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ADAPTIVE IMAGE STEGANOGRAPHY USING PIXEL INTENSITY DIFFERENCE

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Abstract— In this digital world the Internet has become so popular and billions of people are using it. On various platform, web applications as well as standalone applications there is a need of Internet. For this purpose various techniques like cryptography, data encryption/decryption, and data hiding algorithms are invented. But use of these techniques was not too secure and hackers easily stole the secret message. To ensure high security of confidential data a new technique was invented known as "Steganography". In this paper we a new a new steganography scheme which is very efficient with respect to data hiding capacity and distortion. The main approach for this algorithm is based on pixel intensity difference.

Index Terms—Cryptography, Steganography, Intensity, hacker

I. INTRODUCTION

Steganography is the process hiding the data into another data that cannot be detected easily through the open eyes. Image Steganography is the part of Steganography in which images are used for hiding the secret data. The Word came from Greek words "stegos". which means "cover" & "grafia" which means "writing" so "Covered Writing" is the meaning of Steganography Though Steganography sense like Cryptography but there is some differences between them which split these two terms Cryptography always concern about keeping the content message secret but Steganography is concern about keeping the message secret.

The terms which are important in Image Steganography are Image Quality after embedding the secret data and ability of the image to keep maximum confidential data as possible. There are so many algorithms and methods available for Image Steganography which gives the best implementation of Image Steganography. These algorithms have very well embedding capacity with minimum distortion compare to original image.

II. HISTORY AND BACKGROUND LITERATURE SURVEY

a) V.Nagaraj, Dr. V. Vijayalakshmi and Dr. G. Zayaraz have proposed [1] experimental work done Color Image Steganography based on Pixel Value Modification Method Using Modulus Function. In this proposed system introduce approach known as Pixel Value Modification (PVM) using modulus function.

Proposed scheme:

Proposed method cover image divided into three color planes (Red, Green, Blue), this scheme use modulus by 3 function. After dividing pixel value we get separate M*N matrix. And pixel embedded into cover image by sequentially manner suppose,

1. 1st red secret pixel embeds into 1st pixel in red of cover image.
2. 1st green secret pixel embeds into 1st pixel in green of cover image.
3. 1st blue secret pixel embeds into 1st pixel in blue of cover image.

Limitation:

1. It only suitable for 24-bit pixel image. Not on gray scale image, because less cover image embedding capacity.
2. It includes high calculation overhead.

b) Weiqi Luo, Fangjun Huang, Jiwu Huang have proposed [2] experimental work done Edge Adaptive Steganography Based on LSB Matching.

Proposed Scheme:

To overcome the limitations of the "Least Significant Bit" Method the new technic for hiding the secret message was proposed known as "Least Significant Bit Matching Revisited". The paper extends the LSB Matching Revisited Scheme and proposes a new idea.

According to the edge adaptive scheme the selection of the region for hiding secret data is based on following two factors:

1. The size of confidential data.
2. The difference between two successive pixels of the cover image.

Based on the smoother area and edges of the cover image, the sharper edge region is used to hide secret data, when embedding capacity of message is low. When the embedding capacity is get increased then additional region is selected for hiding secret data by adjusting some boundary conditions. According to the pseudorandom number generator some minor changes are done in the LSBMR method, if secret bit is not similar as LSB of the main image then one bit is increased or decreased randomly with respect to pixels value. The normal LSBMR approach deal with a single pixel or pair of pixel without examining the difference between pixels or neighbor pixels

Limitation:

1. In the LSB method it is very easy to detect if we try to manipulate the stego-image. The stegoimage will get destroyed if we perform certain operations like compression, scaling, rotation etc.
2. The secret message size is depends on the size of the image this means the message size have to keep smaller than the original image.
3. Low secure and easily identified by the attacker.
4. Message hiding capacity is low.
5. Less secure and poor quality of stego-image with respect to smoother region of an image.

