Chapter 75
A New Data Hiding Scheme Combining Genetic Algorithm and Artificial Neural Network

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ABSTRACT

Today, in the time of internet based communication, steganography is an important approach. In this approach, secret information is embedded in a cover medium with minimum distortion of it. Here, a video steganography scheme is developed in frequency domain category. Frequency domain is more effective than spatial domain due to variation data insertion domain. To change actual domain of entropy pixels of the video frames, uniform crossover of Genetic Algorithm (GA) is used. Then for data insertion in video frames, single layer perceptron of Artificial Neural Network is used. This particular concept of information security is attractive due to its high security during wireless communication. The effectiveness of the proposed technique is analyzed with the parameters PSNR (Peak Signal to Noise Ratio), IF and Payload (bpb).

INTRODUCTION

Steganography is the art of hiding secret data or secret information at the time of wireless communication (2013). In this special approach, the existence of communication among sender and intended receiver(s) can be hidden from unintentional receiver(s) or hacker(s). In the particular system of methodology, the secret information is embedded in a cover medium, such as- image, audio, video etc. and the embedded file is transferred through communication channel. In Image steganography, image pixels are used for inserting secret data (2014). In video steganography, video frames are used to embed the data. Each video frame is treated as an image. The fact is that video files are safer than image files, because- video

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files take a large no. of image pixels over image files. So, obviously, insertion of data in video files consists of less distortion over image files. There are two major categories of steganography- spatial domain and frequency domain. In spatial domain steganography, the secret data is inserted directly in the image domain.

In frequency domain steganography, the actual domain of cover medium is converted to another medium using some mathematical transformation. This transformed domain is used for inserting secret data. Comparing these two different categories, it is observed that the distortion between actual cover medium and stego medium is generally less in spatial domain steganography over frequency domain steganography. In other words, peak signal to noise ratio (PSNR) and MSE (Mean Squared Error) generally give better result in spatial domain. But it can be easily hacked by unintended receiver(s) using pseudo random number generator (PRNG). Frequency domain steganography is better than spatial domain with respect to PRNG and other statistical attacks. Different mathematical transformations, such as- Discrete Cosine Transformation (DCT), Discrete Wavelet Transformation (DWT), Discrete Fourier Transformation (DFT), Fast Fourier Transformation (FFT) etc are used to transform the actual domain of cover medium. Also, in data compression, different stochastic optimization schemes are used. Among them, Genetic Algorithm (GA), Fuzzy logic etc are very important. Genetic Algorithm (GA) is basically a soft computing based optimization approach. But, the hereditary properties of animal, the concepts of which are used in this particular approach, are very much effective in various fields rather than optimization. Among them, image processing, information security, artificial intelligence etc. are very much important. Basically, GA is developed with three different properties- selection of chromosomes, crossover and mutation. According to the variation of these three operations, various types of GA are developed. GA is generally very much effective for NP hard problems. Another important tool in soft computing is Artificial Neural Network (ANN). In engineering field, this is a sequence of patterns like neurons of human being. In generally, at the time of implementation of all soft computing based approaches, given information and corresponding ingredients are taken as input. Target or goal is obtained Output in all the approaches. The speciality of the approach ANN is that the source pattern and target are taken as input and corresponding ingredients are obtained as output. This speciality makes ANN more effective than other schemes. Depending on variation of source pattern and target, different ANN schemes are developed. Among them, single layer perceptron, multi layer perceptron etc. are very much important. In this paper, a particular approach of frequency domain steganography is developed by using crossover operator of GA and single layer perceptron of ANN. In the next section, some related works are discussed. Then the proposed data hiding scheme is illustrated followed by the algorithm. After that the efficiency of the scheme is analyzed with different type experiments. At last, conclusion of the scheme is given followed by future direction of the work.

BACKGROUND

In this section, some data hiding schemes with cover medium video and tools GA and/or ANN are discussed. In the scheme Optimized Video Steganography using GA (2013), weighted sum approach of multi objective GA is used to make optimizer at the time of encoding. According to the architecture of that scheme is that at first cover video is divided into frames and audio using splitter. After that, in the carrier frame(s), secret data is embedded and stego frame is made. Then an optimizer is developed for steganalysis purpose. In other words, if it is observed that the stego video passes through anti-steganalysis