DATA HIDING IN IMAGES BY NEW HYBRID METHOD

Dadmehr Rahbari

University of Applied Science and Technology, Iran

ABSTRACT

Image watermarking based applications have been developed. Some examples of applications of digital watermarking is to protect property rights, verify content, copy control and usage control, describes the content of the secret data from the possibility of tracking, covert communications and data encryption. Wavelet analysis is a relatively new and exciting achievement of pure mathematics is based on decades of research in harmonic analysis. In addition to facilitating properties of the wavelet transform may vary depending upon the application of orthogonal basis functions are not available. In these cases you can use the two orthogonal. Genetic algorithm to simultaneously consider multiple points of the search space and thus increases the chances that converge to a local maximum, decreases. In Particle Swarm Optimization, Randomly in space group of birds are looking for food. There is only one piece of food in space are discussed. Birds do not know any of the food. One of these strategies can better track the bird is the minimum distance to be food. This strategy is the element algorithm. In This paper is introduced optimization method by Read the input image and its possible conversion to gray levels, the wavelet decomposition of the input image, smoked illustrations of effective bits. In Result section is showed the performance of proposed method by PSNR parameters and the error rate measures the amount of data hidden in the picture.

Keywords: Data Hiding, Wavelet, Genetic Algorithm, Particle Swarm Optimization.

INTRODUCTION

Watermarking for hiding or adding or file in another file so that only people with the necessary tools to achieve conscious. One of the ways to protect multimedia data against illegal copy and distribution is illegal. The main difference is that in writing in invisible watermarking with the purpose of preserving digital watermarking is invisible, but in many areas, the main message is hidden. Watermarking many application areas, most applications Watermarking to carve names and signatures on images, videos, sounds, etc. so that it will not be clear. In case of any unauthorized use of digital media watermark, such as the unauthorized copying or distort the image by any unauthorized person, the owner of the data can be extracted watermark signal, which is possible only by him, to prove his ownership or the changes made on the digital data to determine. For example, it helps if the watermark image is made by you cheat, you can claim that you are the owner of this picture.

A. Wavelet transform

A set of mathematical functions that are used to analyze continuous signal into its frequency components of the resolution of each component is equal to the scale. Wavelet analysis is a function based on the wavelet functions. Wavelets and scale samples were transferred to a function (mother wavelet) with finite length and swinging are strongly damped [1]. In contrast to the Fourier transform, the wavelet feature localization can be very good are quickly damped. Thus, by appropriate choice of the mother wavelet compression can be performed better than the Fourier transform. Graph of a function based on the idea of a complete set of functions first introduced by Joseph Fourier, a mathematician and physicist, between the years 1806-1802, in an essay published in the Academy of Sciences of the heat, was used for display functions [2].

In other words, in February showed that a function f (x) can be achieved by an infinite sum of sine and cosine function of the form sin (ax) and cos (ax) display. February is the basic tool with extra frequent applications of science has come in, because for many types of functions are used, resulting in great physical ambush such boundaries are in the pictures [3].

In 1909, he was the first person to Haar wavelet noted. Mathematicians in 1930 with the intention of singular structures, subject to the modification that occurred February and wavelet analysis as a tool for signal analysis into the ground SEISMIC Grossman French theoretical physicist inversion formula to obtain the wavelet transform. In 1976, Miró and Malta on the basis of wavelet multi resolution analysis to build orthogonal wavelet decomposition Malta and reconstruction algorithms created by using multi resolution analysis. In 1990, along with Antoine Mvrnzy wavelet space to two dimensions and then spread to other dimensions, so that was founded Wavelet-Based Analysis.

B. Optimization Method

In the field of artificial intelligence, a genetic algorithm is a search heuristic that mimics the process of natural selection. This heuristic (also sometimes called a Meta heuristic) is routinely used to generate useful solutions to optimization and search problems [4]. Genetic algorithms belong to the larger class of evolutionary algorithms , which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover. In computer science, particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. PSO optimizes a problem by having a population of candidate solutions, here dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity [5][6]. Each particle's movement is influenced by its local best known position but, is also guided toward the best known positions in the search-space, which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions.

