An Optimized Video Steganographic Method based on Ant Colony Optimization (ACO) Algorithm

SP.Prabu Raja[1] and K.Mahesh[2]

[1]Research Scholar, [2]Professor

Department of Computer Applications,

Alagappa University, Karaikudi-600 003, Tamilnadu, India.

[1]sppraburajadvk@gmail.com , [2]mahesh.alagappa@gmail.com

Abstract

With the development of multimedia application, there is preserving the privacy of information from imposters is increasingly important much. In the area of information hiding, "Steganography" means "covered writing" which is prominent technique to hide the sensitive information inside another medium. In Steganography, various stego objects are used for hiding purpose but the video is to be consider as more efficient than other objects due to separation of image and audio and also it has capability to hide the large voluminous of confidential data. Video Steganography defines hide the information inside the cover object called stego video. Among different transform domain methods, IWT is effective than other due to its efficacy. The aim of the proposed research work is to find best values using ACO (Ant Colony Optimization Algorithm) and the secret information is embedded in those values to obtain the stego video. In this proposed scheme, IWT is adopted to get the transformation coefficients; on these coefficients, ACO algorithm is applied to obtain the optimal values to conceal the data. This developed steganographic scheme is convenient for embedding / extracting of massive amount of data from/into the stego video. Experiments are carried out on several test videos; results demonstrated that best quality in visual, high security and also embedding huge data.

Keywords: Steganography, Video, IWT, ACO, cover video, stego video, secret message

1. Introduction

Data security means to protect a database from destructive forces and the unwanted actions of unauthorized users. Huge amount of confidential information is being exchanged over the Internet (publicly open medium) as this is the most cost- effective and widely available way [1]**.** Many techniques such as digital watermarking, cryptography

and Steganography were developed in order to enhance the data security. Cryptography is an art or science of ciphers that use mathematics to scramble the original text into a seemingly unreadable format for others. Steganography is the art of invisible communication [2]. The Steganography is of two Greek words which are *steganos* and *graphia* means hiding secret information into cover media. The notion of data hiding or steganography was first introduced with the example of prisoners' secret message by Simmons in 1983 [3]. Video steganography means video file is use as a cover medium for hiding secret information. Among all the steganography, video steganography beaten some restrictions because it has capability to embed massive amount of secret data inside the carrier and also it is difficult to detect by third person. Steganography apply in various fields such as military and industrial applications. Lossless steganography techniques are use for secure and successful transmission of information from sender to receiver [4]. In video steganography a video is converted into the frames and in these frames secret information is embedded [5]. Video file is the better option to hide the secret information because it overcame the problem of embedding capacity and security. Steganography is done in two part first one is embedding of information in the cover file and then to extract that information from the video file [6].

2. Related work

Avinash K. Gulve. et al [7] use Integer Wavelet Transform with PVD technique to improve security of secret data which is cover by image. 2D Haar integer wavelet transform is employed to transform the image into four subbands. Then PVD technique is used to embed the secret data into wavelet coefficients of four subbands. This proposed method enhancing the security by calculating the difference between the two IWT coefficients in the pair and modify these difference values. This modified value is used to hide the secret data.

Seyyed Amin Seyyedi. et al [8] use integer Haar wavelet transform to achieve high both in data capacity and security of secret data. In this method, the cover image is split into 8×8 blocks and these blocks are transformed in to two subsets by using two levels integer Haar wavelet transform. Then, secret data is embedded into suitable subset. To improve higher secure, one level integer Haar wavelet transform is applied to secret data before embedding.

In this method [9] cover video is decomposed into different frames. A single level Discrete Wavelet transform is applied on selected frame and on secret image. A private key is

used during the process of encoding and decoding to provide high security. Then the Inverse Discrete Wavelet Transformation (IDWT) is applied to get the stego-video.

In this method [10] purposed a new technique for data hiding that is using the hybrid algorithm. This hybrid algorithm uses the PSO with ACO. The experimental results show that purposed method gives better results than existing methods i.e. with simple PSO and ACO.

In this method [11] A 3-3-2 LSB based scheme has been used as a base technique for video steganography. The base technique is enhanced using Genetic Algorithm (GA) which thrives to get an optimal imperceptibility of hidden data. An anti-steganalysis test is used to check for the innocence of the frame with respect to original frame. Experimental results show a substantial improvement in the Peak Signal Noise Ratio (PSNR) and Image Fidelity (IF) values after optimization over the base technique.

