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Digital Video Steganography Technique for Secure Communication Using Bit Wrapping Method

Venkata Sunil.P[1], Sai Neeraj.G[2], Vino.T[3]

UG Student, Dept. of ECE, Sathyabama University, Chennai, Tamilnadu, India[1]

UG Student, Dept. of ECE, Sathyabama University, Chennai, Tamilnadu, India[2]

Assistant Professor, Dept. of ECE, Sathyabama University, Chennai, Tamilnadu, India[3]

ABSTRACT: The paper proposes the improvement of security for secret digital communication through video file mistreatment adaptation activity with logical cryptographic technique. A given input video file is divided into frames and the key knowledge is hidden among one of the frames for secure communication. A chaos cryptography technique is used for encrypting a secret text whilst the hider chooses the frame to conceal the key encrypted data. Though the coding achieves security bound effects, the created key messages are unnatural. These unnatural messages sometimes intrigue unintended observers attention. The information activity technique uses the adaptation LSB replacement formula for concealing the key message bits into the image in frequency domain and a number rippling remodel is employed to see the high frequency elements for effective knowledge concealing in order to protect the image quality. During the information extraction, the key knowledge is extracted by mistreatment relevant key for selecting the pixel coefficients and later it will be decrypted to urge original data. Finally the performance of this proposal in coding and activity are analyzed by supported image and knowledge recovery.

KEYWORDS: Lifting Wavelet Transform, Chaotic encryption, Logistic mapping based encryption, Bit Wrapping method, Steganography.

I. INTRODUCTION

The process of identification of objects in an image most probably starts with the image processing techniques like noise removal, feature extraction to locate regions, lines and possibly those areas with certain text. The clever bit is used as an interpretation to the collection of these shapes as a single object, e.g. bikes on a road, material boxes on a conveyor belt. One reason is that an object appears very different when it is viewed from different lighting or different angles. One major problem is to decide which features belong to which object and which are backgrounds. The human visual system performs these tasks unconsciously, but a computer requires skillful programmer and lots of power of processing to approach human visual performance. Data can be manipulated trough several techniques in the form of an image. An original image is usually interpreted as a 2-Dimensional array of brightness values and is mostly represented by those patterns of a photographic prints, slides, and television screen. An image can be processed digitally or optically in a computer. To digitally process an image, first the image is reduced in to a series of numbers, each number representing the brightness value of an image at a particular location is called pixel or picture coefficient. A typically digitized image may have 512 x 512 or2,50,000 pixels, as large images became common. Once the image is digitized then there are three kinds of basic operations that can be performed. In terms of the point operation, a pixel value in the output image depends on single pixel value in an input image. For common operations, many neighboring pixels in the input image determine the value of output image pixels. In a universal operation, all of the input image pixels contribute to output image pixel value.

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II. LITERATURE SURVEY

1. Ismail Avcibas, Naisr Memon and Biilent sankur presented a technique for steganalysis of images that are subjected to a watermarking algorithm [1]. The watermarking schemes used leave a statistical evidence that can be exploited for detection with the aid of proper selection of image features and multiple variety regression analysis. An image quality metrics has been used to feature a set to distinguish between un-watermarked and watermarked images and distinguish between different watermarking techniques. Analysis of variance (ANOVA) technique is used to identify specific quality measures which provide a best discriminative power. Then multiple variety regression analysis is used on the selected metrics quality to build a classifier using a collection of images and their respective blurred versions. Simulation results shows a feature set furthermore some renowned and widely available watermarking techniques indicate that the approach is able to precisely make a distinction with high accuracy between images which are marked by different watermarking techniques.

2. Abir Awad and Abdelhakim Saadane presented a comparison on performance of the famous piecewise linear chaotic map with that of PWLCM troubled by a new technique [2]. Then the two chaotic maps are used to control a method of three bit-permutation which have a high-quality property of inherent cryptography. The results present higher performance characteristics by the proposed chaotic permutation methods controlled by the troubled map, when this method is applied to the image.

3. Jun Tian introduced a Reversible data embedding technique using a difference expansion [3]. The benefit of this reversible technique is, the original digital information can be completely restored. The redundancy in digital images to achieve very high embedding capacity, and keep the distortion low is explored. The result shows both the capacity limit of the payload and the visual quality of the embedded images are of high quality.