PSO is originally attributed to Kennedy, Eberhart and Shi and was first intended for simulating social behaviour, as a stylized representation of the movement of organisms in a bird flock or fish school. The

algorithm was simplified and it was observed to be performing optimization. The book by Kennedy and Eberhart describes many philosophical aspects of PSO and swarm intelligence. An extensive survey of PSO applications is made by Poli. PSO is a Meta heuristic as it makes few or no assumptions about the problem being optimized and can search very large spaces of candidate solutions. However, metaheuristics such as PSO do not guarantee an optimal solution is ever found. More specifically, PSO does not use the gradient of the problem being optimized, which means PSO does not require that the optimization problem bedifferentiable as is required by classic optimization methods such as gradient descent and quasi-newton methods. PSO can therefore also be used on optimization problems that are partially irregular, noisy, change over time.

In This paper is introduced optimization method by following: Read the input image and its possible conversion to gray levels. The wavelet decomposition of the input image. Smoked illustrations bits CH, CV and CD. To implement a genetic algorithm in MATLAB function intended that the process is as follows: Inputs to the algorithm are the parameters of the CA, CH, CV, CD Lena after the wavelet transform of the image are obtained, and the parameters to their optimal values.

In Result section is showed the performance of proposed method by PSNR parameters and the error rate measures the amount of data hidden in the picture.

GENETIC ALGORITHMS

Genetic algorithm to simultaneously consider multiple points of the search space and thus increases the chances that converge to a local maximum, decreases. Search in more conventional ways, the decision rule governing this case serves to move from one point to another in a matter of searching this way can have a maximum bite. Because they may converge to a local maximum. But the whole population of the genetic algorithm (strings) to produce and test each point individually by combining quality (content) of spots, a new population, which includes the improvement of has the form. Apart from doing a search, consider the same number of points in the genetic algorithm, which makes it adaptable to parallel machines because of the evolution of each point, is an independent process. The genetic algorithm only requires information on the quality of the solutions produced by each set of variables. If some optimization methods require derivative information or even need to have a complete understanding of the structure of matter and variables. Because genetic Algorithm not require such specific information on the issue is thus more flexible than most search methods. The genetic algorithm is a search method, which is to guide the search for methods of use random selection will vary [7][16]. Although the decision as to define methods of accident and chance, but the search space is not a random walk. Genetic algorithms are suitable for the crash exploit a priori knowledge they use to solve the nearly optimal to quickly reach it.

The coding problem and a fitness function to determine the barrier population over generations by using the operators of selection, mutation and cutting, elitism is to involve the local optimal solutions.

17

Elitism   in   the   replacement   of   a   case   is   done. The coding of chromosomes and the problem:

| 1 | 0 | 0 | 1 | 1 | ..... | 0 | 0 | 1 | 1 | 0 | 0 | 1 |

Fig 1. Coding Problem in Genetic Algorithms

A. Fitness function

 Fitness Changes in the genetic algorithm as the fitness function, the objective function is considered. Linespace function in Matlab software the specified range is divided into 100 so that the fitness value is used calculation. This function has a minimum and maximum value and the boundary value of the chromosome is randomly generated value between these two values to be given. Limit values based on data obtained from the data collection phase of the two intersections Flowers and knowledge of governmental requirements.

