Artificial Bee Colony (ABC)

Artificial bee colony algorithm, some sort of swarm-based synthetic cleverness protocol, can be encouraged by way of brilliant foraging behavior regarding darling bees. While in the ABC protocol, there are a few bee organizations around synthetic bee nest: in lookers, scouts, plus employed bees exactly where every bee delivers a posture within the lookup space. As soon as the circle consists and cluster-head alerts, the particular bees travel within the lookup space with and dimensions. The particular ABC uses some sort of inhabitants regarding bees to get the cluster-heads. A bee holding out on the flow area to determine to select a meal source is usually an viewer as well as a bee should go to your meal source been to because of it recently is usually an employed bee. A bee that will does arbitrary lookup is known as scout. The location of an meal source delivers a likely way to the particular optimization trouble as well as nectar quantity of an meal source matches the particular quality (fitness) of the associated solution.

4. STATIONARY WAVELET TRANSFORM (SWT)

The particular stationery wavelet convert is an extension box with the standard under the radar wavelet transform. Non moving wavelet convert utilizes high and low move filters. SWT use high and low move filtration system to the results at each place as well as at upcoming point delivers a couple of sequences. The two brand new sequences are having exact same period when that regarding an original sequence. With swt, instead of decimation most people modify the filtration system at each place through underlay all of them zeroes. Non moving wavelet convert is computationally more complex2.

4.1 Genetic algorithms (GA)

GA is really a randomized world-wide search method in which eliminates difficulties through copying functions seen via organic evolution. Using the surviving and also processing of the fittest, GA continuously exploits new and better methods without the pre-assumptions, just like continuity and also unimodality. GA continues to be effectively acquired in numerous difficult optimization difficulties and also displays the benefits through regular optimization strategies, specially when the computer within analysis possesses several community greatest solutions.

4.2 Particle swarm optimization (PSO)

Particle swarm optimization (PSO) is the newest evolutionary marketing techniques.The contaminants,which might be likely options within the PSO protocol, take a flight all over within the multidimensional search space or room and the positions of person contaminants usually are tweaked relating to its past finest location, and the neighborhood finest or maybe the world best. Due to the fact just about all contaminants throughout PSO usually are stored since folks the people all over the course of the particular seeking course of action, PSO is the one evolutionary protocol which doesn't carry out tactical in the fittest. As basic and also economic throughout thought and also computational charge, PSO has been shown to correctly optimize a number of continuous marketing troubles.

5. METHODOLGY

PROPOSED METHODOLOGY

The detailed working of GAPSO technique.