4. Shubo Liu, Jing Sun, Zhengquan Xu introduced an image encryption algorithm based on chaotic system [4]. one of the main cipher techniques, security of stream cipher dependents completely on the quality of generated pseudo-stochastic sequences. The pseudo-random sequences with good randomness are produced by employing chaotic systems that are suitable to the stream cipher.
   A new encryption algorithm has been proposed by analyzing the principle of the chaos encryption algorithm which bases upon the logistic mapping where the security and performance of the proposed algorithm is also estimated. The results which are based on coupled chaotic maps approve the effectiveness and the coupled chaotic maps shows high-level security and advantages of large key space. The cipher text generated by this method is suitable for the secure transmission of classified information through the Internet.

5. Weiming Zhang, Biao Chen, and Nenghai Yu generalized a method of decompression algorithm as the coding scheme for embedding data and demonstrate that the codes can reach the rate–distortion bound provided that the compression algorithm reaches entropy[5]. By the proposed binary codes, three reversible data hiding RDH schemes that use binary feature sequence as covers, that is one scheme for JPEG images, one RS scheme for spatial images, and a substitution pattern scheme for binary images. The experimental results show that the codes can considerably reduce the embedding distortion and by modifying the histogram shift (HS) manner the proposed codes can be also subjugated to improve the schemes of integer operation based.

III. CLASSIFICATION OF IMAGES

In Digital Image Processing, there are three types of images used. They are:

1. Binary Image
2. Gray Scale Image
3. Color Image

Binary Image: A binary image is a digital image which has two possible values for each single pixel. The typical two colors used in binary image are black and white although any two colors can be used. The foreground color used for the objects in an image and rest of the image is used for the background color. Binary images are also called as Bi-level or 2-level. Thus each pixel is stored as a single bit (0 or 1).

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Gray Scale Image: A grayscale image is a digital image in which each pixel value is a single sample that carries only intensity information. These images known as black and white are composed of shades of gray (0-255), ranging from black (0) at the lowest intensity to white (255) at the highest. Grayscale images and one-bit black and white images are distinct that the computer imaging has only two colors they are black and white also called bi-level or binary images, while grayscale images are having many shades of gray color in between. Grayscale images are also monochromatic, which indicates the absence of any chromatic light.

Color Image: A digital color image has the color information for each pixel. Each pixel has a particular value which determines it's appearing color. The values are given by the decomposition into three primary colors Red, Green and Blue. Any color visible to the human eye can be represented in this way. The decomposition of the color into three primary colors is quantified by a number between 0 and 255. For example, white is coded as R = 255, G = 255, B = 255; while black is coded as (R, G, B) = (0, 0, 0); and pink as (255, 0, 255).

IV. CRYPTOGRAPHY

The earliest forms of information hiding are considered to be highly important forms of private key cryptography, where in this case the "key being the method employed (security through obscurity). Over time these primitive cryptographic techniques improved a lot in terms of capacity, speed and transmitted message security. Cryptographic techniques depend on the metaphor like a piece of information is placed in a secure "box" and then locked with a "key". Anyone with the proper key can gain access and once if the box is open, all the secure information is lost. Cryptography is the science of using mathematic principles for encrypting and decrypting the original data. Cryptography enables to store important information or to transmit the data across insecure networks like internet, so that the data cannot be read by anyone except the recipient intended.

V. STEGANOGRAPHY

Steganography means to hide the secret information into innocent data. Digital images are ideal for hiding the secret data. An image which contains the secret message is called as cover image. The difference of the cover image the stego image is not noticeable. The process of embedding must not draw any extra attention to the stego image so that no hacker would try to extract the hidden message which is not legal and the process of message hiding must be reliable. The length of the secret message should be as long as possible."Steganography is an art of information hiding in a way that prevents the detection of hidden message".

Steganography in a Digital Image: Steganography is the art of secret communication. It's very purpose is to hide the data using cryptographic technique generating specific keys and those who do not possess the right key cannot access the data. Digital image files, sound files, and video files that contain perpetually irrelevant information can be used as carriers or covers to hide the secret data. When the secret message is embedded into the cover image, the stego image is obtained.. Another important factor is the choice of cover image. Although computer generated images may seem as good as covers because of their complexity and irregularity, actually they are generated by many strict rules that may be easily violated by embedding the message.

