International Journal of Engineering Research and Development
e-ISSN : 2278-067X, p-ISSN : 2278-800X, www.ijerd.com
Volume 2, Issue 7 (August 2012), PP. 69-72

Two Stages Data-Image Steganography Using DNA Sequence

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Abstract—In Image steganography Secret massages hide with in an Image where the Secret massage is embedding with in the Cover image. In this paper an attempt has been made to introduce a method in which Secret information is hidden within the Cover image and Cover image is hidden within DNA sequence. In this paper two steps steganography approach are used where Secret information has been hidden in more depth than general steganography approach. Due to approach unauthorized person may consider Cover image as Secret information. This is a great advantage with respected to security. To implement this approach three algorithms have been used one for hiding information and other twos for recovering.

Keywords—DNA, Embedding, Steganography, Cover image, Secret Information, Complement

I. INTRODUCTION

The term Steganography comes form the Greek words stegos (cover) and graphy (write). Therefore steganography literally means covered writing. Steganography unlike cryptography, does not change or scramble the message until it is illegible for an illegitimate receiver, it camouflages the message to occult its existence.[1]

DNA sequence, the information in DNA possess some interesting properties which can be utilized to hide data as a code prepared up of four chemical bases (A,C,G,T) : adenine (A), guanine (G), cytosine (C), and thymine (T). Conventionally, data hiding approaches frequently implant a secret message into the congregation images. However, this could deform the congregation image to some degree, and may therefore; medicinal effectiveness and susceptibility for solving complex, highly comparable computational problems have also been demonstrated. The capability to hide, gloss information, and watermarks within this intermediate is clearly meaningful. The order, or sequence, of these bases determines the information accessible for structuring and preserving an organism, comparable to the technique in which correspondence of the alphabet come into vision in a certain categorize to form sentence and words. DNA bases join up with both together, A with T and C with G, to configure units called base pairs that can promote greatly from a data hiding scheme, and a bit of surroundings in retroviral DNA sequences is required to understand this method. Each base is also closed to a sugar molecule and a phosphate molecule [2].

In this paper an attempt has been made to explore a new method which makes steganography process more secure than in general approach. In our approach secret data covered by more than one object, one is outer cover and other is inner cover. Use DNA complementary rule and magic number sequence to achieve the goal.

In the next section we will discuss about the background of the proposed work. In Section 3, flow diagram of steganography method ;Section 4,Binary representation of nucleotides; Section 5, Details of the hiding algorithm; Section 6, Reverse procedure; Section 7, Example and Section 8, Conclusion.

II. BACKGROUND OF THE PROPOSED WORK

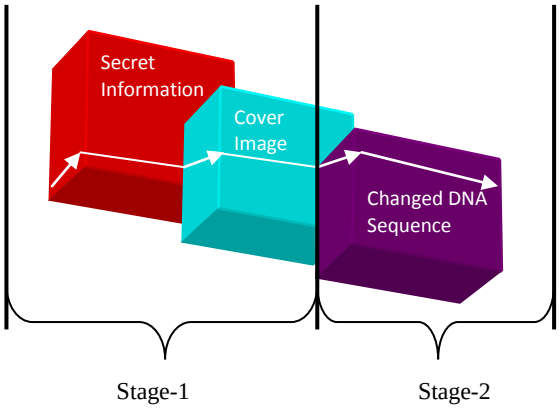
The complimentary DNA sequence means the sequence on the other strand of DNA directly opposite your specified sequence.

There are six major Complementary rules for each letter of DNA sequence. For all letter x, C(x), C(C(x)), C(C(C(x))) is not equal.[3]

1. A→T , T→C , C→G , G→A
2. A→T , T→G , G→C , C→A
3. A→C , C→T , T→G , G→A
4. A→C , C→G , G→T , T→A
5. A→G , G→T , T→C , C→A
6. A→G , G→C , C→T , T→A

We used the **magic number** as the forward tracking algorithm. It is very simple to implement and do what is our purpose. The basic concept of magic number is we select one base value and add nine. If we add the digits of result, it will produce the base value. If n is base f(n) = R, R_n+..+R_2+R_1 = n. If we choose 1 as base the result we as follows:
f(1)=1,1+9=10 (1+0=1), 10+9=19 (1+9=10,1+0=1), 19+9=28 (2+8=10, 1+0=1),…[4]