B. Selection Operator

The selection of parents in genetic algorithms to further its chances of reproduction of the members that have higher fitness. There are several ways to do this. A technique that is commonly used selection method using a wheel [8][15]. The implementation of this method is as follows: A - the fitness of all members of the population and thus the suitability of the call stack. (B) a randomly generated number n, so that it is a number between zero and total fitness. (C) The first member of the population that add elegance to the fitness of the population of the former is larger than or equal to n restore. Effects of parental choice back wheel of a parent is randomly selected. Although the selection process is random, the chance that each parent is selected is directly proportional to its fitness. The balance in the number of generations the genetic algorithm with the lowest fitness of the disposal and the release of genetic material in the most graceful members of help. It may be the worst member of the population can be chosen by the algorithm (because anyway there is a random element in the algorithm.) In the population acts of violence, however, are negligible and the assumption that members of a generation, the next generation is much more likely to desorption. However, after many generations, the members of the population are excreted. Parents should be careful in the process of selecting a range of fitness levels should be positive integers.

C. Crossover operator

The performance of this operator and mutation operator causes the fibers produced during reproduction, the parents are different disciplines. In nature, this function occurs when two parents exchange portions of their corresponding fields and genetic algorithms, operator communication, exchange of genetic material between the parent sequences to the child (discipline) create there [9][17]. There are several types of exchange operator. But the most famous exchange operator used in genetic algorithm is a function of a point**Error! Reference source not found.**. The genetic algorithm is the operator in the manner described below may apply.
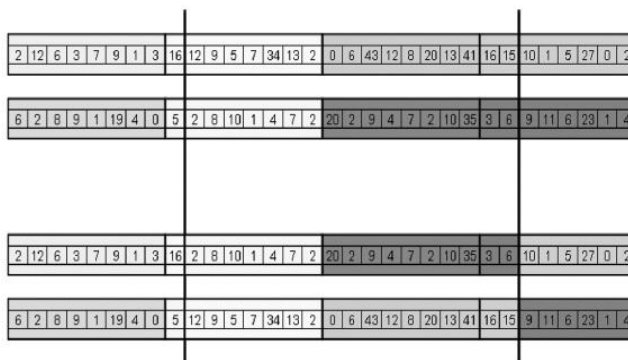
Fig 2 . A view of the intersection operator

To be able to use this function need to have two fields. The selection operator is applied to the current population of the two strands of the double-take then do a test to determine the probability that the exchange operator acts on two fields it or not. This test is done using a heterogeneous coin, this means that the probability (P crossover) milk and with probability of crossover line comes from[10]. For example, if the applied field with a tap on the coin exchange operator, we assume that we have thrown a coin into the milk.

Then enter the next phase of the implementation of the exchange operator, we generate a random number between one and the length of the string. After determining the location of the integer that represents the exchange of strings two strands of the location of this specifies the number of broken and distal parts are interchangeable with each other. All parts are separated from each other are connected to the new string is obtained.

D. Mutation Operator

The operator is also one of the operators of genetic algorithms and the ability to use genetic algorithms to find near-optimal solutions increases. Mutations, random changes in the value field is a special situation. By applying this operator characteristic that is absent in the parent population, is created. Because mutations alter a gene, i.e. if the value is zero, and vice versa if it is a zero. So why the change is characterized by a series of premature convergence and to not be perfect. Because one of the causes of premature convergence of the population is members of the same mutation causes the same probability of being members of the new population is much reduced. The implementation of this function is described below.
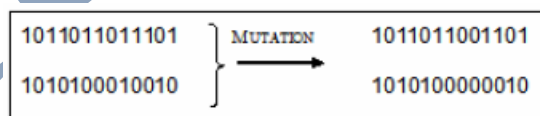

Fig 3. Mutation Operator

This operator, unlike the exchange operator to compare two strings needed to cover a range of needs, after the exchange operator acts on two fields and two new strings to the operator of mutations to the double-stranded is applied to either separately. The method is applied to the individual elements of a string, mutation

19

testing is done. If this test is successful, the status is changed from one to zero or from zero to one, and the so-called mutations. Test the possibility of using heterogeneous coin with probability (P crossover) milk and with probability line comes with a coin toss will be done and if the milk is collected bit value of the mutation [11]. As noted above, the probability for each state of a field test should be performed. In other words, for every mutation released once the coin is heterogeneous with regard to the outcome, finds little bit mutation or a mutation goes no further.

