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Data Hiding by Image Steganography Appling DNA Sequence Arithmetic

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***Abstract*—Image steganography we can hide the secret data in cover manner. Where present of secret information can't realize or visible by malicious users. In this approach steganography procedure divided into two steps. In first step DNA sequence (combination of four nucleotides A,C,G&T) used to convert secret information into a grayscale image by generating key. In second step, gray scale image of step-1 will steganography by any standard steganography procedure.**

Index terms -Steganography, DNA sequence, nucleotide, Key generation, LSB.

I. INTRODUCTION

For secure transmission of data steganography procedure widely used. According to availability and applicability of steganography we can categories into two types – Watermarking and Steganography .The word Steganography came from Greek culture. It is an expertise hiding technique in which hiding done inside a picture or an audio file or a video file ,in an efficient way so that no one can realize except the sender and the receiver that there is a secret message.[1]

The process which determine the proper order of nucleotides with in a DNA molecule is called NA sequencing .DNA sequencing allows to determine the order of four nucleotides in a DNA chain by any method. DNA sequencing methods has greatly accelerated in the field of biological and medical science domain.

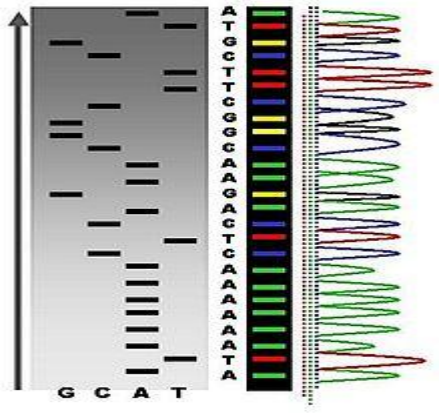


Figure 1. An example of the results of automated chain-termination DNA sequencing [2]

In the year 1970,first DNA sequence obtained by two-dimensional chromatography method [2].

Remaining portion of this paper structured as follows, related works in section 2, proposed work in section 3, Example in section 4 and conclusion in section 5.

II. RELATED WORK

A. Least Significant Bit Insertion

LSB insertion is one of the common and popular method for Steganography. In this method Cover-image LSB bits will alter by Secret information. Here the method is illustrated below.

Pixels: (00100111 11101001 11001000 11100011)

(00100111 11001000 11101001 10101100)

(11001000 00100111 11101001 01100110)

B: 01000010

Result: (00100110 11101001 11001000 11100010)

(00100110 11001000 11101001 10101100)

(11001000 00100111 11101001 01100110)

Above example shows that how to embed latter B in first eight bytes of three pixels in a 32-bits image.

Only three bits are altered out of 96 bits .On an average half of the bits of an image required to change for LSB insertion. Here only 8 bytes required to hide 8 bits latter B. So, remaining bytes can be used for hide other part of secret information. If substitute two or more LSB bits per byte then it will increase the embedding capacity. But disadvantage of this alteration is that Cover-image is more detectable. Alteration in LSB procedure only done if no statistical changes occur[3].

B. DNA encryption

Logic for DNA encoding and decoding:

In DNA four nucleotides can store information this are: adenine (A), guanine (G), cytosine (C), and thymine (T).Pairs are available in DNA sequence, such as, T with A and G with C and pairs can be complement to each other. Similar like 1 and 0 are component in binary, so 10 and 01 are component. To represent four nucleotides in binary, required two bits. This are 00=A, 01=C, 10=G and 11=T. In case of 8 bit grey images required DNA sequence of length 4 to represent each bit. For example: 5th pixel value is 137, then its binary form is [10001001], then corresponding DNA sequence is [GAGC].

Logic for addition and subtraction of DNA sequences:

Like other computing procedure DNA computing has a great impact on field of research. Addition and subtraction operation in DNA sequences is same as binary addition and subtraction respectively, but here discard carry. For example: 11+11=00, 00-11=11.Binary representation of A,C,G,T is 00, 01, 10, 11 respectively. That is T+T=C, A-T=T……[4].

Addition and subtraction operation should be performing according to Table-1 and Table 2 respectively.

+	A	C	G	T
A	A	C	G	T
C	C	A	T	G
G	G	T	A	C
T	T	G	C	A

Table 1.

--	A	C	G	T
A	A	T	G	C
C	C	A	T	G
G	G	T	A	C
T	T	G	C	A

Table 2.

