AN IMPLEMENTATION OF GENETIC ALGORITHM BASED DATA HIDING TECHNIQUE

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Abstract— Abstract— This paper proposes a Steganography scheme based on Genetic Algorithm and Integer Wavelet transform. In this scheme data embeds in integer wavelet transform coefficients by using a mapping function. It is based on Genetic Algorithm in an 8x8 block on the cover image. The optimal pixel adjustment process will be applied after embedding the message. In proposed method frequency domain is used to increase the robustness of our Steganography. Integer wavelet transform reduces the floating point accuracy problems of the wavelet filter. They use Optimal Pixel Adjustment Process and GA to obtain an optimal mapping function to reduce the difference error between the cover image and stego-image and to increase the hiding capacity with low distortions respectively. By using the Integer Wavelet transform limitations are Less robustness and minimizes visual quality of the stego-image with obtained hiding capacity and Using the GA in LSB limitations are Less efficiency and reduce the quality of stego-image. While using GA and IWT has increased the capacity and imperceptibility of the image.

Index Terms— Steganography, Integer Wavelet Transform, Genetic Algorithm, Optimal Pixel Adjustment Process, Peak Signal to Noise Ratio.

I.INTRODUCTION

In this highly digitalized world, the Internet as an important role for data transmission and sharing. After all, it is a worldwide and publicized medium some secret data may be stolen, copied, modified, or destroyed by an unintended observer. Therefore, security problems become an necessary issue. Still encryption achieves certain security effects, they make the secret messages unclear and unnatural or meaningless. These meaningless messages usually attract some unintended observer’s attention. This is the reason a new security approach called “Steganography” arises. The word Steganography is composed of two Greek words ‘steganos’ and ‘graphia’ which means "covered writing".

Hiding a secret message in any cover media this method is called Steganography. Cover media can be a text, or an image or an audio or video etc. It is an art of hiding information in ways a message is hidden in cover media so that will not arouse an unintended observer. A covert channel can be defined as a communications channel that transfers secret information. Observers are unfamiliar that a covert message is being connected. Only the sender and receiver of the message notice it.

We can divide the data hiding techniques into two parts: spatial and frequency domain.In spatial domain embedding message in the Least Significant Bits (LSB) of image pixels. The LSB method has a high capacity and very simple implementation but there are low strength and some attacks such as low-pass filtering and compression. In frequency domain finds the frequency coefficients of images and then embeds the secret messages with them. These methods overcome the robustness and imperceptibility problem found in the spatial domain.

The application of Genetic Algorithm in Steganography can increase the capacity or imperceptibility. This paper proposes a method to embed data in Integer Wavelet Transform coefficients using a mapping function based on Genetic Algorithm in 8x8 blocks on cover images and it applies the OPAP after embedding the message to maximize the PSNR.

II.THE STEGANOGRAPHY METHOD

In this proposed method, the secret message is embedded on Integer Wavelet Transform coefficients based on Genetic Algorithm. Then, OPAP algorithm is applied on the received embedded image. In this section describe this method, and the embedding and extracting algorithms in detail.

A. Discrete Wavelet Transform

Wavelet transform has the capacity to present data information in both time and frequency domain together. This transform passes the time domain data through low pass and high-pass filters to extract low and high frequency information respectively. This process is repeated for number of times and each time a section of the signal is drawn out.

DWT analysis divides the discrete signal into two sections by signal decomposition for various frequency bands . DWT uses two function sets: scaling and wavelet which associate with low and high pass filters. Only half of the samples in a signal are sufficient to represent the whole signal, doubling the frequency separately. Haar wavelet operates on data by calculating the sums and differences of contiguous elements. This wavelet operates firstly on contiguous horizontal elements and then on contiguous vertical elements. One important feature of Haar wavelet transform is that the transform is equal to its inverse. Figure 2.1 shows image Lena after one Haar wavelet transform. Then each transformation, the size of the square that contains the most important information is reduced by 4.

