AN EFFICIENT AGING LEADER BASED PARTICLE SWARM OPTIMIZATION TECHNIQUES

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***Abstract*:** A fresh watermarking strategy on the basis of discrete wavelet transform in conjunction with aging leader-based particle swarm optimization based SVD has been proposed in this paper. The watermark scrambling has also been done by using the Arnold transform to safeguard it. Arnold transform modify the watermark in such a way that it becomes meaningless for the hackers or crackers. The use of aging leader-based particle swarm optimization based SVD has been improved the speed and security of the watermarking technique further. Extensive analysis reveals that the proposed technique outperforms existing watermarking techniques.

***Index Terms*- Discrete wavelet transform, Singular value decomposition, Arnold transform, Artificial Bee Colony**

I. INTRODUCTION

As digital media is getting acceptance day by day, their problems regarding safety are also getting higher concern. Digital watermarking is a way that enables an individual to incorporate trademark notices as well as some different affirmation messages to electronic media [1]. It is an approach for embedding different forms of data in digital content. Basically data for defending copyrights and demonstrating validity of information is stuck as a watermark. Picture authentication is the main application among all other purposes of this strategy that will be useful for verifying electronic pictures [2]. A still image, any sound clip, a movie, a text document might come under the digital media. The main intent behind this approach is to recognize the person which owns the digital data as well as it may recognize the supposed receiver [3].

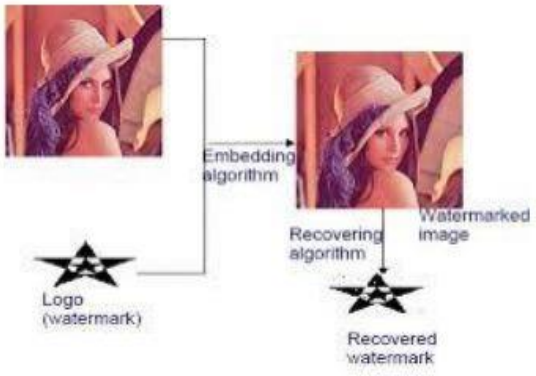


Fig 1: General overview of watermarking process

***A. Types of watermarking*:** Everyone can find two forms of watermarking i.e. apparent watermarking and hidden watermarking [4].

1) Visible watermarking: An apparent watermark is a transparent image that will be overlaid on original image. Possibly due to logo of the corporation which holds the rights to the original picture, it enables that picture to be considered but nevertheless marks that image since the property of that possessing corporation.
2) Invisible watermarking: The picture which cannot be observed but which is often recognized algorithmically is called an unseen watermark [5].

B. Structure of digital watermark

In the figure given below, the structure of digital watermark is shown.

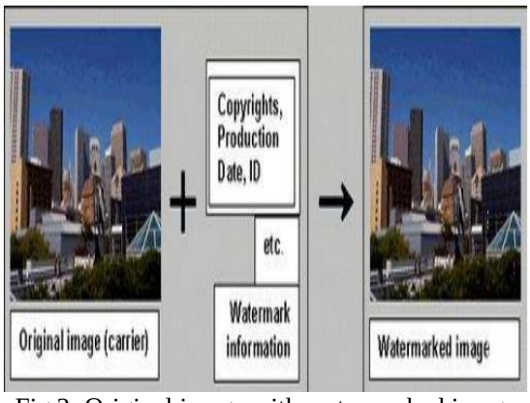


Fig 2: Original image with watermarked image

A carrier is that material which carries digital watermark. A watermark is never offered as a different record [6]. It is that type of information which is embedded directly into the carrier file. Thus, only observing the carrier picture comprising it can't recognize the watermark [7]. Picture as well as music related data can take watermarks and it can be recognized as revealed in figure 3.