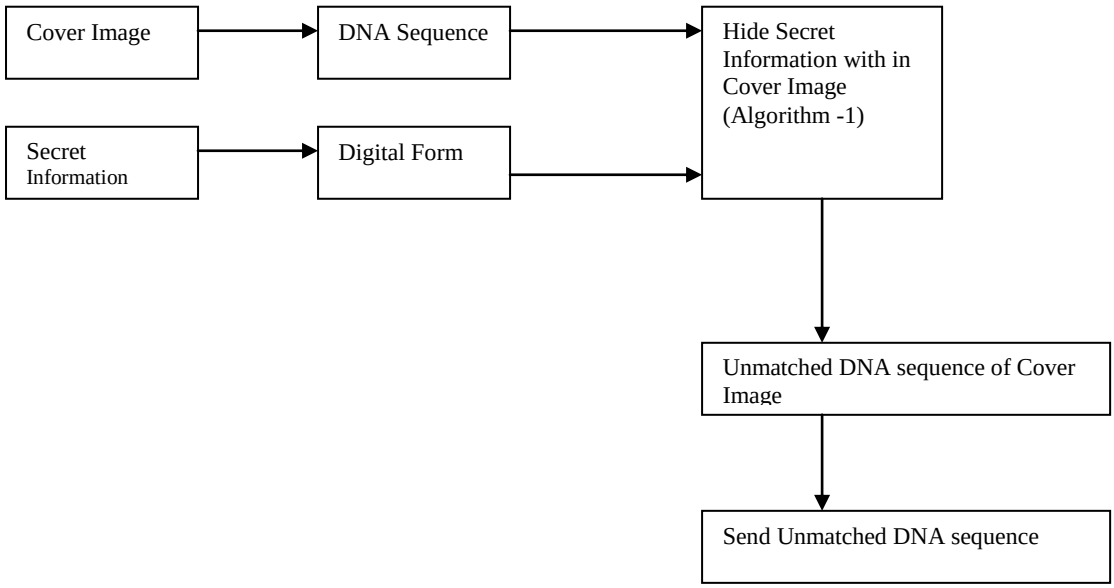
The proposed method can be viewed graphically as follows



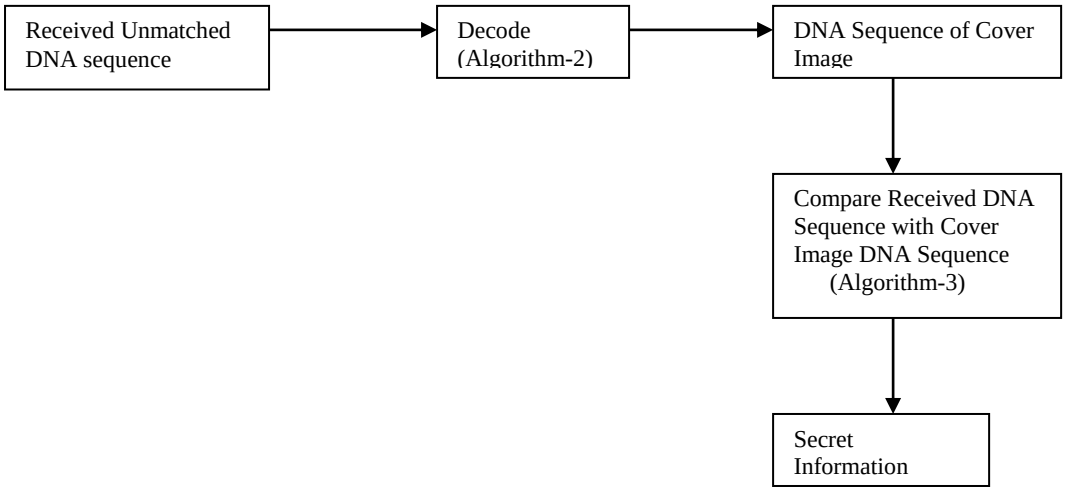
III. STEGANOGRAPHY PROCEDURE

The actual procedure for hiding data at the sender side and receiver side are presented below through block diagrams.