3. Proposed Method

3.1 Ant Colony Optimization Algorithm

Ant colony optimization (ACO) was introduced by the Italian scholar [13] M. Dorigo and colleagues. It is a novel Meta -heuristic technique that has been successfully applied in solving various problems in combinatorial optimization. To establish the shortest path from food sources to nests, the ants deposit pheromone trail while walking and all other ants prefer to follow a path where the amount of pheromone is rich. When an ant searches a food source, it carries it back to the nest and starts depositing the chemical. Other ants will tend to select a shorter path between food source and their nest, where there is higher quantity of pheromone.

The ACO algorithm consists of a number of cycles (iterations) of solution construction. In each iteration, a number of ants construct complete solutions by using heuristic information and the collected experiences of previous groups of ants. These collected experiences are represented by the pheromone trail which is deposited on the constituent elements of a solution [12].

3.2 Methodology

The main idea behind the proposed work is hide sensitive data inside input video sequences of frames using IWT and ACO which is named as Ant Colony Optimization algorithm. In this method, text file and video clip as a cover video which is multimedia elements are read as input, input text is converted into ASCII values and other input video is extracted into red, green and

blue frames and those frames are divided into 8x8 blocks. Then IWT technique is applied on these blocks to obtain wavelet coefficients. On these transformed coefficients, ACO Algorithm is utilized to find the best pixel values and embed the information at those optimal points. Afterwards embedded process has been completed; inverse IWT method is employed to get the stego video at the sender side. Authorized recipient can extract the secret data from stego video by performing the embedding process reversely. The entire process of proposed method is illustrated as in figure 1.
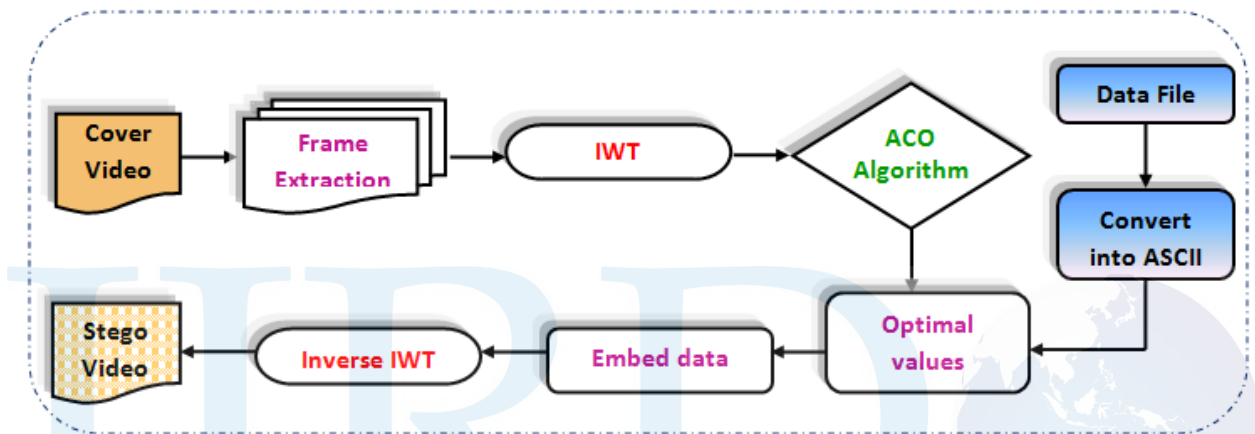

Figure 1. Block diagram of proposed method

3.2.1 Embedding Procedure

The following steps are used to embedding the sensitive data in cover video.

Input   : Cover video, Data file

Step 1: Read Input video and secret data to be hidden.

Step 2: Input video is break into R, G, B color components and then IWT is applied on each color band separately. Another input secret data is converted in to ASCII values.

Step 3: Ant Colony Optimization (ACO) algorithm is used to find the optimal   points where the data to be hide.

Step 4: Secret data could be hide at that optimal points.

Step 5:   After that, Inverse IWT is applied to obtain stego video.

Output: Stego Video

3.2.2 Extracting Procedure

The following steps are used to extracting the sensitive data from stego video.

Input: stego video

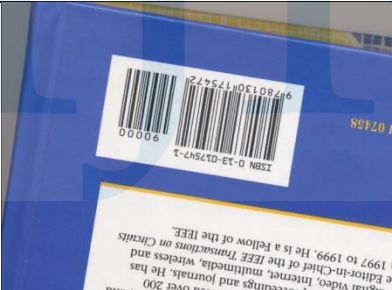Step 1: Data is extract by applying reverse procedure of embedding process.

