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# Comparison of LSB, MSB and New Hybrid (NHB) of Steganography in Digital Image

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**ABSTRACT**
This paper presents the comparison of LSB, MSB and new Hybrid (NHB) steganography in digital image. LSB steganography embed the secret data in least significant bit of digital image and MSB steganography embed the secret data in most significant bit of digital image. The new Hybrid (NHB) steganography embed the secret data in LSB or MSB. The difference of embedding the data in an image used the LSB, MSB and new Hybrid steganography is shown in this paper. Many different secret data formats (txt, docx, xlsx, pdf) are embed in cover image. The image quality is measured with Mean Square Error (MSE) and Peak Signal Ratio (PSNR).
*Keywords :*— LSB, MSB, new Hybrid, MSE and PSNR.

## I.    INTRODUCTION

The word steganography is a composite of the Greek words steganos, which means "covered," and graphia, which means "writing" [5]. The most important requirement of any steganographic system is that it is impossible for an eavesdropper to distinguish between original image and stego image that contain secret data. This system consists of two basic components: the embedding and extracting. The embedding algorithm concepts have to be given three input; the secret data to be communicated, the secret shared key that controls the embedding and extracting algorithms, the cover object, which will be new to convey the data. The output of the embedding algorithm is called the stego image. When the stego image is presented as an input to the data extracting algorithm, it produces the secret data.

## II.    METHODS OF STEGANOGRAPHY

### A.  LSB Steganography

The least significant bit (LSB) is the lower bit in a series of numbers in binary. The LSB used to embed the secret data in to the least significant bits of the pixel values in a cover image. For example, let consider a 24 bit for jpg image:
Data to be inserted: character 'A': 01000001
3 pixels will be used to store one character of 8 bits.
Embedding 'A'

| Cover Image: | 00100111 | 11101001 | 11001000 |
|---|---|---|---|
|  | 00100111 | 11001000 | 11101001 |
|  | 11001000 | 00100111 | 11101001 |
| LSB Method: | 0010011**0** | 1110100**1** | 1100100**0** |
|  | 0010011**0** | 1100100**0** | 1110100**0** |
|  | 1100100**0** | 0010011**1** | 11101001 |

Extracting 'A'=> 01000001

### B.  MSB Steganography

The most significant bit (MSB) is the highest bit in a series of numbers in binary. The MSB used to embed the secret data in to the most significant bits of the pixel values in a cover image. For example, we consider a 24 bit for jpg image:
Data to be inserted: character 'A': 01000001
3 pixels will be used to store one character of 8 bits.
Embedding 'A'

| Cover Image: | 00100111 | 11101001 | 11001000 |
|---|---|---|---|
|  | 00100111 | 11001000 | 11101001 |
|  | 11001000 | 00100111 | 11101001 |
| MSB Method: | **0**0100111 | **1**1101001 | **0**1001000 |
|  | **0**0100111 | **0**1001000 | **0**1101001 |
|  | **0**1001000 | **1**0100111 | 11101001 |

Extracting 'A'=> 01000001

### C.  NHB Steganography

The new hybrid (NHB) that embeds secret text if the value MSB of cover image is the identical to the value MSB of secret data, it insert the last 2 bit of each byte at cover image '00'. If the value MSB of cover image is not identical the value MSB of secret data, it insert the last 2 bit of each byte at cover image '01'or '10'. For example, let consider a 24 bit for jpg image:
Data to be inserted: character 'A': 01000001
3 pixels will be used to store one character of 8 bits.
Embedding 'A'

| Cover Image: | 00100111 | 11101001 | 11001000 |
|---|---|---|---|
|  | 00100111 | 11001000 | 11101001 |
|  | 11001000 | 00100111 | 11101001 |
| New Hybrid Method: | 001001**00** | 111010**00** | 110010**10** |
|  | 001001**00** | 110010**10** | 111010**10** |
|  | 110010**10** | 001001**01** | 11101001 |

Extracting 'A'=> 01000001

## III.    COMPARISON METHODS

### A.  Mean Square Error

The mean square error (MSE) is defined to use measure the distortion of the image that is the different of error between the original image and stego image [2]. The value of MSE is