Cryptography vs Steganography: Cryptography is the science of encrypting data in such a way that nobody can understand the message encrypted, whereas in steganography the existence of data is conceived can't be noticed. The message to be hidden is embedded into the cover object which can be a text, image, audio or video so that the appearance of cover object does not vary even after the information is hidden (Information to be hidden + cover object = stego object.)To add more security the data to be hidden is encrypted with a key. To extract the hidden information one should have the key. A stego object is the one that looks exactly same as the cover object with hidden information.

Existing Method

- Bit modification and spread spectrum.
- Discrete Cosine and wavelet transformation

Drawbacks

- The data hiding capacity is low in this technique.
- More distortion is due to the hiding process, so it may degrade the quality of the image.
- Floating point precision error.

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VI. PROPOSED METHOD

Secret data transmission is based on security enhancement system where the data is encrypted and an adaptive data embedding technique is employed, which is based on chaos encryption as well as adaptive least significant bit replacement algorithm.

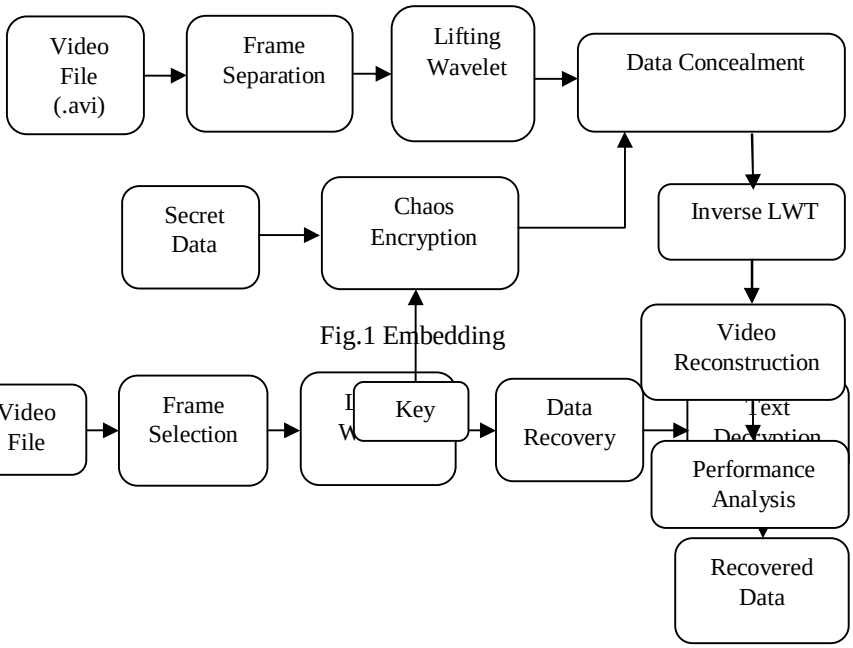

Fig.1 Embedding

Fig.2 Extraction

WAVELET TRANSFORM: Basically we use Wavelet Transforms to analyze the non-stationary signals, whose frequency response changes in time, as Fourier Transform is not suitable for such signals. The width of this window in time should be equal to the segment of the signal and where it is still considered stationary. By STFT we can get time-frequency of a signal, which cannot be obtained by FT. The short term, Fourier Transform for a real continuous signal is defined as:

$$X(f, t) = \int_{-\infty}^{\infty} [x(t) w \quad (t-\tau)^{*}] e^{-2j\pi ft}\, dt \qquad (1.1)$$

Where the length of the window is (t-T) in time such that we can shift the window by changing the value of t and by varying the value of T we get different frequency response of signal segments.

Narrow window ----good time resolution and poor frequency resolution

Wide window----good frequency resolution and poor time resolution

The wavelet transform involves projecting a signal onto a complete set of translated and dilated versions of a mother wavelet E (t). The strict definition of a mother wavelet is dealt with later so that so that the form of the wavelet transform. The basis sets of wavelets are generated from the mother or basic wavelet is defined as:

$$\Psi_{a,b}(t) = \frac{1}{\sqrt{a}} \psi \left(\frac{t-b}{a} \right) ; \; a, b \in \Re \text{ and } a>0 \qquad (1.2)$$

The variable 'a', inverse of frequency, reflects the width of ta particular basis such that it's large value low frequencies and small value gives high frequency. The variable 'b' specifies it's translation along x-axis in time. The '$\frac{1}{\sqrt{a}}$'is used for normalization.

