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Extracting Spread Spectrum Data from Image

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Abstract: ***The problem of extracting blindly data embedded over a wide band in a spectrum domain of digital medium image is considered. Multicarrier Iterative Generalized Least Square (M-IGLS) algorithm is develop to extract unknown data hiding in the host via multicarrier SS embedding. Original host and embedding carriers are not need to be known. This project consider the blind extraction technique. Which means original host and embedding carriers are assumed unavailable. The hidden data which is embedded in the image to the host signal via multicarrier SS embedding. The hidden data is extracted from image. Multicarrier Iterative Generalized Least Square (M-IGLS) algorithm is the extraction algorithm is used to extract the hidden data from image. M-IGLS is low complexity algorithm which provides high performance. Experimental studies on image show that the developed algorithm can achieve recovery probability of error equals to what may be attained with known embedding carriers and original host.***

Keywords: Spread spectrum, GLS, blind extraction, DCT transform, data hiding

1. Introduction

Data tracking are increasing rapidly in everywhere like mobile tracking. So there is need of secure communication scheme for transmitting data. For that, there are many data hiding and extraction schemes. Data hiding is used for secure communication which is used in military communication system like encrypted message used for finding sender and receiver or its existence. This paper focus on blind recovery of hidden data in host via spread spectrum. The original host and embedding carriers both are assumed to be not known, so here the fully blind extraction is considered. This blind extraction problem also referred as watermarked content only(WOA) attack in watermarking security.

In Iterative Generalized Least Square(IGLS) was developed to blindly extract unknown messages hidden in image host via SS embedding. This is a low complexity algorithm with strong recovery performance and this algorithm is designed for single carrier SS embedding where the messages hidden with one signature only and is not generalizable in the multicarrier case. Multicarrier SS embedding is used to increase security and payload rate.

In this paper, we develop a Multicarrier Iterative Generalized Least Square (M-IGLS) algorithm for extraction of hidden data and to improve the performance. The greatest challenge is to extract the small hidden messages. The proposed algorithm is used to test security robustness of SS data hiding. Attributes of data hidings are a) robustness b) payload c) transparency d) security.

Active hidden data extraction is relatively new research while passive detection-only of the presence of embedded data is investigated in past years. In blind extraction of SS embedded data the unknown host acts as disturbance to the recovery of data and the blind signal separation application arise in the array processing and CDMA communication terms. The embedded hidden messages are identically distributed. independent component analysis utilised to pursue hidden Data extraction.

In this paper Multicarrier Iterative Generalized Least Square(MIGLS) is developed for hidden data extraction. Applications of the developed algorithm are not to attacking steganographic covert communication by recovering hidden embedded messages. All the carriers are estimated with embedded data. The developed scheme is used for message removal or tampering attack or the fabricated message reinserted in the original place.

2. Spread Spectrum

Spread-spectrum techniques are used to generate the signals with a particular bandwidth which is spread in the frequency domain, It generates the signal with a wider bandwidth. Spread-Spectrum is used for secure communication, increasing resistance to natural interference like noise and jamming and to prevent detection. There are various spread-spectrum techniques but this paper use Direct-sequence spread spectrum which is modulation technique. Modulation is process of varying one or more properties of periodic waveform which is called carrier signal. Modulation signal contains the information to be transmitted. Spread-spectrum algorithm for blind steganography based on understanding that host signal acts as source of interference to secrete message, which is useful for blind receiver at the recovery side to minimize the extraction error rate for host signal. In SS embedding hidden data spread over many host signal by adding low energy noise sequence.

SS embedding algorithms for blind image steganography (that is, hidden message recovery without knowledge of the original image) have been based on the understanding that the host signal acts as a source of interference to the secret message of interest. It should also be understood that this interference is known to the message embedder. Such knowledge can be exploited appropriately to facilitate the task of the blind receiver at the other end and minimize the recovery error rate for a given host distortion level. It also minimize host distortion for a given target recovery error rate and maximize the Shannon capacity of the covert steganographic channel, etc. Indeed, if we were to place the steganography application in an information theoretic context, it can be viewed as a communications with side information problem. Optimized embedding methods can facilitate host interference suppression at the receiver side when knowledge of the host signal is adequately exploited in system design.

2.1 Advantages of Spread Spectrum (SS) Techniques:

1) Reduced interference: In Spread Spectrum systems, interference from undesired sources is considerably reduced due to the processing gain of the system.
2) Low susceptibility to multi-path fading: Because of its inherent frequency diversity properties, a spread spectrum system offers resistance to degradation in signal quality because of multi-path fading. This is particularly beneficial for designing mobile communication systems.
3) Co-existence of multiple systems: With proper design of pseudo-random sequences, multiple spread spectrum systems can co-exist.
4) Immunity to jamming: An important feature of spread spectrum is its ability to stand with strong interference, sometimes generated by an enemy to block the communication link. This is one reason for extensive use of this concept of spectrum spreading in military communications.

3. Types of Spread Spectrum

Based on the kind of spreading modulation, spread spectrum systems are broadly classified as:

(i) Direct sequence spread spectrum (DS-SS) Systems
(ii) Frequency hopping spread spectrum (FH-SS) systems
(iii) Time hopping spread spectrum (TH-SS) systems.