B. Integer Wavelet Transform

The proposed algorithm use the wavelet transform coefficients to embed secret messages into four sub-bands of wavelet transform. Using Integer wavelet transform we avoid the problems with floating point attention of the wavelet filters. The LL sub-band in the case of IWT appears to be a nearby copy with smaller scale of the original image while in the case of DWT the resulting LL sub-band is distorted as shown in "Fig2.1

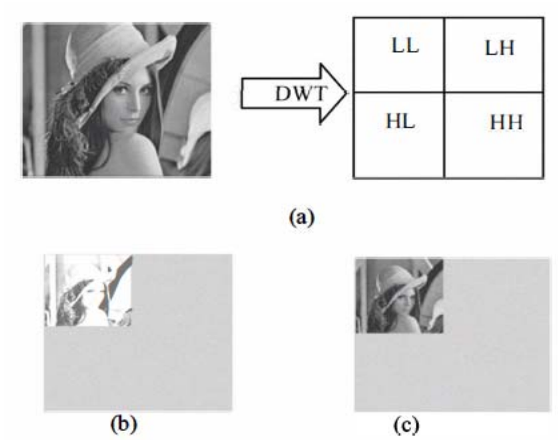

Figure .1 (a) Original image Lena and how to analyze in wavelet domain. (b) One level 2DDWT in sub-band LL (c) One level 2DIWT in sub-band LL.

C. *Genetic Algorithm*

This paper embeds the secret message inside the cover image with the least distortion therefore we have to use a mapping function to LSBs of the cover image according to the content of the message. We use Genetic Algorithm to find a mapping function for all the image blocks. Block based design can conserve local image property and reduce the algorithm complexity compared to single pixel substitution. In our GA method, a chromosome is encoded as an array of 64 genes containing modifications of 1 to 64 that point to pixel numbers in each block. Every chromosome produces a mapping function as shown in “Figure.2”.

60	7	24	….	52	3

Figure.2 A simple chromosome with 64 genes

1) Mating and mutation functions are applied on each chromosome. The mutation process reverses some bits and produces some new chromosomes, then, elitism is selected which means the best chromosome will keep and be passed to the next generation.
2) Selecting the fitness function is most important steps in designing a GA-based method. Since our GA aims to improve the image quality, Pick Signal to Noise Ratio (PSNR) can be an convenient evaluation test. Thus fitness function will be:

$$PSNR = 10\log_{10}\frac{M * N * 255^2}{\sum_{i,j}(y_{i,j} - x_{i,j})^2}$$

Where x and y are the image intensity values and M and N are the image size before and after embedding.

D.OPAP algorithm

The most important use of the OPAP is to minimize the error between the cover image and the stego image. For example suppose the pixel number of the cover is 100000 (decimal number 32) and the message vector for 5 bits is 11111, then the pixel number will change to 111111 (decimal number 63) and the embedding error will be 31, while after applying OPAP algorithm the sixth bit will be changed from 1 to 0, and the embedding error is reduced to 1.
The OPAP algorithm may be described as follows:

Case 1 (2k-I < &i < 2k): if pi'2: 2k, then pi " = pi'- 2k

otherwise pi" = pi';

Case 2 (-2k-I < &i < 2k-I): pi " = pi';

Case 3 (-2k < &i < -2k-I): if pi' < 2S6 - 2k, then

pi "= pi' + 2k; otherwise pi "= pi';

Pi, Pi <5 and Pi 6 are the corresponding pixel values of the

i^{th} pixel in the images i.e cover, stego and the received image by the simple LSB method, respectively. Ji (=. PiG -Pi) is the embedding error between Pi and PiG.

III.ALOGORITHMS

A. Embedding Algorithm

The embedding process steps:

- Take the input standard cover image.
- Take the secret text message.
- Perform the Integer Wavelet Transform of the input cover image using lifting scheme.
- Perform integer lifting wavelet transform on image.
- Divide the input cover image in 8*8 blocks.
- Select any of the wavelet coefficients (redundant coefficients) from the obtained high frequency coefficients.
- Generate 64 genes , containing the pixels numbers of each 8x8 blocks as mapping function.
- Embed the message bits in 4-LSBs IWT coefficients each pixel according to mapping function.
- Store the coefficient in new image.
- Now the selected coefficients are processed to make it fit for modification or insertion.
- Fitness evaluation is performed to select the best mapping function.
- The secret message plus the message length is embedded into the processed coefficients.
- Apply Optimal Pixel Adjustment Process on the image.
- Convert image to binary.
- Finally, the inverse 2D-IWT on each 8x8 block is applied to obtain the Stego image.
- Stego image obtained.