1-D Continuous wavelets transform: The 1-D continuous wavelets transform is given by:

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$$W_f(a, b) = \int_{-\infty}^{\infty} x(t)\psi_{a,b}(t)\,dt \qquad (1.3)$$

The inverse 1-Dimenssional wavelet transform is given by:

$$X(t) = \frac{1}{C}\int_{0}^{\infty}\int_{-\infty}^{\infty} W_f(a,b)\psi_{a,b}(t)\,db\,\frac{da}{a^2} \qquad (1.4)$$

$$\text{Where } C = \int_{-\infty}^{\infty} \frac{|\psi\omega)|^2}{\omega}\,d\omega \qquad (1.5)$$

is the Fourier transform of the mother wavelet(t). 'C' is required to be finite, which leads to one of the required properties of a mother wavelet.

1-D Discrete wavelets transform: The discrete wavelets transform (DWT), which transforms a discrete time signal to a discrete wavelet. The first step to proceed is to discretize the wavelet parameters, which reduces the previously continuous basis set of wavelets to a discrete and orthogonal set of basis wavelets.

$$\psi_{m,n}(t) = 2^{m/2}\,\psi(2^m t - n);\ m, n \in Z \qquad (1.6)$$

such that $-\infty < m, n < \infty$

The 1-Dimenssional DWT is given as the inner product of the signal x(t) being transformed with each of the discrete basis functions.

$$Wm,n = \langle x(t), \psi m,n(t) \rangle\ ;\ m, n \in Z \qquad (1.7)$$

The 1-D inverse DWT is given as:

$$X(t) = \sum_m \sum_n W_{m,n}\psi_{m,n}(t)\ ;\ m, n \in Z \qquad (1.8)$$

2-Dimenssional wavelets transform: The 1-D DWT can be extended to 2-D transform using separable filters, applying a 1-D transform to all the rows of the input and then repeating on all of the columns can compute the 2-Dimenssional transform. When one level 2-Dimenssional DWT is applied to the image, four coefficient sets are created. As depicted in figure, the four sets of coefficients are LL, LH, HL and HH, where the first letter corresponds to applying either a low pass or high pass filter to the rows, and the second letter responds to the filter applied to the columns.

VII. RESULTS

Fig.3 Selected Input Cover Video

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In the Fig3. it shows that an input cover video is selected and then divided into frames, where a B channel is chosen from a particular frame.

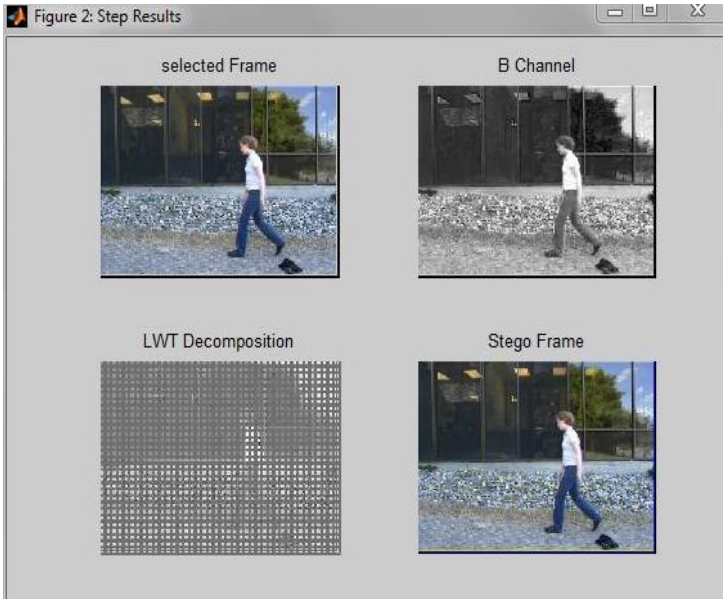

Fig.4 Step Results

In the Fig4. it shows that the cover video is divided into frames where a particular frame is being chosen and then Lifting Wavelet Transform (LWT) is applied and finally a stego image is obtained.