E. elitism

With regard to a possible value can be a percentage of the population without mutation and crossover operators are transferred to the next generation. This amount is likely to vary depending on the values that make up the result set. Genetic algorithm performance is significantly dependent on the different stages of the skins. For instance, each of the following: improve the efficiency of the routing issues.

PARTICLE SWARM OPTIMIZATION ALGORITHM

For the first time in 1995 by Eberhart and Kennedy as a non-deterministic search methods for optimization was proposed.

 This algorithm procession of birds looking for food to be inspired.

Randomly in space group of birds are looking for food. There is only one piece of food in space are discussed. Birds do not know any of the food. One of these strategies can better track the bird is the minimum distance to be food. This strategy is the element algorithm .

The solution, which is called a particle, the PSO algorithm is equivalent to a mass movement of birds is flying in the algorithm. Each particle has a fitness value is calculated by a fitness function. The particle in the search space to the target - the food at the birds move closer, more competence [12][13]. Each particle has a velocity that drives the motion of charged particles. Following the optimum particle size of the particles in the present case, the problem will continue to move space. This is the beginning of the work group of PSO particles randomly caused by updating generations are trying to find the optimal solution. At each step, each particle   is   updated   using   the   best   value.
 The first, the best position is that it has so far failed to reach the particle. These positions are recognized and maintained. The amount pbest another name used by the algorithm, the best position ever achieved by particle   population.   This   position   gbest   displayed.
After finding the best value, speed and position of each particle using equations (1) and (2) a day[18][19].

$v[] = v[] +$
$c1 * rand() * (pbest[] - position []) +$
$c2 * rand() * (gbest[] - position[])$ (1)

$$position[] = position[] + v[] \qquad (2)$$

Thus, the particle collector, remains fixed in place and others are moving toward the particle [14]. In contrast, if only the first part of equation (1) to consider the particles are normal to the wall, and they do a nationwide search.

Pseudo-code algorithm PSO:

1. Randomly generate an initial population of particles.
2. Calculate the objective function or the fitness of particles
A. Because we want to reduce the amount of fitness before me.

3. Record the best position for each particle Pibest the best position among all the particles Pgpest.

4. update the particle's velocity vector.

5. The particle transfer to new situations

6. If the algorithm is the best answers will go to the next step, otherwise go to step 2
7. At the end of the PSO function of the genetic algorithm, the values CA, CH, CV, CD optimized to the calling function or the main function returns the operation secret.

HYBRID ALGORITHM

The use of wavelet transform for image watermarking is done according to the following steps:

1. Read the input image and its possible conversion to gray levels.
2. The wavelet decomposition of the input image.
3. Smoked illustrations bits CH, CV and CD.
4. bits of data compression in CH, CV and CD.
5. GA and PSO called evolutionary algorithms for parameter optimization.
6. Read the latent image and convert it to a format to embed the image.
7. Insert the data cache consists of the latent image and compress the image Lena.
8. Insert the data cache and compress the header information

9. If the end bits, CH, CV and CD algorithm we all and if not go to step 4.

To implement a genetic algorithm in MATLAB function intended that the process is as follows:

Inputs to the algorithm are the parameters of the CA, CH, CV, CD Lena after the wavelet transform of the image are obtained, and the parameters to their optimal values.

21

1.   Set   the   initial   parameters   of   the   algorithm   include: Population = 20

The number of generations or iterations = 200

Chromosome length = 4 * 8 = 32 bits.

Pm: mutation probability equal to 0.02.

Pc: 0.5   times   the   probability   of   the   intersection   operator elitism_rate: elitism   equal   probability   0.02.
2. The initial population is generated randomly

3. Calculate the fitness value for all members of the population

A. Bit2num.m function to calculate the decimal value of the binary input.

B. Because we want to reduce the amount of fitness before me.

4. The members of sorting and selection based on fitness values, the percentage of the population with regard to the rate of elitism.