Step1:Initialize t = 0 Countpg = 0

Step2:Generate population Pold of size N

Step3:For each chromosome i$i \epsilon p_{old}$

3.1 Generate rule i from the chromosome i

3.2 Calculate fitness of the rule i

3.3 Initialize X0, V0, Pi, Pg

Step4: Initialize empty population Pnew of size N

Step5: OldPg = Pg

Step6: For each chromosome I and i+1 ϵ Pold

6.1 Mutate and crossover chromosome i with i+1

6.2 Add reproduce chromosome to Pnew

6.3 Generate rule i from the reproduce chromosome i

6.4 Calculate fitness of rule i

6.5 Update Vi, Xi, Pi, Pg

7. Select fittest rules form the Pold and Pnew then put it in the Pold

Step8: If OldPg = Pg then

CountPg++

Else

CountPg = 0

Step9: t++

Step10: If((t > G or (CountPg > (G/4))) then

S = Pold

Stop algorithm

Else

Go to Step5

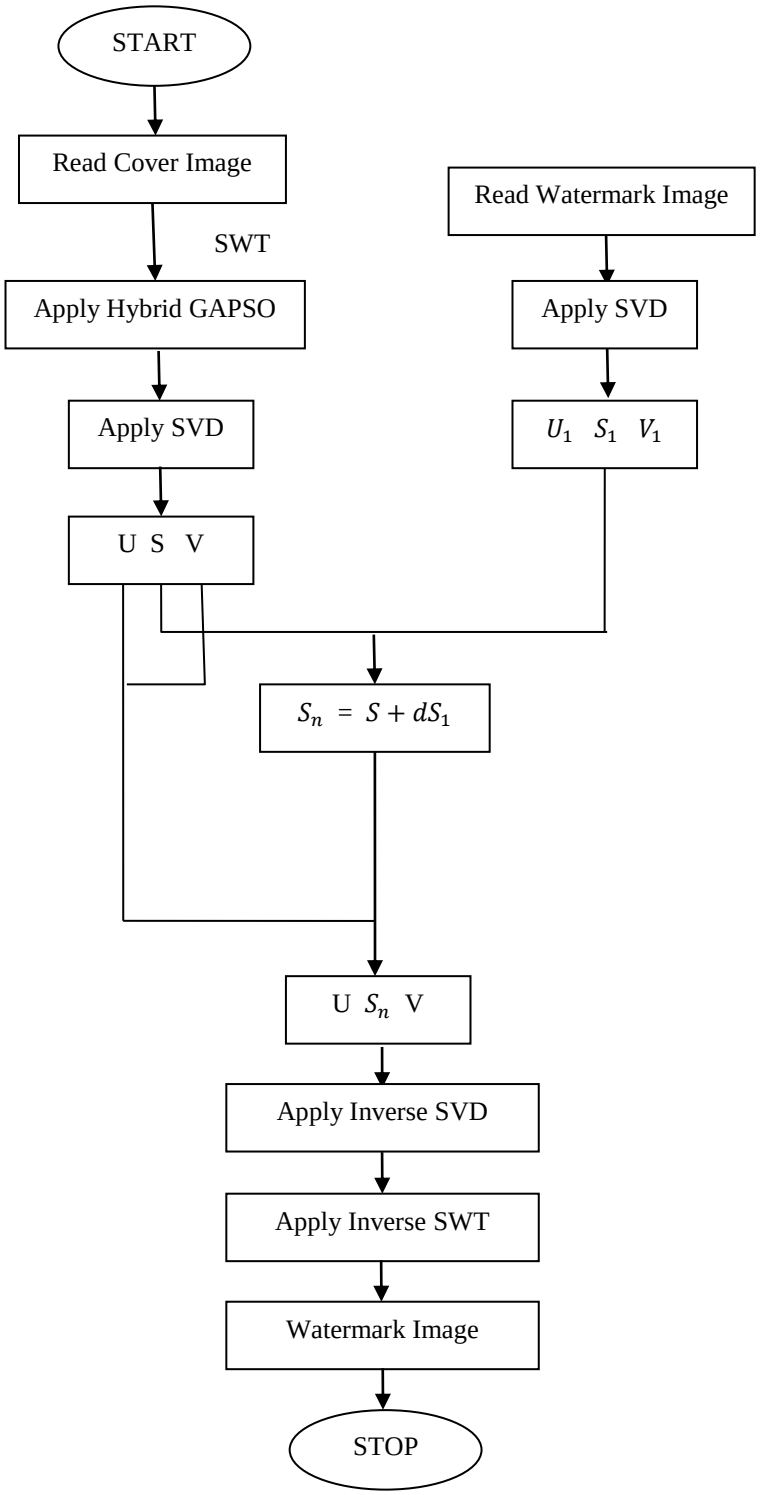


Fig 2: Flowchart of watermarking process

6. EXPERIMENTATION AND RESULTS

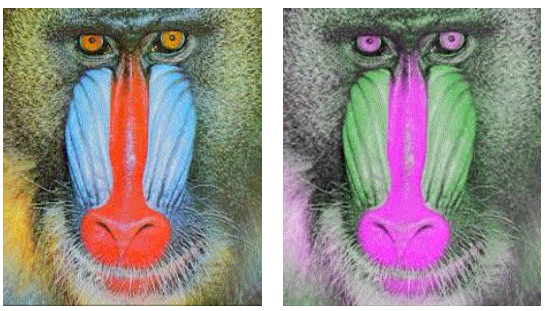
Mary Agoyi [19] has obtained watermark images by using various techniques on it. It has been observed that the effect of the multiple attacks on a given watermarked image has been neglected by the most of the existing researchers .The use of watermark scrambling has been ignored by the majority of the existing researchers.

Applying the ABC based DWT on the existing output image and apply the PSOGA based SWT on the proposed output image.