Fig.5 Output Command Window

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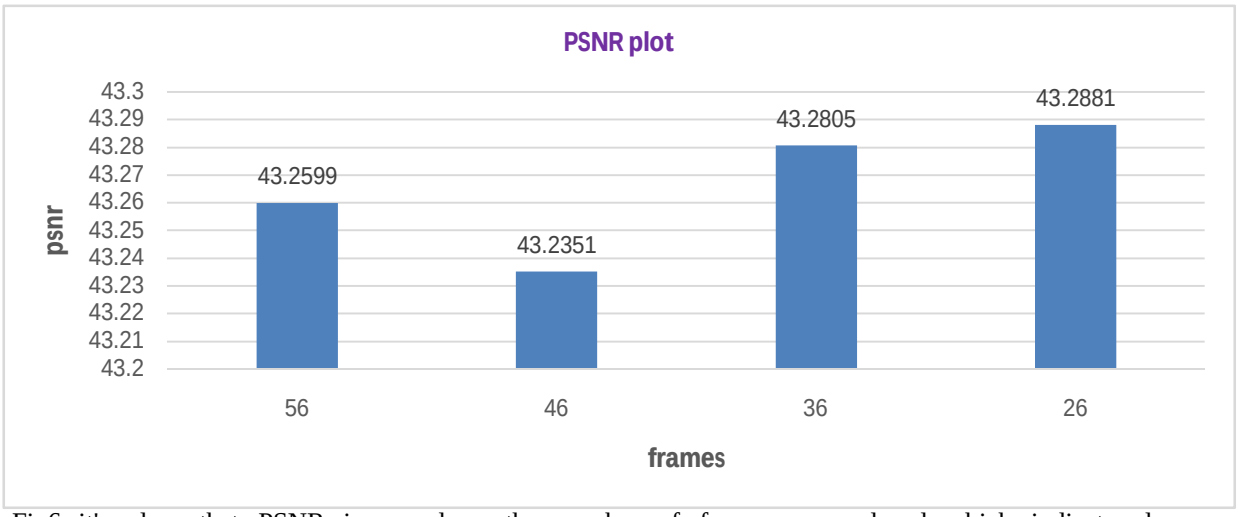
In the Fig5. it shows that Input text is converted into the ciphered text and later the information is decrypted. Then the performance analysis is taken into consideration which includes Root mean square error, PSNR (dB), Correlation coefficient and Processing time.

PERFORMANCE ANALYSIS/COMPARISON

Fig.6 PSNR Comparison Of The Respective Frames



In Fig6. it's clear that PSNR increased as the number of frames are reduced which indicates low error.

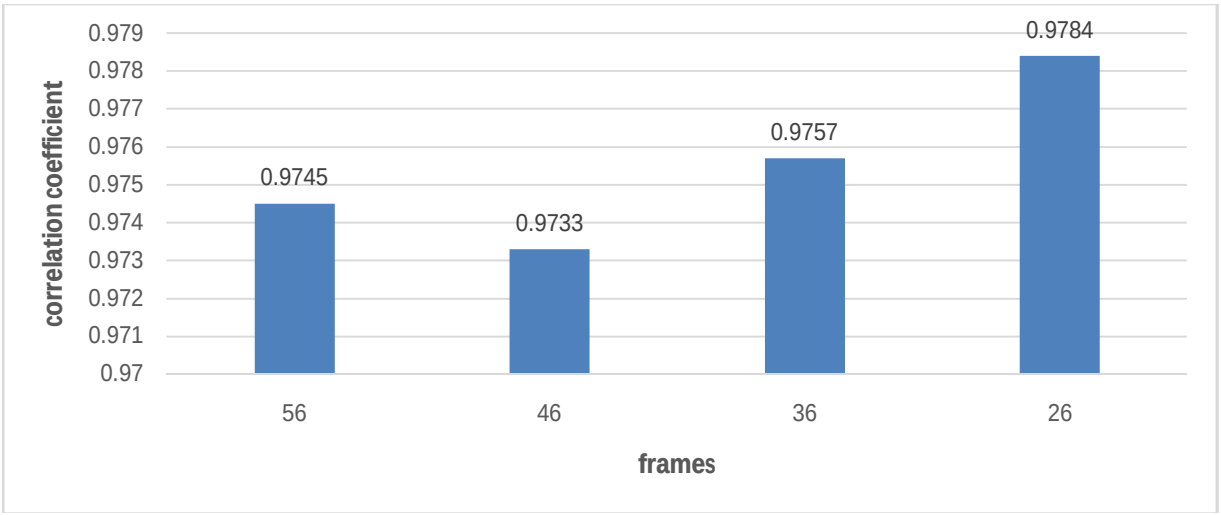


Fig.7 Correlation Coefficient Comparison Of The Respective Frames

In Fig7. the maximum of 0.9784 is touched for a particular frame count, where a value of exactly 1.0 shows a perfect positive relation.