III.HELPFUL HINTS

A. References

i. V. Nagaraja, Dr. V. Vijayalakshamib and Dr. G. Zayaraz [1], "Color Image Steganography based on Pixel Value Modification Method Using Modulus Function" IERI Procedia 4 (2013)17-24.

ii. Naddem Akhtar, Shahbaz Khan and PragatiJohri [2] ,"An Improved Inverted Image Steganography" ICICT 2014.

iii. Weiqi Luo, Fangjun Huang, Jiwu Huang [3] ,"Edge Adaptive Steganography Based on LSB Matching Revisited" IEEE Transactions on Information Forensics and Security Vol. 5,No. 2, JUNE 2010.

iv. R.S.Gutte, Y.D.Chncholkar, R.D. Lahane [4] "Steganography for two and three LSB's using extended substitution algorithm" ICTACT Journal on communication technology, March 2013.

B. Abbreviations and Acronyms

LSB: Least Significant Bit.
TPVM: Tri-Pixel Value Modification
APVM: Adaptive Pixel Value Modification
PVD: Pixel Value Difference
EMD: Exploiting Modification Direction.
LSBMR: Least Significant Ration Matching Revisited.
MSE: Mean Square Error.
PSNR: Peak Signal to Noise Ratio.

C. Equations

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

Where,
m*n = Total no of pixels.
I(i, j) = Prediction values of new image.
K(i, j) = True values of original image.

$$PSNR = 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right) = 20 \cdot \log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right) = 20 \cdot \log_{10}(MAX_I) - 10 \cdot \log_{10}(MSE)$$

Where,
PSNR= Peak Signal to Noise Ratio
Max= Maximum intensity values=255
MSE= Mean Square Error

IV. PROBLEM DEFINATION

i. PROBLEM DECRIPTION

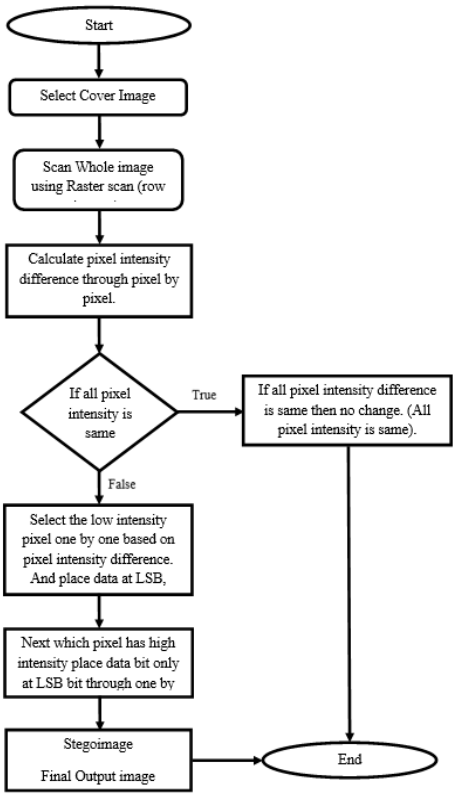
The literature survey on the studied schemes has some limitations with respect to some factors. These factors are manipulation of image, embedding capacity, distortion, calculations. So we proposed a new method to overcome these limitations known as "Adaptive Image Steganography using Pixel Intensity Difference".

ii. PROPOSED SYSTEM AND METHDOLOGY

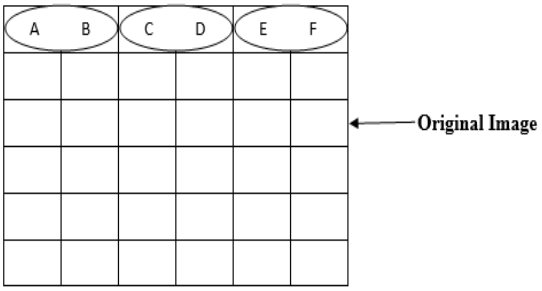
i. ALGORITHEM

1. Select cover image.
2. Scan cover image row by row(Raster scan), Convert cover image into binary format stored into buffer, and calculate pixel intensity difference pixel by pixel.
3. Covert secret data into binary format.
4. If pixel intensity difference is same, no embed secret data into cover image.
5. If pixel intensity difference is different then select low intensity pixel and embed data at LSB-bit, LSB-1 bit. And select contiguous higher intensity pixel embeds data only at LSB bit.
6. If pixel intensity difference is then repeat step 5 until secret data not completely embed.