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small the image quality is good. The MSE between two images: I₁(M, N) and I₂(M, N)

$$MSE = \frac{[I_1(M,N) - I_2(M,N)]^2}{M*N}$$

### B. Peak Signal to Noise Ratio

The peak signal to noise ratio is used to compare image compression quality of original image and stego image [9]. Generally if PSNR is 40dB or greater, the original and the reconstructed images are virtually in distinguishable by human observers.

$$PSNR = 10\log_{10}\frac{(255)^2}{MSE}$$

## IV. EXPERIMENTAL RESULTS

We tested the system using different secret text format (txt, docx, pdf) in cover image. A pepper.jpg with dimension (300x300) pixels and file size of 47.1 kilo byte was used as the cover image. A 25 kilo byte text file was also used secret message.



Original image (300x300)　　　　Stego image
MSE = 0.37, PSNR = 52.48
Fig.1(a) pepper.jpg hiding txt file using LSB



Original image (300x300)　　　　Stego image
MSE = 5962.14, PSNR = 10.38
Fig.1(b) pepper.jpg hiding txt file using MSB



Original image (300x300)　　　　Stego image
MSE = 1.83, PSNR = 42.50
Fig.1(c) pepper.jpg hiding txt file using NHB

A rose.jpg with dimension (560x448) pixels and file size of 85.6 kilo byte was used as the cover image. A 41 kilo byte docx file was also used secret message.



Original image (560x448)　　　　Stego image
MSE = 0.22, PSNR = 54.71
Fig.2 (a) rose.jpg hiding docx file using LSB



Original image (560x448)　　　　Stego image
MSE = 3595.93, PSNR = 12.57
Fig.2(b) rose.jpg hiding docx file using MSB



Original image (560x448)　　　　Stego image
MSE = 1.10, PSNR = 47.70
Fig.2(c) rose.jpg hiding docx file using NHB

A graffie.jpg with dimension (750x1125) pixels and file size of 92.2 kilo byte was used as the cover image. A 78 kilo byte pdf file was also used secret message.

Original image (750x1125)          Stego image
MSE = 0.13, PSNR = 57.12
Fig.3 (a) graffie.jpg hiding pdf file using LSB
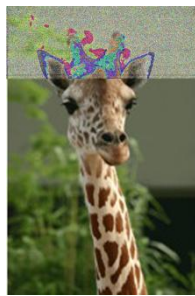


Original image (750x1125)          Stego image
MSE = 2037.02, PSNR = 15.04
Fig.3 (b) graffie.jpg hiding pdf file using MSB



Original image (750x1125)          Stego image
MSE = 0.63, PSNR = 50.11
Fig.3 (c) graffie.jpg hiding pdf file using NHB

An innlay.jpg with dimension (1024x683) pixels and file size of 304 kilo byte was used as the cover image. A 62 kilo byte xlsx file was also used secret message.



Original image (1024x683)          Stego image
MSE = 0.12, PSNR = 57.34
Fig.4 (a) innlay.jpg hiding xlsx file using LSB



Original image (1024x683)          Stego image
MSE = 1931.82, PSNR = 15.27
Fig.4 (b) innlay.jpg hiding xlsx file using MSB



Original image (1024x683)          Stego image
MSE = 0.61, PSNR = 50.31
Fig.4 (c) innlay.jpg hiding xlsx file using NHB

TABLE 1. RESULT OF STEGO IMAGE FOR LSB, MSB, NHB

| SN | Cover Image | | Secret Data Type | Algo: | Experimental Results | | |
|----|-------------|-----------|------|-------|------|------|----------|
| | Dimension | File size | | | MSE | PSNR | Security |
| 1 | Pepper.jpg (300x300) | 47.1 KB | txt: 25 KB | LSB | 0.37 | 52.48 | weak |
| | | | | MSB | 5962.14 | 10.38 | weak |
| | | | | NHB | 1.83 | 42.50 | strong |
| 2 | Rose.jpg (560x448) | 85.6 KB | docx: 41 KB | LSB | 0.22 | 54.71 | weak |
| | | | | MSB | 3595.93 | 12.57 | weak |
| | | | | NHB | 1.10 | 47.70 | strong |
| 3 | Graffie.jpg (750x1125) | 92.2 KB | pdf: 78 KB | LSB | 0.13 | 57.12 | weak |
| | | | | MSB | 2037.02 | 15.04 | weak |
| | | | | NHB | 0.63 | 50.11 | strong |
| 4 | Innlay.jpg (1024x683) | 304 KB | xlsx: 62 KB | LSB | 0.12 | 57.34 | weak |
| | | | | MSB | 1932.82 | 15.27 | weak |
| | | | | NHB | 0.61 | 50.31 | strong |