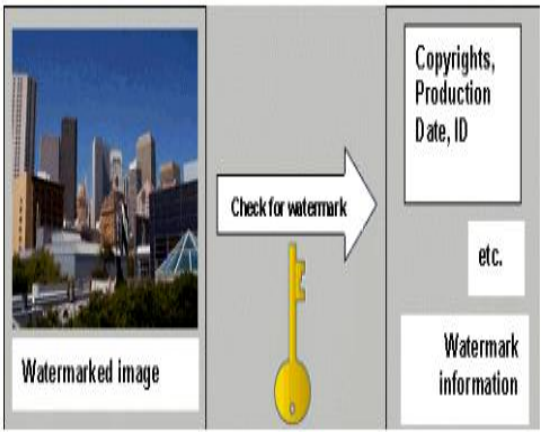


Fig 3: Unmarked watermarked image

II. WATERMARKING TECHNIQUES

A. Discrete wavelet transform

DWT is just a process of filters. It includes wavelet filter also known as high pass filter and scaling filter also known as low pass filter [8]. The main advantage of DWT is that it offers both simultaneous spatial localization and a frequency spread of the watermark along with sponsor picture [9]. The hierarchical property of DWT presents chance of evaluating a signal at various resolutions and orientations [10].

B. Singular value decomposition

A picture could be displayed as a matrix of positive scalar values. Basically, SVD for almost every picture X of size d x d can be represented by: $X=MNO_T$, in which M and O are orthogonal matrices and N is really a diagonal matrix of unique values in decreasing order [11]. Main purpose of this strategy will be to locate SVD of picture as well as adjusting the singular value in order to upload a watermark [12].

C. Arnold Transform

Picture scrambling describes change of the picture to attain the security of the picture [13]. It rearranges spatial position of pixels relating with some principles. Arnold transform is employed to scramble watermark image [14].

D. Artificial Bee Colony

Artificial Bee Colony algorithm depends on the interaction of smart bees with one another. Honey bees split their functions among themselves: Employed bees, onlooker bees and scout bees [15]. The activities performed by them can be split into four important phases:

Initialization stage, Employed bee stage, Onlooker bee stage and scout bee stage [16]. The very first point is that each used bee is given with numerous food resources. In second stage, each used bee determines quantity of food resources related to it and also the exact range of it from hive. After gathering crucial data of source these bees reveal that data with those bees waiting in hive. In third stage, onlooker bees which were still in the hive study information related to various food assets and select the most effective food source. At last stage, employed bees whose food reference becomes forgotten change into scout bee. So the purpose of scout bees is looking for some new food resources [17]

Algorithm for ABC comprises of the following steps:

- Start
- Replicate
    a) Allocate the applied bees to food places which have been in memory.
    b) Position the onlooker bees on those food references which are in memory.
    c) Deliver scouts to research region to explore new food sources.
- Until(Requirements are met)

E. Particle Swarm Optimization

PSO is a new approach proposed in the computational intelligence arena which is proposed by Kennedy and Elberhart. It is just a stochastic optimization model based on population that is developed after the social behavior of bird flocks. PSO not want any gradient data of the function to be increased, it just employs simple mathematical operator. Populace later becomes particles. Every particle holds its own place, speed and storage. Individuals show their positions based on the value of objective function [18]. In search of better objective function, every particle moves around search place along a specific level of freedom and flexibility and it is capable of finding the most effective position to talk about its recent

efficiency. Particle effective solution or local best solution is actually the very best solution of an individual. Global best answer is the top solution among all of the neighbors [19].

III. RELATED WORK

Mauro barni et.al (1998) [2] had revealed a fresh algorithm for electronic photos, that embeds a pseudo-random series of real numbers in a selected pair of DCT coefficients and runs in the frequency domain. Following embedding, the watermark is adapted to the picture by exploiting the masking traits of the individual visible process, hence ensuring the watermark invisibility. By exploiting the mathematical attributes of the stuck series, the tag may be easily produced without resorting to the first uncorrupted image.