Step 2: Obtain secret message from the cover video.

Output: Cover Video and original data.

4. Experimental Results

In this section, experiments are done to prove the efficiency, data payload, quality, and security of the proposed method. This Current system workings on uncompressed grayscale video, but as the video is uncompressed file volume is more this puts limitation on memory. This system is not lossless and reversible as embedding data in frame results in a stable distortion of the original frame or concealed data but within suitable range. This technique video or frame are not loss this real shape or streaming after embedding secure data in video file. Experimental results are in a single frame on several sample videos as shown in table1.

TABLE 1 : SIMULATED RESULTS OF THE PROPOSED METHOD IN VARIOUS SAMPLE VIDEOS

over Video	Sample Secret data	Stego Video
	The Steganography is of Greek word which is hiding secret information within cover media such as image, text, audio or video so that imposters can't detect what data is hidden in it. In the cryptography, render message unintelligible but in Steganography cover the existence of the message.	
	Video is an electronic medium for the recording, copying, playback, broadcasting, and display of moving visual media. Video systems vary greatly in the resolution of the	

	display, how they are refreshed, and the rate of refreshed, and 3D video systems exist.	

5. Conclusion

The proposed Optimized Video Steganographic methodology is a Information Hiding technique for provides high Information Hiding strength and robustness against the attacks such as compression and tampering. It provides high capacity and imperceptible stego-video for human vision of the hidden secret information. The performance of the proposed method is studied and experimental results shows that this scheme can be applied on videos with no noticeable degradation in its quality. This method extracts the data as identically, without any loss in quality and size of the original video. This algorithm is to achieve high capacity, security, low time consuming and certain robustness. In future this algorithm can be made to hide data in text, audio also uses different Stegnography technique like DCT, DWT, etc, better validation along with an increase in the number of frames.

References

1. Shivani Khosla and Paramjeet Kaur, "Secure Data Hiding Technique Using Video Steganography and Watermarking", International Journal of Computer Applications, Vol.95, No.20, 2014.

2. Swetha V, Prajith V and Kshema V, "Data Hiding Using Video Steganography -A Survey", International Journal of Computer Science Engineering and Technology, Vol 5, Issue 6, page(s): 206-213, 2015.

3. Masoud Nosrati and Ronak Karimi, "A Novel Steganographical Approach to Text Message Hiding in RGB Carrier Image", Vol.4, Number.1, pp. 21-24, 2012.

4. Kamred Udham Singh, "Video Steganography: Text Hiding In Video By LSB Substitution", International Journal of engineering Research and Applications, Vol. 4, Issue 5(Version 1), pp.105-108, 2014.

5. Mandeep Singh and Garima Mahajan, Secure Secret Information Transmission with Audio-Video Steganography Using Encryption and Data Authentication, International Journal of Science and Research (IJSR), Volume 5 Issue 9, 2016 .

6. Koumal Kaushik and Suman, "An Innovative Approach for Video Steganography", International Journal of Computer Network and Information Security, Vol.11, pp.72-79, 2015.

7. Avinash K. Gulve and Madhuri S. Joshi, An Image Steganography Method Hiding Secret Data into Coefficients of Integer Wavelet Transform Using Pixel Value Differencing Approach, Mathematical Problems in Engineering, 2015.

8. Seyyed Amin Seyyedi and Nick Ivanov. "High Payload and Secure Steganography method Based on Block Partitioning and Integer Wavelet Transform", International Journal of Security and Its Applications, Vol.8, No.4, pp.183-194, 2014.

9. Abhinav Thakur, Harbinder Singh and Shikha Sharda, Secure Video Steganography based on Discrete Wavelet Transform and Arnold Transform, International Journal of Computer Applications, Vol.123,No.11, 2015.

10. Navdeep Kaur and Anu Garg, "Steganography Using PSO Based Hybrid Algorithm", International Journal of Advanced Research in Computer Science and Software Engineering, Vol.4, Issue 11, 2014.

11. Kousik Dasgupta, Jyotsna Kumar Mondal, and Paramartha Dutta, Optimized Video Steganography using Genetic Algorithm (GA), Procedia Technology, vol.10,pp.131 – 137, 2013.

12. Ping Duan and Yong AI, "Research on an Improved Ant Colony Optimization Algorithm and its Application" , International Journal of Hybrid Information Technology, Vol.9, No.4, pp. 223-234, 2016.

13. Dorigo, Marco, and Luca Maria Gambardella. "Ant colonies for the travelling salesman problem", biosystems, 43., pp: 73-81, 1997.