5. The function call Nextpopu.m

A. Given the rate of elitism, a member of one of the best and worst of the population and the transition to the next generation feel uncomfortable.

B. Using the following equation, all fitness levels to the normal range between zero and one to put it all in a proportional amount to be scalable.

New Fitness i = (Fitness i - Min (Fitness i)) / (Max (Fitness) - Min (Fitness))

D. Select a random member of the population and single-point crossover operator is applied on it. E.
6. At the end of the function of the genetic algorithm GA, values, CA, CH, CV, CD Nahansazi.m optimized to the calling function or the main function returns the operation secret.

SIMULATION AND RESULTS

The results of the algorithm for the problem of secret data in image:

Lena image in TIF format folder to put the code to be read with MATLAB runtime. If the Lena image type is RGB, it converts the gray level image. Also those with ulterior intention of it in our Lena image as a jpg file format ready for more.

Fig 4 . The input data for the latent image

In this section, you can use the Lena image or any other image for covert operations of use.

Fig 5 . Raw image of the invisible

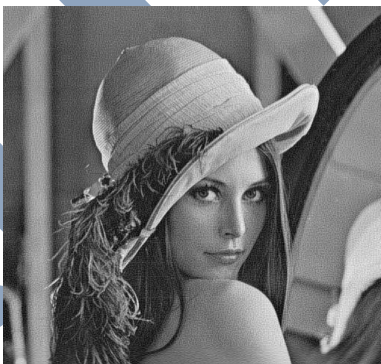The results of the genetic algorithm:

Fig 6. Latent image produced by the GA

Payload(bpp) = 0.343262

Embedded Data(Header+Original Bits+Watermark) = 127004 bits

Watermark Length = 90000 bits

PSNR = 27.848426

Because the genetic algorithm, the results are better than the usual method of Tsavyrdashth is hidden. In addition, simulation results obtained above, we try to select a suitable fitness function.

Collective intelligence algorithm particles:

Fig 7. The latent image produced by pso

Result of PSO:

Payload(bpp) = 0.343262

Embedded Data(Header+Original Bits+Watermark) = 286817 bits

Watermark Length = 90000 bits

PSNR = 28.175843

Recovery of the latent image extracted from the image:

Fig 8 . Image retrieval based on the latent image

It can be observed, for the secret of preliminary data, after the retrieval algorithm is returned to the upper limit. The performance of the proposed algorithm is relatively "is acceptable.

Compare standard PSNR:

The ratio between the maximum possible signal to noise ratio of the signal power and noise distortions that affect its quality [20][21]. Because many signals have a very wide dynamic range (ratio between the largest and smallest possible value of the variable) PSNR is therefore usually expressed in terms of the logarithmic decibel scale.

Metric peak signal to noise ratio is under review.

PSNR a standard definition image processing, the error rate is obtained. This parameter is used to calculate the mean square error of the method used.

The mean squared error:

The mean square error allows us to compare the actual value of the pixel in the original image to see the hidden image. This parameter represents the mean square error between the actual image and the image noise is included. The standard error is the amount by which the value of the original image to image noise becomes clear [22].

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2 \qquad (3)$$

The signal to noise ratio:

$$
\begin{aligned}
PSNR &= 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right)\\
&= 20 \cdot \log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)\\
&= 20 \cdot \log_{10}(MAX_I) - 10 \cdot \log_{10}(MSE) \qquad (4)
\end{aligned}
$$

PSNR algorithm code is as follows:

The error rate measures the amount of data hidden in the picture:
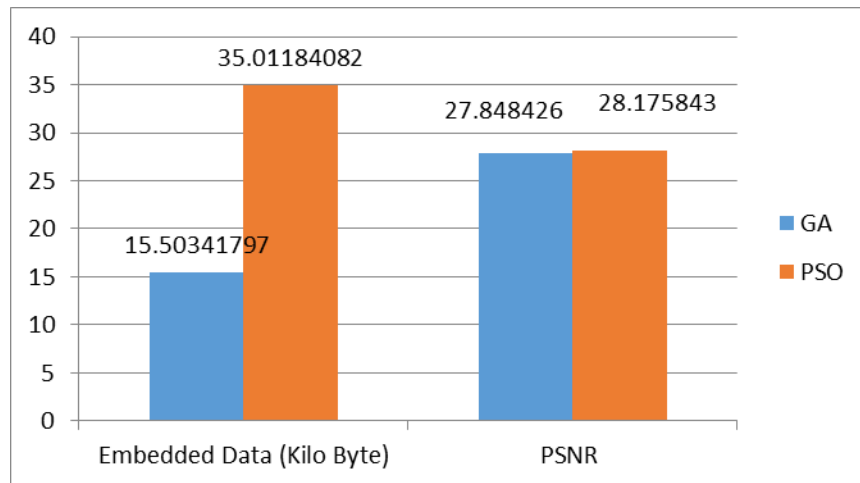
Fig 9. The error rate measures the amount of data hidden in the picture

Comparing the results of objective criteria psnr and also see the hidden images and retrieved the genetic algorithm has better results than the particle collective intelligence algorithms.

CONCLUSION

Rapid advances in digital technology allows anyone to easily create valuable digital photos and share them on the Internet. In addition, digital images can be easily copied and used illegally. By placing a mark on the original image watermarking unauthorized use it can be prevented. The process of placing symbols visible on the image watermarking host, called visible watermarking, and image matching, the image is visible watermarking. Three main features visible watermarking for images include visibility, transparency, and strength. In other words, symbols watermarking should be clearly visible on the image watermarking and mark the edges of the host image watermarking for high transparency should not be distorted. In addition, the watermarking signal should easily be removed. However, one of the features described are usually prioritized over other features.

A powerful tool for image processing such as Fourier transform, wavelet transform is used to transfer pictures from space to space once again used this space, which is three times the size, scale and scope of the account. It is important to convert the three-dimensional space that offers the conversion of the image reveals certain characteristics of the image that are not accessible by other means of image processing.

In contrast to the Fourier transform, the wavelet feature localization can be very good. are rapidly damped. Thus, by appropriate choice of the mother wavelet compression can be performed better than the Fourier transform.

Using genetic algorithms, we design a function or a function of several variables, we set the parameters of the project are to describe the wavelet transform. Then we have provided data for some variables. The genetic algorithm will execute the functions and variables that are searched.

Using the algorithm of particle mass needed to optimize the parameters of wavelet paid intuitive results can be seen in the image Lena.

Simulations show that the genetic algorithm is better than the results of the algorithm is the mass of the particle mass. Complete evaluation shows the basic parameters defined by the operator of the genetic algorithm and the results are very impressive.

Due to the quality parameters of the algorithm and the results of simulation in the last section, we discuss evaluation parameters of the latent image. Simulation results of the project based on the ratio of the mean square error is obtained better results than other articles. One of the drawbacks of evolutionary algorithms are a long time to reach the best response. To solve this problem, we can answer or end points to reach to a certain extent be considered Optimality and evolutionary algorithm techniques used immediately. Since the introduction of soft computing methods and techniques rather mixed results "are better. Smart ways to optimize it can be used again. The parameters presented in this project can be a good basis for further research in the area of the latent image.

REFERENCES

[1] N.Bisla, P.Chaudhary, "Comparative Study of DWT and DWT-SVD Image Watermarking Techniques", Ijarcsse - Volume 3, Issue 6, 2013.

[2] P. Singh, S.Agarwal, "A Hybrid DCT - SVD Based Robust Watermarking Scheme for Copyright Protection" . ICETET Dec. 7-8, 2013.

[3] P.M. Naini, "Digital Watermarking Using MATLAB", University of Tehran- Iran, 2011.

[4] P.M.Pithiya, H.L.Desai, "DCT Based Digital Image Watermarking, Dewatermarking & Authentication", IJLTET Vol. 2 Issue 3, 2013.