Ching-Tang Hsieh et.al (2008) [6] had presented the multi-purpose technique for halftone pictures along with dithering approach and PSO. Dot order dither cells produced by it reaching excellent robustness and picture quality generate styles as embedding watermarks. The watermarks got stuck into the halftone photo with creatively openness by the range of dither arrays, strong to harmful attacks and counterfeits for objective of trademark security.

V. Siva Venkateswara Rao et.al (2012) [10] had shown a non-blind watermarking system for photos predicated on SVD and PSO in the DWT domain. In DWT domain unique values of original picture as well as key aspects of the watermark are altered for assuring trademark safety in addition to reliability. To locate the ideal scaling facets for effective robustness and the fidelity of process, PSO is integrated into the system.

Min Li et.al (2013) [4] had talked about a security algorithm, that may enhance the protection of picture throughout transmission more effectively. The major limitation of traditional scrambling algorithm is that it only applies to the square area. Emphasis on this, a multi-region technique for image scrambling security model is planned, which divides the non-square picture to numerous sq areas, and scrambles every part.

Seifeddine Naffouti et.al (2013) [13] had planned a strategy by invoking PSO process in wavelet domain to boost that process of watermarking. To prevent that the watermarking eliminate their robustness and imperceptibility and acquire the watermark underneath the great efficiency, PSO is merged with the technique presented in [1] that is used to place the watermark in the approximation subband LL3 and which do not use almost any type of picture handling to be able to display their stability against different forms of problems.

Vikas kumar et.al (2013) [5] had planned a protected improved watermarking system for electronic pictures, that is on the basis of the particle swarm optimization. For embedding, the DWT is employed for the original image transformation and PSO which is dependent on co-relation coefficient are accustomed to discover the large power coefficient watermark bit in main image and afterwards hide it into the main image. After that various kinds of attacks are applied to the watermarked picture to gain its reliability. The efficiency of technique is examined by PSNR and Correlation coefficient. The planned method supplies a great imperceptibility and effectiveness for numerous problems.

Shuchi sirmour et.al (2014)[3] had talked about the hybrid DWT SVD centered algorithm for applying and getting method to boost the performance. The recommended approach is conducted by adjustment on SVD of pictures in DWT domain. Change of the right sub-bands contributes to a watermarking approach which positively keeps the quality.

Gaurav Tiwari et.al (2015) [1] had shown a thorough study of the existing systems which have been created and their performances. As a result of development in imaging ability and the convenience with which electronic material may be copied and run there is a solid necessity for an electronic patent unit to be put in place. It needs for validation of the information in addition to the owner. Electronic Watermarking exists as a possible key to this problem.

Vibha Verma et.al (2016) [18] had mentioned about a method predicted on DWT and SVD is planned. For applying the watermark, original picture is splits into various subbands by utilizing 2-level DWT. After 2-level decomposition of cover image, SVD is used on both moderate frequency subbands. Watermark picture is decomposed into two equivalent images on column basis. By the usage of zero padding these pictures are again resized to the how big is of first watermark image. The unique value matrices of moderate frequency subbands of main picture are revised by splitted watermark photos applying appropriate range factor acquired by PSO. Again SVD is used on these altered unique value matrices.

Mashruha Raquib Mitashe et.al (2017) [17] had found a versatile picture watermarking design centered on revised Fuzzy C-means clustering. Discrete Wavelet Transform is utilized for watermark insertion method. The sponsor picture is pre refined by making use of PSO to give a hand to clustering process. The target is to concentrate on appropriate segmentation of the photo so that stuck watermark can endure popular image processing attacks and offer safety to digital pictures.

IV. PROBLEM DEFINITION

The existing Artificial Bee Colony watermarking technique does not provide high speed as well as security of watermarking as different types of attacks may degrade the picture clarity while on another side the utilization of Aging Leader based Particle Swarm Optimization technique will work on the drawbacks of Artificial Bee Colony therefore it will enhance the speed as well as security of watermarking by utilization of the discrete wavelet transform. The watermark scrambling will also be done in order to protect the watermark further from various kinds of attacks.