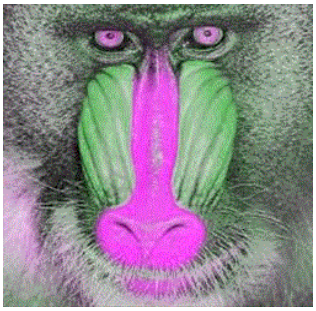
a) input image b) existing output image with ABC based DWT

c) Proposed output image with PSOGA based SWT

Now the watermark inserted to the cover image and we will conclude the results based on three parameter Peak signal noise ratio (PSNR),structural similarity metric(SSIM) and contrast gain(CG).



a) input image b) existing output image with ABC based DWT



c) Proposed output image with PSOGA based SWT

a) input image b) existing output image with ABC based DWT

c)Proposed output image with PSOGA based SWT

7. PERFORMANCE ANYLYSIS

This proposed method is implemented by using MATLAB tool u2013a.The algorithm results are concluded by using various performance parameters Structural similarity index metric (SSIM), Peak Signal to Noise Ratio (PSNR) and Contrast Gain (CG).

1. **Structural similarity index metric**

The structural similarity (SSIM) index is a method for predicting the perceived quality of digital television and cinematic pictures, as well as other kinds of digital images and videos. SSIM is maximum in case of the proposed algorithm thus proposed algorithm provides better results compared to the existing technique.

Table 1: Execution Time comparison table

SNO	COVER IMAGES	WATERMARK	SSIM (ABC based DWT)	SSIM (PSOGA based SWT)
1	C1	W1	0.9785	0.9892
2	C2	W2	0.9178	0.9281
3	C3	W3	0.9503	0.9603
4	C4	W4	0.9804	0.9761
5	C5	W5	0.9411	0.9519
6	C6	W6	0.9596	0.9707
7	C7	W7	0.9771	0.9884
8	C8	W8	0.8902	0.9009
9	C9	W9	0.8796	0.8899
10	C10	W10	0.8921	0.9028

Figure 3 has shown the quantized analysis of the different image Structured Similarity index Metric by Existing value in (Blue line) & proposed values in (Red lines). In SSIM the values of the proposed approach is maximum for better results to improve the quality of the image.

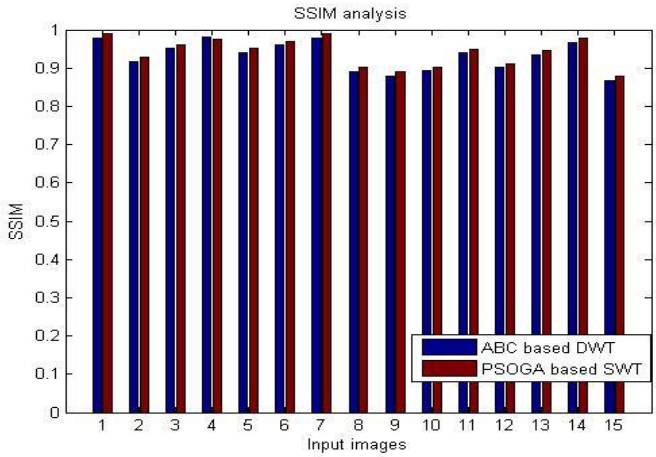


Fig 3: Structural similarity index metric

2) ***Peak signal noise ratio***

PSNR is used to estimate the imperceptibility. PSNR is utilized to gauge the corruption brought about by the watermarked impact. The PSNR, i.e. calculated

within decibels characterizes the likeness between a unique picture and the reproduced picture.
PSNR value of images with the usage of proposed method over other methods. This increase represents improvement in the objective quality of the image in comparison to existing technique

Table 2: Peak signal to noise ratio comparison table

S NO:	COVER IMAGES	WATERMARK	PSNR(ABC based DWT))	PSNR(PSOGA based SWT)
1	C1	W1	55.2272	57.3797
2	C2	W2	40.9309	52.0732
3	C3	W3	52.1529	54.2893
4	C4	W4	58.7782	60.9149
5	C5	W5	51.1653	53.2868
6	C6	W6	52.3621	54.4941
7	C7	W7	54.4969	56.6672
8	C8	W8	48.8234	50.9691
9	C9	W9	49.8834	52.0237
10	C10	W10	48.7439	50.8844