[5] P.Saxena, Sh.Garg, A. Srivastava, "DWT-SVD Semi-Blind Image Watermarking Using High Frequency Band", ICCSIT Singapore April 28-29, 2012.

[6] P.Cika,   "Watermarking method based on Discrete Wavelet Transform and Singular Value Decomposition", Electrorevue VOL 3, NO 1, 2012.

[7] S. Murty, M.U. Bhaskar, P.R. Kumar, "A Semi-Blind Reference Watermarking Scheme Using DWT-DCT-SVD for Copyright Protection". IJCSIT Vol 4, No 2, 2012.

[8] S.Dogan, T.Tuncer, E.Avc, A.Gulten,   "A robust color image watermarking with Singular Value Decomposition method", IJASCSE Volume 3, Issue 4, 2014.

[9] Abu-Errub, Ali Al-Haj and Aymen, "Performance Optimization of Discrete Wavelets Transform Based Image Watermarking Using Genetic Algorithms", Journal of Computer Science, pp. 834-841, 2008.

[10]   D.Rahbari, "High Performance Data mining by Genetic Neural Network", International Journal of Computer Science and Business Informatics, Volume 5, Issue 1, 2013.

[11]   D.Rahbari, "Digital handwritten recognition by optimized neural networks", Integrated Journal of British, http://www.ijbritish.com, Volume 1, Issue 1, Pages 9, 2014.

[12]   C.-S. Shieh, H.-C. Huang, F.-H. Wang and J.-S. Pan, "Genetic watermarking based on transform domain techniques", Pattern Recognition, Vol. 37, No. 3, pp. 555-565, 2004.

[13]   C-C.Chen and C-S.Lin, " A Genetic algorithm based nearly optimal image authentication approach". International Journal of Innovative computing, Information and Control, Volume 3, No. 3, pp 631-640, June 2007.

[14]   A.I. Hammouri1, B.Alrifai and H.Al-Hiary, "An Intelligent Watermarking Approach Based Particle Swarm Optimization in Discrete Wavelet Domain", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 2, No 1, March 2013 ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784.

[15]   P. Meerwald and A. Uhl, "Watermarking of raw digital images in camera firmware: embedding and detection," in Proceedings of the 3rd Pacific Rim Symposium on Image and Video Technology, PSIVT '09, vol. 5414 of Lecture Notes in Computer Science, (Tokyo, Japan), pp. 340–348. Springer, Jan. 2009.

[16]   A. Khan and A. M. Mirza, "Genetic perceptual shaping: Utilizing cover image and conceivable attack information during watermark embedding," Information Fusion, vol. 8, pp. 354–365, October 2007.

[17]   Y. Q. Shi, "Reversible data hiding," Proceedings of International Workshop on Digital Watermarking, Seoul, Korea, Oct. 1 to Nov. 2, 2004.

[18]   Z. Ni, Y. Q. Shi, N. Ansari and W. Su, "Reversible data hiding," Proceedings of IEEE International Symposium on Circuits and Systems, vol. 2, pp. 912-915, Bangkok, Thailand, May 2003.

[19]   A. Leest, M. Veen, and F. Bruekers, "Reversible image watermarking," Proc. of IEEE ICIP, vol.2, pp.731-734, Sept.2003.

[20]   J. Tian, "Reversible data embedding using a difference expansion," IEEE Transactions on Circuits and Systems for Video Technology, pp. 890-896, Aug. 2003.

[21]   G. Xuan, J. Zhu, J. Chen, Y. Q. Shi, Z. Ni and W. Su, "Distortionless data hiding based on integer wavelet transform," IEE Electronics Letters, Dec. 2002, pp. 1646-1648.

[22]   G. Xuan, Y. Q. Shi, Z. Ni, "Lossless data hiding using integer wavelet transform and spread spectrum," IEEE International Workshop on Multimedia Signal Processing, Siena, Italy, September 2004.