V. PROPOSED METHODOLOGY

Watermarking is the procedure to full cover up some information that will be tagged into the original data in a way that it could be found later to create an assertion about the item. These systems have already been utilized to fix trademark security issues of pictures. The scope of this work is find the rightful ownership of copyrighted images using discrete wavelet transform in combination with aging leader based particle swarm optimization based SVD. The aging strategy will be used on leaders of numerous population or species rather than on the leader of an individual population of particles and introduces an algorithm AL-PSO. According to this algorithm, leaders of various populations are compared to generate an efficient best solution and got the faster convergence of PSO features.

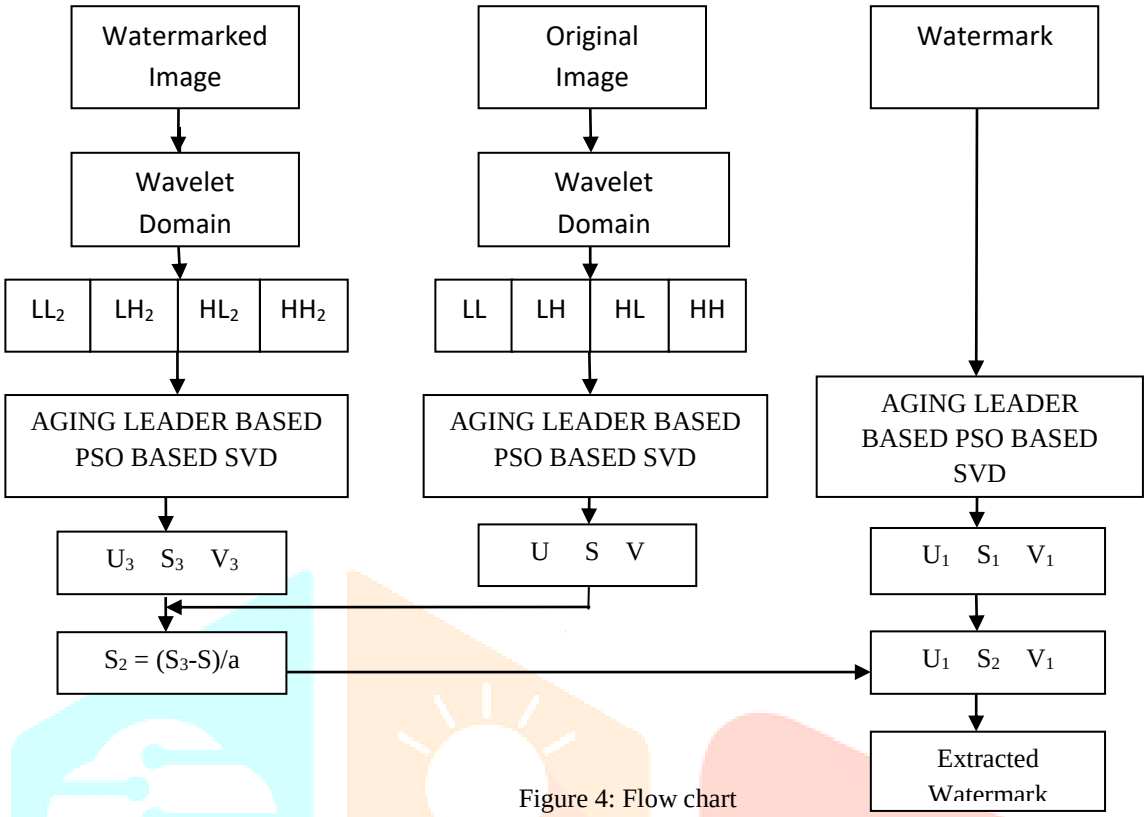


Figure 4: Flow chart

Algorithm

Stage 1: Initialization:

Starting jobs of most of contaminants are created arbitrarily with velocities starting from 0. The most effective particle on the list of swarm is opted as the leader. Age of the best choice is assigned to zero and the lifetime of the best choice known as leader is defined to starting value o.