Direct Sequence Spread Spectrum **(DSSS)** differs from FHSS in that the transmitted data packet is “spread” over a broad-channel, effectively transmitting on multiple narrow channels simultaneously. While a data packet is getting transmitted, the data packet is modulated with a pseudorandom generated key, normally called as a ‘chipping-key’ which spreads the transmission across the wide-band channel. After receiving the message receiver decodes and recombines the message using the same chipping key to return the data packet to its original state. FHSS has higher capacities than DSSS, but it is a very sensitive technology, influenced by some environmental factors, mainly reflections. The best way to reduce such influences is to use the technology in either (i) point to multipoint, short distances applications or (ii) long distance applications, but point to point topologies. In both cases the systems can take advantage of the high capacity offered by DSSS technology, without paying the price of being disturbed by the effect of reflections. As so typical DSSS application includes indoor wireless LAN in offices (i), building to building links (ii), Point of Presence (PoP) to Base Station links (in cellular deployment systems). A DSSS system can reduce the effects of interference on the transmitted information. An interfering signal may be reduced by a factor which may be as high as the processing gain. The main feature of DSSS system is its ability to operate in presence of strong co-channel interference. A popular definition of the processing gain (PG) of a DSSS system is the ratio of the signal bandwidth to the message bandwidth.

3.2 Frequency Hopping Spread Spectrum (FHSS):

Frequency Hopping Spread Spectrum **(FHSS)** has the frequency of the transmitted message periodically changed (or hopped). The transmitter hops frequencies according to a pre-set sequence. The receiver either stays synchronized with the transmitter hopping, or detects the frequency of each transmission. FHSS could hop rapidly, several times per message, but usually it transmits a complete message (or data packet) and then hops. Every transmitter hops to a particular hop-sequence, which it either chooses automatically or is user-configured. Although the hop-sequences of different transmitters are different, the hopping of a “foreign” transmitter exhibits statistical randomness (though not truly random). Though FHSS hopping sequences are random, in that the probability of a foreign transmitter hopping to a particular channel appears to be random. FHSS is a very powerful technology, with little influence from noises and reflections, other radio stations or other environmental factors. Adding in that, the number of simultaneously active systems in the same geographic area (collocated systems) is significantly higher than the equivalent number for DSSS systems. All these features of FHSS makes technology the one to be selected for installations designed to cover big areas where a big number of collocated systems is required and where the use of directional antennas in order to minimize environment factors influence is impossible. The applications for FHSS include cellular deployments for fixed Broadband Wireless Access (BWA), where the use of DSSS is nearly impossible because of its limitations.

3.3 Time hopping spread spectrum systems (THSS):

Time-hopping (TH) is a communications signal technique which can be used to achieve anti-jamming (AJ) or low probability of intercept (LPI). It can also refer to pulse-position modulation, which in its simplest form employs 2^k discrete pulses (referring to the unique positions of the pulse within the transmission window) to transmit k bit(s) per pulse. To attain LPI, the transmission time is changed randomly by varying the period and duty cycle of the pulse (carrier) using a pseudo-random sequence. The transmitted signal would then have intermittent start and stop times. Although usually used to form hybrid spread-spectrum (SS) systems, TH is especially speaking a non-SS technique. Spreading of the spectrum is occurs by other factors associated with TH, such as using pulses with low duty cycle having a wide frequency response. An example of hybrid SS is TH-FHSS or hybrid TDMA (time division multiple access).

4. Multi-Carrier Spread Spectrum Embedding

The procedure of spread spectrum may possibly permit partially to fulfil the basic requirements. The embedding technique is intended to assure the perceptual limit and advance the perceive capability as well as the embedding charge. As a substitute of the pixel rate, the histogram can be customized to embed the data. If we observe distinctive histograms of DCT coefficients we will locate some trial include high amplitudes that the widespread Gaussian technique cannot effectively established. We will believe the DCT coefficients whose amplitude is beneath a confident threshold importance. In this embedding proposal, the hidden data is Hidden over various test of host signal or image by totalling the DCT coefficient as the carrier. For image transformation, we will take the DCT transform. It is well known that DCT transformation provides excellent energy compaction in low spectral coefficients for highly correlated data. Any disturbance directly or indirectly added in the frequency domain may result in a change of statistical properties.DCT is applied in blocks of 8*8 matrix. The Gaussian distribution is used to model the statistical properties of the DCT coefficients.

Advantages of spread spectrum procedures are broadly well-known: Invulnerability against multi-path alteration, no necessitate for frequency preparation, high elasticity and uneven data rate transmission. The propensity of diminishing multiple access interference in direct-sequence code-division-multiple-access system is specified by the cross-correlation properties of spreading codes. In the case of multi-path transmission the ability of distinctive one section from others in the complex received signal is obtainable by the auto-correlation properties of the scattering codes.

5. Generalized Least Square(GLS)

Its a technique for estimating the unknown parameters in linear regression model. GLS is applied when variance of observations are unequal or there is certain degree of correlation between the observation. Linear regression is approach for modelling the relationship between scalar dependent variable X and one or more explanatory variables. Dependent variable is measured variable Y.

5.1 Least Squares

It is standard approach to the approximate solution of over determined system.(i.e. set of equations in which there are more equations than unknowns). Over determined system, in maths system of linear equations is considered over determined if there are more equations than unknown.

Example: simple dataset consist of n points.(data pairs)

(Xi, yi) where i=1......n , xi is independent variable and yi is dependent variable. Its value is found by observation. Model function has form f(x, β) where m adjustable parameters are held in vector β. The goal is to find parameter values for the model which "best fits" the data.

When the sum S of squared residuals is Least squares method finds its optimum S=$\sum_{i=1}^{n} ri^2$ between the observed value and estimated function value.

6. Conclusion

The main aim of the proposed system is to provide a good extraction technique which considered the blindly recovery of data. The M-IGLS algorithm is used for the extraction. The data is embedded via DCT transform by multicarrier SS embedding. This technique of extraction will provides high peak signal to noise ratio and it will attains the probability of error recovery equals to known host and embedding carriers. This technique is enhanced by using harmony search algorithm where it provides low time consumption and high attack resistance.

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