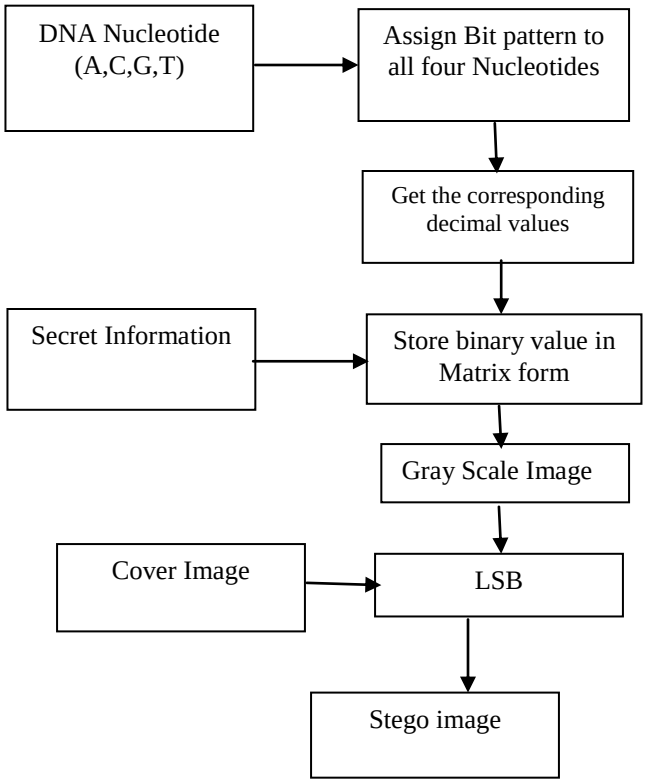
III. PROPOSED WORK

A. Diagrammatical representation of Proposed Method

The proposed method is described below:

Algorithm –I for Transformation from secret information to grayscale image.

1. Scan the secret information string from left to right.
2. Starting from 1st character.
3. Find out which one is closest among A, C, G &T in difference chart.
4. Get the corresponding decimal value of character by adding difference with nearest nucleotide key value.
5. Convert decimal value in binary.
6. Store binary value into a matrix(M) in which each binary digit value will insert row wise.
   Matrix will contain difference taken from which nucleotide, difference value and forward or backward difference.
7. Goto next character.
8. Repeat step-3 to 5 upto end of secret string.
9. Construct a grayscale image from M.
10. End.



B. Key generation

Decimal Value of nucleotides (A,C,G,T) is the Key. Values will assign either from addition table (Table-1) or subtraction table(Table-2) .For example if it's coming from addition table then A= ACGT,C=CATG,G=GTAC and T=TGCA. So, corresponding binary value A=00011011,C=01001110,G=10110001 and T=11100100.

Equivalent decimal value A=27,C=78,G=177,T=228.

C. Difference Chart

If key generated from addition table then difference chart as follows

A=27	B=28	C=78	D=79	E=80	F=81	G=177
H=178	I=179	J=180	K=181	L=182	M=183	N=184
O=185	P=186	Q=187	R=188	S=189	T=228	U=229
V=230	W=231	X=232	Y=233	Z=234	Space=235	

D. Difference calculation rule

Rule-1: Difference from a character to next character is 1(Forward difference).

Rule-2: Difference from a character to previous character is 1(Backward difference).

Rule-3: Forward difference can be calculates from Aupto B, from C upto F, from G upto M,

from T upto Z.

Rule-4: Backward difference only calculates from T upto N.

Rule-5: Difference only calculates from nucleotide.

IV. EXAMPLE OF CONVERSION FROM SECRET INFORMATION TO BINARY MATRIX

Secret Information: Six Bomb.

Decimal Value: S=228-189=29, i=179-177=2, x=232-228=4, Space=235-228=7,28-27=1,o=228-185=43,m=183-176=7,b=28-27=1

Matrix will be:

***DTC**= Difference Taken from Colum

***FC**= Forward Colum

***BC**= Backward Colum

DTC		FC	BC	DV					
1	1	0	1	0	1	1	1	0	1
1	0	1	0	0	0	0	0	1	0
1	1	1	0	0	0	0	1	0	0
1	1	1	0	0	0	0	1	1	1
0	0	1	0	0	0	0	0	0	1
1	1	0	1	1	0	1	0	1	1
1	0	1	0	0	0	0	1	1	1
0	0	1	0	0	0	0	0	0	1

***DC**= Difference Value

V. CONCLUSIONS

The steganography is defined as to hide information from unauthorized user. Degree of success of a steganography procedure depends on two factors –First, amount of information hiding, second, rate of distortion of cover image. In this paper propose a unique method of steganography which hidings two secret images with in a cover image. Uniqueness of this method is that hide two secret images without distortion of cover image. DNA microarray and it's hybridization procedure use as a tool for implementation.

REFERENCES

[1]. Moerland, T., "Steganography and Steganalysis", Leiden Institute of Advanced Computing Science,www.liacs.nl/home/ tmoerl/privtech.pdf
[2]. https://en.wikipedia.org/wiki/DNA_sequencing.
[3]. MamtaJuneja, Parvinder S. Sandhu, and EktaWalia, " Application of LSB Based Steganographic Technique for 8-bit Color Images ", World Academy of Science, Engineering
and Technology 50 2009.
[4]. Kuldeep Singh, Komalpreet Kaur," Image Encryption using Chaotic Maps and DNA Addition Operation and Noise Effects on it ",International Journal of Computer Applications (0975 – 8887),Volume 23– No.6, June 2011.

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