Stage 2: Updating leader:

For contaminants m (m=1, 2…N), if the recently created place surpasses the head then newly created contaminant becomes newest chief of that specific population. The leader presents the most effective alternative developed by contaminants throughout the head's life.

Stage 3: Lifetime control:

After updating the jobs of contaminants, the major energy of head for boosting whole swarm is examined. The lifetime t is modified by lifetime operator.

Stage 4: Generating a challenger:

A newly generated particle is employed to challenge the best choice whose lifetime is exhausted.

Stage 5: Analyzing the challenger:

Evaluation of leading energy of recently created challenger is done. Challenger will become new head by replacing the previous head if it has enough leading power. On the other hand the previous leader will remain unaffected and can continue steadily to guide the swarm.

Stage 6: Most effective solution found by the population is noted.

Stage 7: In the related way the most effective solution found by other population is compared to offer more optimum solution in a multi population.

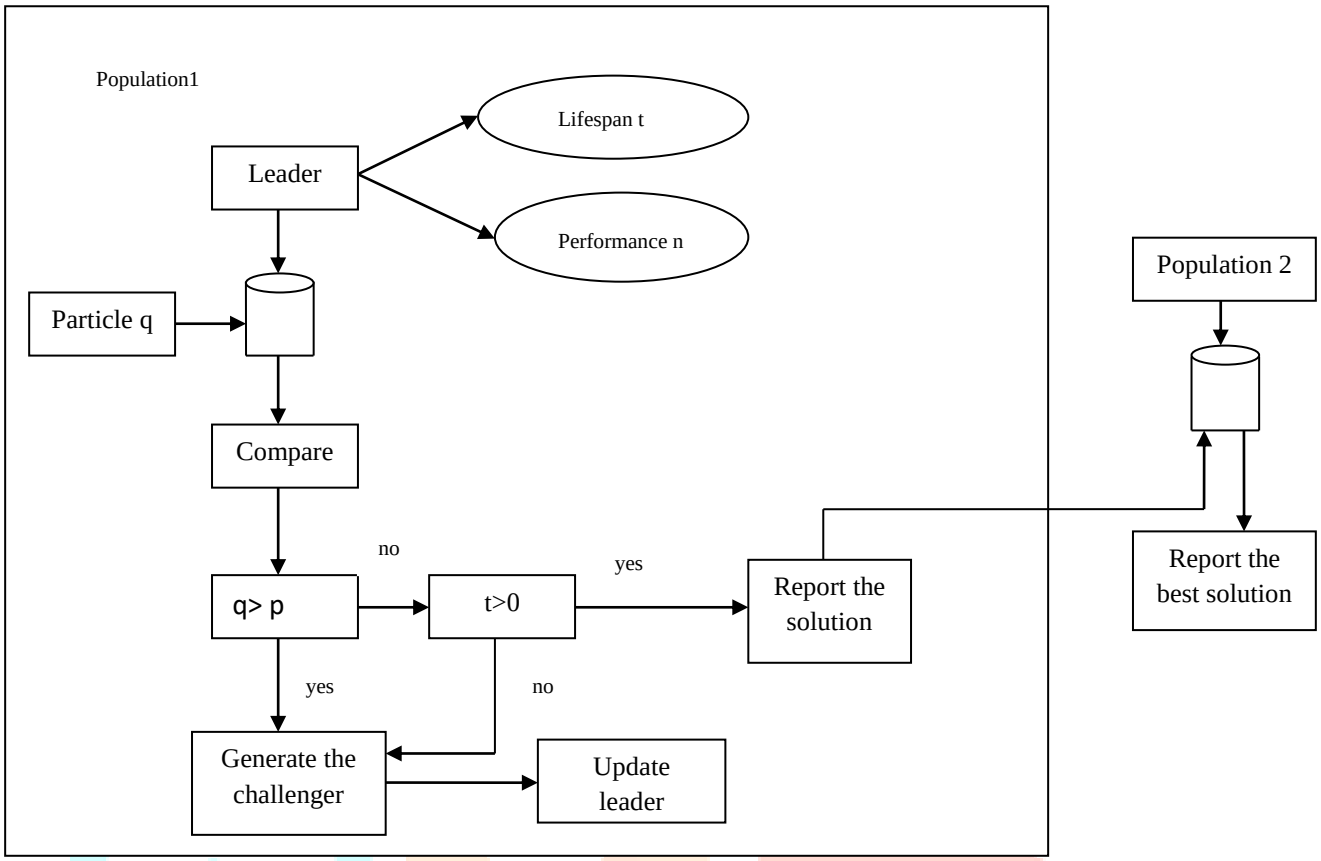


Figure 5: Block diagram

VI. IMPLEMENTATION AND RESULT

MATLAB is really an advanced specialized processing language and active environment for algorithm progress, information visualization, information evaluation and numeric computation. Utilizing the MATLAB solution, specialized processing issues may be resolved quicker in comparison with conventional coding languages like C, C++ AND FORTRAN. It may be utilized in variety of purposes such as picture handling, economic modeling and evaluation. Toolbox extends the MATLAB environment to solve particular classes of problems in these application areas. MATLAB provides a number of features for documenting and sharing the work. MATALB code can be integrated with other languages and applications also the MATLAB algorithms and applications can be distributed as well.

