Discrete wavelet transform based signal stegnography & encryption

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Abstract: Stegnography and signal encryption are the most important tools that provide data and information security by hiding the signal under cover signal. It is usually done through mathematical manipulation of the data with on in comprehensible format for unauthorized user. Some time it is essential to transmit Real Time signal through internet with appreciable confidentiality for preventing unauthorized information access, this is prime consideration for growing use of signal stenography. Proposed algorithm based on Discrete Wavelet Transform technique for signal stegnography and one stage of encryption; both methods are used for secure communication Cryptograph which deals with data or signal encryption at sender side and decryption at receiver side [3] with help of key or password, stegnography used for secure data transmission.

Key word*: Signal encryption, stegnography, DWT, decomposition.*

1. Introduction

Before phone & before mail or other traditional method the secret message were send by the messenger by hiding the signal on his memory, sometime later invisible ink were the best method to hide the secret message later one spread spectrum techniques were also in use, present days stenography doesn't mean for the text message only but also for the signal & image[1] , here in this approach little emphasis is given to the encryption of stegnographic signal to improve the information security .here in "stego-encrypto"approach implements stenographic and encryption method together In which the amount of security increased[2]. In this paper "stego-encrypto" techniques based on DWT is presented.

2. Methodology:

Discrete Wavelet Technique (Dwt): The transform of a signal is just another form of representing the signal. It does not change the information content present in the signal. The Discrete Wavelet Transform provides a compact representation of a signal in time and frequency that can be computed efficiently [3]. In wavelet analysis, we often speak of approximations and details. The approximations are the high-scale, low-frequency components of the signal. The details are the low scale, high frequency components The DWT is defined by the following equation:

$$w(j,k) = \sum_j \sum_k x(k) 2^{-j/2} \varphi(2^{-\frac{j}{2}} n - k) \qquad (1)$$

Where φ (t)is a time function with finite energy and fast decay called the mother wavelet Equation(1) shows that it is possible to build a wavelet for any function by dilating the function φ (t) with a coefficient 2^j, and translating the resulting function on a grid whose interval is proportional to 2^{-j}. The DWT analysis can be performed using a fast, pyramidal algorithm related to multi rate filter banks [4]. In the pyramidal algorithm the signal is analyzed at different frequency bands with different resolution by decomposing the signal into a coarse approximation and detail information. The coarse approximation is then further decomposed using the same wavelet decomposition step. This is achieved by successive high- pass [n] and low-pass h[n] filtering of the time domain signal and is defined by the following equations:

$$yhigh[k] = \sum_{nk} x(n) g(2k - n) \qquad (2)$$
$$ylow[k] = \sum_{nk} x(n) g(2k - n) \qquad (3)$$

Where $yhigh[k]$ and $yhigh[k]$are the outputs of the high pass (g) and low pass (h) filters, respectively after down sampling.

3.Algorithm:

At transmitting end : First of all the payload(embedded) and cover signal both are decomposed by applying *DWT* ,in this the signals are transformed from spatial domain to frequency domain and separate the approximation and detail coefficient *c1[],c2[]* & *l1[],l2[]* which is high and low frequency coefficient respectively at second stage fusion of approximate coefficient *C[]=c1[]+c2[]* & detail coefficient *L[]=l1[]+l2[]* for both signal, applying the inverse wavelet transform to construct the stenographic signal *ss[],* at the third stage further decomposing of stenographic signal on *A[] & D[]* at level of 3 to perform encryption on it , the detail coefficient vector d[]of the signal now combined vector *R[]=d[]+code* with code value of the wave name used as wavelet to decompose the stenographic signal value, without which the reconstruction of a signal at the receiving end is impossible.

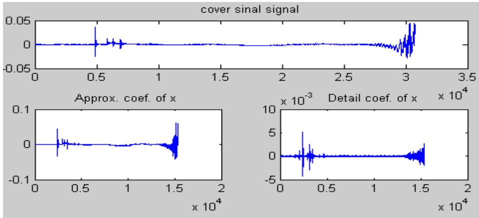
At receiving end: At very first requirement is detaching key *code=R[]-d[]* from the detail coefficient vector & reconstruction of stenographic signal with help of key code and approximate & detail coefficient second stage apply IDWT on stenographic signal the reconstruction of payload signal from stenographic signal with help of approximate and detail coefficient [1][2], table showing the encryption time and key code of the various wavelet.

4. Result: Proposed methods were tested for various type of wavelet and there signal encryption time also be analyzed, decryption technique at the receiver end can be successfully used to recovered the embedded signal from stegnographic signal.

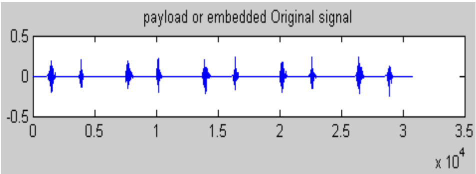
5.Conclusion & Discussion: "Steno-encrypto" is proposed algorithm in this paper ,the algorithm used,for the signal stenography with one stage of encryption, thereafter, here "stego-encrypto" approach implements stenographic and encryption method together In which the amount of information security may increased, using the function available in MATLAB, the process of signal encryption applied on the stenographic signal using DWT, where the code name of wavelet used for decomposition is used as key for encryption, result of the signal stegnography & cover signal, embedded signal shown in the fig.1 below & at the same time signal encryption time using different wavelet is also analyzed in the table 1, fig.1 showing the cover signal stegnographic signal & embedded signal respectively.

Table 1: Time of encryption and the encryption code for different wavelet.

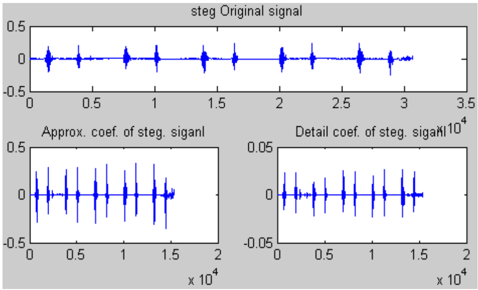
Wavelet used	Key code for encryption	Time of encryption in sec.
Db1	1	0.2500
Db2	2	0.2810
Db3	3	0.2500
Db4	4	0.2810
Db5	5	0.3750
Db6	6	0.2810
Db7	7	0.2500
Db8	8	0.2660
Db9	9	0.3290
Sym1	10	0.2970
Sym2	11	0.2810
Sym3	12	0.2500
Sym4	13	0.2810
Sym5	14	0.2960



(a)



(b)



(c)

Fig.1 (a) Embedded signal (b) Cover signal (c) Stegnographic signal.

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