## V.    CONCLUSIONS

This paper compares the result of LSB, MSB and new Hybrid (NHB) by calculation MSE and PSNR. LSB algorithm gives better performance than other two algorithms. However, NHB algorithm's image quality is approximately as good as the stego image quality of LSB algorithm. But NHB algorithm's image quality is better than MSB algorithm's. As the value of PSNR is more than 40dB and this of MSE is lower, the image quality of NHB is better. Moreover, NHB algorithm gives better security because it is more complex than other two algorithms. LSB and MSB algorithm are so easy to decode that its security is weak. As complex algorithm (NHB) complicates to decode itself, its security is strong. In the future work, it should be experimented that audio and video will be able to embed into the cover image with this NHB algorithm. It is better to be upgraded the new hybrid (NHB) algorithm to get superior image quality and security.

## REFERENCES

[1]    Arun Kumar Singh, Juhi Singh, Dr. Harsh Vikram Singh, "Steganography in Images Using LSB Technique", *International Journal of Latest Trends in*

*Engineering and Technology (IJLTET),* Vol. 5 Issue 1 January 2015, ISSN: 2278-621X

[2] Solomon O.Akinola and Adebanke A.Olatidoye, "On the Image Quality and Encoding Times of LSB, MSB and combined LSB-MSB Steganography algorithms using digital images", *International Journal of Computer Science & Information Technology (IJCSIT)* Vol 7, No 4, August 2015

[3] L.Baby Victoria, Dr.S.Sathappan, "A Study on Spatial Domain and Transform Domain Steganography Techniques used in Image Hiding**",** *International Journal Of Innovative Technology And Creative Engineering* (issn:2045-8711) Vol.5 no.5 May 2015

[4] Deepika [1], Dr. Sanjay Kumar [2], "Image Based Steganography Using LSB Method and Java Based Encryption", *International Journal of Engineering Trends and Applications (IJETA)* – Volume 2 Issue 5, Sep-Oct 2015

[5] Anil Khurana, B.Mohit Mehta, "Comparison of LSB and MSB based Image Steganography", *International Journal of Computer Science and Technology (IJCST)* Vol.3, Issue 3, July-Sept 2012

[6] Mr. Gaurav**, "**A New Method for Image Steganography Using LSB and MSB**",** International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 2, Issue 4, December 2015, pp. 169-174

[7] Mr. Falesh M. Shelke1, Miss. Ashwini A. Dongre2, Mr. Pravin D. Soni3, **"**Comparison of different techniques for Steganography in images", *International Journal of Application or Innovation in Engineering & Management (IJAIEM),* Volume 3, Issue 2, February 2014

[8] Deepesh Rawat, Vijaya Bhandari, "Steganography Technique for Hiding Text Information in Color Image using Improved LSB Method", *International Journal of Computer Applications (0975 – 8887)* Volume 67–No.1, April 2013

[9] Kanika Anand, Rekha Sharma, "Data Security Using LSB & MSB Image Steganography", International Journal of Electrical & Electronics Engineering (IJEEE), Vol.1, Issue 6, December, 2014

[10] Padmini $K_1$ and Champakamala B $S_2$, "Image Hiding using Least Significant Bit Algorithm Steganography", *Proc. of Int. Conf. on Current Trends in Eng., Science and Technology,* ICCTEST, Grenze ID: 02.ICCTEST.2017.1.111

[11] H. B. Kekre, Dhirendra Mishra, Rhea Khanna, Sakshi, "Comparison between the basic LSB Replacement Technique and Increased Capacity of Information Hiding in LSB's Method for Images", *International Journal of Computer Applications (0975–8887)* Volume 45–No.1, May 2012

[12] Rohit Garg and Tarun Gulati. "Comparison of LSB & MSB Based Steganography in Gray-Scale Images", *International Journal of Engineering Research & Technology (IJERT)*, Vol. 1, Issue 8, 2012