The experimental results with artificial bee colony technique are shown below.

Host pictures

(i) Baby

(ii) Fruit

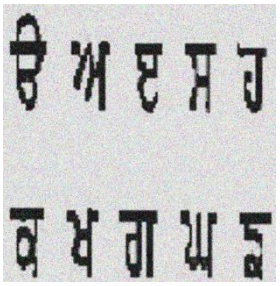
Watermark pictures

(vi) w1

(vii) w2

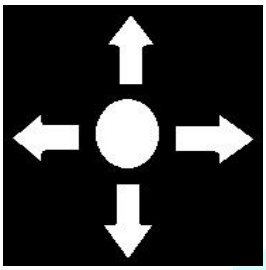
(iii) Car

(iv) Hina



(viii) w3

(ix) w4



(v) Arrow

(x) w5

Table 1: PSNR values with proposed technique

PSNR		
Cover Images	Watermark Images	Proposed Technique
Baby	w1	62.2004
Fruit	w2	52.9694
Car	w3	58.0193
Hina	w4	56.5085
Arrow	w5	63.1508

Table 2: RMSE values with proposed technique

RMSE		
Cover Images	Watermark Images	Proposed Technique
Baby	w1	0.1979
Fruit	w2	0.5729
Car	w3	0.3203
Hina	w4	0.3812
Arrow	w5	0.1774

Table 3: MSE values with proposed technique

MSE		
Cover Images	Watermark Images	Proposed Technique
Baby	w1	0.0392
Fruit	w2	0.3282
Car	w3	0.1026
Hina	w4	0.1453
Arrow	w5	0.0315

VII. CONCLUSION

From the extensive review, it has been observed that existing techniques suffer from various issues so a new watermarking technique based on the discrete wavelet transform in combination with aging leader-based particle swarm optimization based SVD has been proposed in this paper. Arnold transform is also done in order to modify the watermark so that no one can get information related to watermark. The speed and security of the watermarking technique is enhanced due to utilization of Aging Leader based swarm optimization method. Extensive analysis reveals that the proposed technique outperforms existing watermarking techniques. However, in this work we have not considered the effect of encryption on watermark image. Therefore, in near future we will propose integrated encryption based watermarking technique to improve the security rate further.

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