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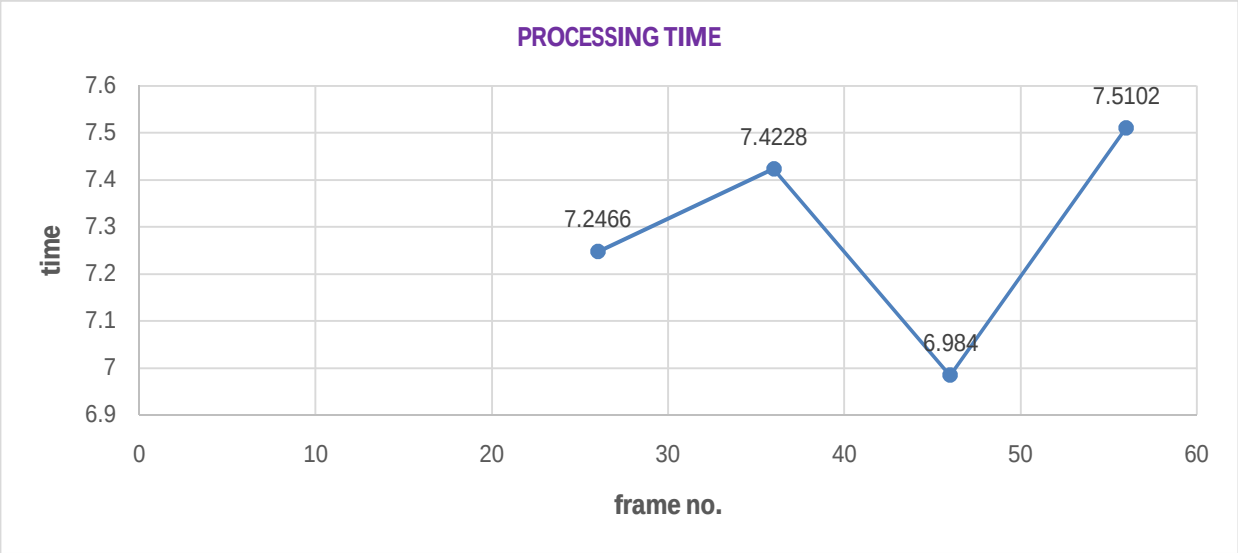

Fig.8 Processing Time Comparison Of The Respective Frames

In Fig8. the graph shows that processing time cutback as the number of frames are reduced, which is very efficient.

VIII. CONCLUSION

The paper presents secret data communication through video file using adaptive data hiding with cryptographic technique to enhance the security for transmission. Data hiding using steganography has two primary objectives first steganography should provide the maximum possible payload, and the second is embedded data must be imperceptible to the human eye. It should be stressed on the fact that steganography is not meant to be robust. It was found that the proposed method gives high payload into the cover image with estimable error.

REFERENCES

[1] Avcibas, I., Memon, N., and Sankur, B., "Steganalysis using image Quality metrics", IEEE Trans. IP, Vol.12, pp.221-229, Feb 2003.
[2] Awad, A., Saadane, A., "Efficient Chaotic Permutations for Image Encryption Algorithms", proceedings of the world congress on Engineering, Vol I, June 30 - July 2010.
[3] Tian, J., "Reversible data embedding using a difference expansion", IEEE Transactions on Circuits and Systems for Video Technology, Vol. 13, No. 8, pp. 890–896, Aug. 2003.
[4] Liu, S., Sun, J., Xu, Z., "An improved image Encryption Algorithm based on Chaotic System", Journal of Computers, Vol.4, No.11, Nov 2009.
[5] Zhang, W., Chen, B., Yu, N., "Improving Various Reversible Data Hiding Schemes via optimal Codes for Binary Covers", IEEE Transactions On Image Processing, Vol. 21, No. 6, June 2012.
[6] Ishwar, P., Johnson, M., Prabhakaran, V. M., Ramchandran, K., and Schonberg, D., "On compressing encrypted data", IEEE Transactions Signal Process, Vol. 52, No. 10, pp. 2992–3006, Oct. 2004.