Sender Side (Hiding)



Receiver Side (Recovering)



IV. BINARY REPRESENTATION OF NUCLEOTIDES

Algorithm 1 &2 use two methods to convert nucleotide in binary form –1)using 2 bits , 2)using 3 bits.2 bits encoding use for normal DNA sequence and 3 bits for special purpose .Tabel-1 and Tabel-2 showing 2-bits and 3-bits representation respectively.

Nucleotide	Binary Form
A	00
C	01
G	10
T	11

Tabel-1

Nucleotide	Binary Form
A	000
C	001
G	010
T	011

Tabel-2

V. ALGORITHM

Algorithm-1

This algorithm uses for embedding secret image within cover image. Following postulates for the algorithm-

- DNA sequence length of a Cover image >=Greatest magic number. Length of DNA sequence relates with Length of Secret information bit stream.
- Embed secret image bit stream into DNA sequence of Cover image by magic no. sequence.

Step-1: Take DNA sequence of Cover image.
Step-2: Take Secret information bit stream.
Step-3: Generate magic number (No. of magic number = No. of bits in Secret information bit stream) .
Step-4: Embed Secret information bits with in DNA sequence by DNA sequence Complementary rules, embed position is magic number wise.
If secret bit is 1 then
Use Complementary rule-1 and convert that complementary form in binary 2 bits wise.
(Any of the rule can be use from six rules)
Otherwise
Convert that nucleotide in binary 3 bits wise

Step-5: Changed DNA sequence (S′).
Step-6: End.

Algorithm-2

Step-1: Take received DNA sequence (S′) as input.
Step-2: If (magic number. wise position) and (2 bits representation) Then
Reverse mapping of Complementary rule-1.
Otherwise
No change.
Step-3: Cover image DNA sequence S.
Step-4: End.

Algorithm-3

Step-1: Take S and S′.
Step-2: i=0.
Step-3: Compare S and S′ only magic number wise positions.
Step-4: If C(S) =S′
Secret [i++] =1
Otherwise
Secret [i++] =0
Step-5: Array "Secret" contains bit stream of Secret information.

VI. EXAMPLE

The process is illustrated through the following example.

Sender side

For the above Cover image corresponding DNA sequence is “CTTCCGTGCGATGTA GCCGGTATCTTTGGACAT TGGTATATTTCATGC” which is chosen arbitrarily.

Secret massage 100011

Complementary Rule-1: A→T, T→C, C→G, G→A.

Embedded position magic number wise are- 2, 11, 20, 29, 38, 47(No. of bit in secret massage is 6)

Position :	**2**		**11**		**20**		**29**		**38**		**47**												
S:	C	**T**	T	C	C	G	T	G	C	G	A	**T**	G	T	A	G	C	C	A	T	G	G	A	C	A	T	T	C	A	T	**G**	C
Secret massage :	1		0		0		0		1														
1																							

Changed DNA sequence : C**C**T CCG TGCG**A**T GTA GCCG**G**TATC TTT G **G**ACAT TGG T **T**TATT TC A T **A**C (Complementary Rule-1)

Binary form : 01**01**110101101110011**000**11101100100101**010**1100110111111111**010**000100111110 1011**11**1100 111111010011**00**01

Receiver Side

Changed DNA Sequence : C**C**T CCG TGCG**A**T GTA GCCG**G**TATC TTT G **G**ACAT TGG T **T**TATT TC A T **A**C (01**01**110101101110011**000**11101100100101**010**1100110111111111**010**000100111110 1011**11**1100 111111010011**00**01)

Using Algorithm-2 : CTT CCG TGCGAT GTA GCCGGTATC TTT GGACAT TGG T ATATT TC A T GC

Cover Image DNA Sequence : CTT CCG TGCGAT GTA GCCGGTATC TTT GGACAT TGG T ATATT TC A T GC

Secret Information (Using Algorithm-3) : 1 0 0 0 1 1

VII. CONCLUSION

In this paper two steps steganography approach are used where Secret information has been hidden in more depth than general steganography approach. The procedure for the method is illustrated with example.

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