***B**. Extraction Algorithm*

The extraction process steps:

- Take the desired stego image.
- Divide stego image into 8x8 blocks
- Extract the transform domain coefficient by 2D IWT of each 8x8 blocks.
- Find the pixel sequences.
- Select the desired pixels for process.
- Extract 4-LSBs in each pixel.

- Process the selected pixel coefficients for extraction.
- Now extract the message length and the secret message from these processed coefficients.
- Secret message to be obtained.

IV.EXPERIMENTAL RESULTS

This work is done on two sets of data image, Both cover images have utilization of 100% and their respective accomplished results of reversible statistical analysis are as follows.

Cover Image	MSE	PSNR (dB)
Jellyfish	**1.5932e+003**	**50.9652**
Penguins	**1.5775e+003**	**51.0081**

Table 1 Comparison of capacity and PSNR for 4-LSBs

As we compare these embedded images with the input cover images (figure 1), we realize that there are no serious changes in images. The stego images look like the same as cover images. So the unintended observer's cannot recognize in between the communication of two parties that secret message is embedded in these images.

Figure.3 Images after embedding the secret data

(a) Jellyfish image after embedding with 4-LSBs (b) Penguins image after embedding 4-LSBs

Cover Image	Method	MSE	PSNR (dB)
Jellyfish	A Steganographic method based on IWT and GA.	**1.5932e+003**	**50.9652**
	A Steganographic method Based on DWT and LSB.	0.000233968	84.4392
Penguins	A Steganographic method based on IWT and GA.	**1.5775e+003**	**51.0081**
	A Steganographic method Based on DWT and LSB.	0.000259399	83.9911
Desert	A Steganographic method based on IWT and GA.	**1.5835e+003**	**50.9914**
	A Steganographic method Based on DWT and LSB.	0.000305176	83.2853

Table 2 Maximum hiding capacity and PSNR obtained from proposed method and its comparison with the existing methods.

V. CONCLUSION

This paper presented a different technique to increase the capacity and the undetectability of the image after embedding. GA is employed to obtain an optimal mapping function to reduce the error difference between the cover and the stego image. the block mapping method to keep local image properties and to reduce the algorithm complexity, and then applied the Optimal Pixel Adjustment Process to increase the hiding capacity of the algorithm in comparison to other systems.

REFERENCES

[1]K. L. Chung, C.H. Shen, L. C. Chang, "A novel SVD and VQ- based image hiding schem," Pattern Recognition Let. 22(9) 1051- 1058 July 2001.

[2] W. Chen, "A comparative study of information hiding schemes using amplitude, frequency and phase embedding," PhD thesis, National Cheng Kung University, Taiwan, May 2003

[3] Ji. Rongrong, Yao. Hongxun, L. Shaohui and W. Liang, "Genetic algorithm based optimal block mapping method for LSB Substitution," International Conference on Information Hiding and Multimedia Signal Processing, pp, 215-218, Dec 2006.

[4] B. Lai and L.Chang, "Adaptive Data Hiding for Images Based on Haar Discrete Wavelet transform," Lecture Notes in Computer Science, Vol 4319, 2006.

[5] A.M. Fard, M.R Akbarzadeh and A. F Varasteh. "A new genetic algorithm approach for secure JPEG steganography," International Conference on Engineering ofintelligence Systems, pp 1-6,2006

[6] K. B. Raja, Kiran Kumar. K, Satish Kumar. N, Lashmi. M. S, Preeti. H, Venugopal. K. R. and Lalit. M. Patnaik "Genetic algorithm based steganography using wavelets," International Conference on Information System Security Vol. 4812, pp, 51-63. 2007.

[7] K. S. Babu, K. B. Raja, K. Kiran Kumar, T. H. Manjula Devi, K. R. Venugopal and L. M. Pataki, *"Authentication of secret information in image steganography"*, IEEE Region 10 Conference, TENCON- 2008, (2008) November, pp. 1-6.

[8] El Safy, R.O, Zayed. H. H, EI Dessouki. A, "An adaptive steganography technique based on integer wavelet transform," ICNM International Conference on Networking and Media Convergence, pp 111-117,2009.

[9] Swati malik, Ajit "Securing Data by Using Cryptography with Steganography" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 5, May 2013.