Figure 4 shows the quantized analysis of the peak signal to noise ratio of different images by Existing value in (Blue line) & proposed values in (Red lines). It is very clear from the graph that there is increase in PSNR value of color medical images with the use of proposed method over existing methods. This increase represents improvement in the contrast of the image

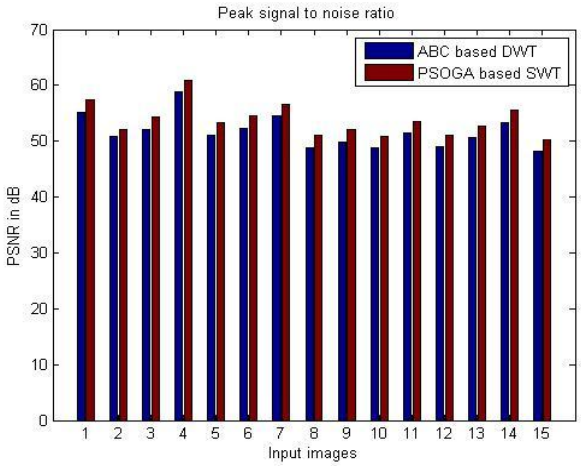


Fig 4: Peak Signal Noise Ratio

3) ***Contrast gain***

Contrast gain have to be maximize therefore the proposed algorithm is showing the better results compared in comparison to existing technique.

Table 3: Contrast gain comparison table

S NO:	COVER IMAGES	WATERMARK	CG (ABC based DWT)	CG (PSOGA based SWT)
1	C1	W1	3.1163	3.3315
2	C2	W2	2.5781	2.7899
3	C3	W3	2.7431	2.9548
4	C4	W4	3.4713	3.6849
5	C5	W5	2.7100	2.9221
6	C6	W6	2.8297	3.0429
7	C7	W7	3.0431	3.2602
8	C8	W8	2.4758	2.6904
9	C9	W9	2.4444	2.6569
10	C10	W10	2.4837	2.6975

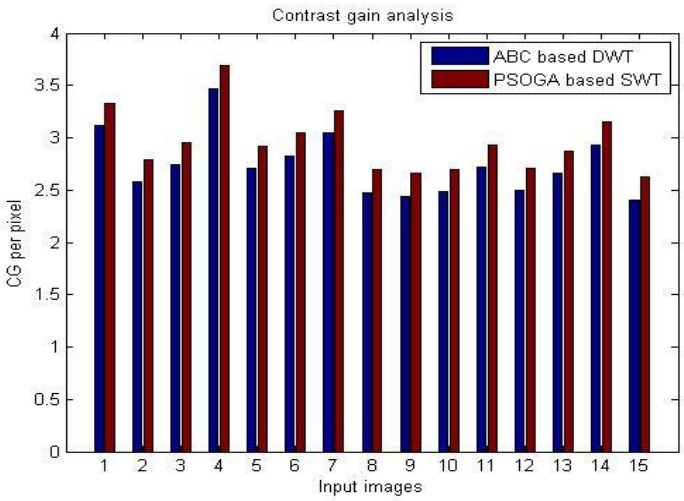


Fig5: Contrast Gain (CG)

Figure 5 shows the quantized analysis of contrast gain of different images by Existing value in (Blue line) & proposed values in (Red lines). It is very clear from the graph that there is increase in CG value of color medical images with the use of proposed method over existing methods. This increase represents improvement in the contrast of the image

8. CONCLUSION AND FUTURE WORK

The new proposed method in which SWT integrated with GA and PSO enhanced the performance of the digital watermarking.The proposed method is designed and implemented in the MATLAB 2013a by using signal processing toolbox. The image is split in to his frequency sub bands via 1-level SWT and then watermark is added to the singular matrix of transformed by using Arnold transform for the watermark scrambling . Location determined for the watermark insertion always according to the confidential key that acquired through the scrambling level computed within Arnold transform. Experiment result shows SWT with the emergence of GA and PSO gives more imperceptibility and robustness against multiple attacks on a given watermarked image in contrast to pre-existing DWT-SVD with ABC method of watermarking. As in near future we try to enhance the proposed watermarked algorithm further by using the contourlet transform instead of SWT transform. Also different image encryption techniques can be used.

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