ii. FLOWCHART



V. RESULT AND DISSCUSSION



The above image is color image in which every pixel represents 24 bits that is
Red: 8 bit
Green: 8 bit
Blue: 8 bit
Binary representation of pixels is as follows

Pixel A: Pixel B:
Ar = 125 = 01111101 Br = 99 = 01100011
Ag = 197 = 11000101 Bg = 97 = 01100001
Ab = 127 = 01111111 Bb = 100 = 01100100

Pixel C: Pixel D:
Cr = 127 = 01111111 Dr = 97 = 01100001
Cg = 127 = 01111111 Dg = 100 = 01100100
Cb = 95 = 01011111 Db = 105 = 01101001

We have to hide secret data "Hi"
Now the conversion of Hi into binary data is
H= 72 =01001000
i = 105= 01101001
According to our proposed algorithm suppose the pixel B having low intensity than pixel A.
So that we are going to embed two bits of secret data at LSB & LSB-1 position in Pixel B. Whether pixel A having high intensity than B we will embed only one bit secret data at LSB position.
Change in bits: Bold
No change: Bold with Underline

Pixel B: Pixel A:
Br = 99 = 01100011 Ar = 124 = 01111100
Bg = 98 = 01100010 Ag = 196 = 11000100
Bb = 101 = 01100101 Ab = 126 = 01111110
Pixel D: Pixel C:
Dr = 99 = 01100011 Cr = 127 = 01111111
Dg = 101 = 01100101 Cg = 127 = 01111111
Db = 104 = 01101000 Cb = 95 = 01011111
Calculation for MSE and PSNR values:
The secret data we used for embed is "Hi I am virus"

Original Pixel Values of color Image

125 197 127	99 97 100	127 127 95	97 100 105	99 105 120	127 155 120
70 80 112	224 220 007	107 108 109	95 95 90	125 118 91	120 99 99
115 165 98	77 74 27	114 120 222	95 95 17	112 124 155	110 108 102
92 92 114	40 40 120	112 112 108	97 97 90	78 78 105	95 95 102

Change pixel value in cover image

124 196 126	99 98 101	127 127 95	99 101 104	96 105 120	126 155 120
71 82 112	225 220 006	106 109 109	94 92 88	125 118 91	126 96 96
114 164 98	71 71 24	114 120 222	91 94 20	112 125 154	110 111 102
92 92 115	43 43 123	113 113 109	96 97 90	78 78 105	95 95 102

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

Where,
m*n = Total no of pixels.
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$$PSNR = 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$
$$= 20 \cdot \log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$
$$= 20 \cdot \log_{10}(MAX_I) - 10 \cdot \log_{10}(MSE)$$

Where,
PSNR= Peak Signal to Noise Ratio
Max= Maximum intensity values=255
MSE= Mean Square Error

The Mean Square Error (MSE) for the proposed algorithm is
MSE= $\frac{1}{24}(\frac{228}{3})=\frac{228}{72}$= 3 db
PSNR= $20\log_{10} 255 - 10\log_{10} 3$
= 20*2.4065 - 10*0.4771
= 48.1308 – 4.7712
PSNR = 43.3596 db

I. FUTURE WORK

The algorithm can be made more secure by changing the encryption technique of data. We can also add new ryptographic algorithm to improve the confidentiality.

II. CONCLUSION

We have designed a new method which overcomes the limitations of the existing schemes. The proposed scheme on color image steganography provides more embedding capacity as well as less distortion of the image.

REFERENCES

[1] V. Nagaraja, Dr. V. Vijayalakshamib and Dr. G. Zayaraz [1], "Color Image Steganography based on Pixel Value Modification Method Using Modulus Function" IERI Procedia 4 (2013)17-24.

[2] Naddem Akhtar, Shahbaz Khan and PragatiJohri [2] ,"An Improved Inverted Image Steganography" ICICT 2014.

[3] Weiqi Luo, Fangjun Huang, Jiwu Huang [3] ,"Edge Adaptive Steganography Based on LSB Matching Revisited" IEEE Transactions on Information Forensics and Security Vol. 5,No. 2, JUNE 2010.

[4] R.S.Gutte, Y.D.Chncholkar, R.D. Lahane [4] "Steganography for two and three LSB's using extended substitution algorithm" ICTACT Journal on communication technology, March 2013