Volume 5, Issue 6, June 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

# Image Self Embedding and Watermarking using Least Significant Bit

Bali Sharma, S. V. Pandit
Department of CSE
IES College Bhopal, M.P., India

***Abstract— Digital information sharing is not a big task in this era, as the number of internet users are increasing day by day. This sharing of data is done only by providing secure network, but this is not possible due to some packet loss. For overcoming this problem different researcher work by using various approach. This paper put information in the packet which will help the receiver to re-construct it again. This approach is strengthening by embedding watermark information in the data using LSB. Such combination of robust embedding and reconstruction method is implementing in this work. Results show that proposed work is better as compare to previous at different evaluation parameter.***

***Index Terms— Digital Watermarking, Image segmentation, LSB, Self Embedding.***

## I. INTRODUCTION

As the number of internet users are increasing day by day transferring of data get fast. Different software and hardware help in this work such as mobiles, camera, etc. This raise to one new problem of harming the proprietorship. So privacy of the individual get lo easily, where most of images get pirates very easily. In order to handle this problem it is required to provide watermark the image. As watermarking is broadly divide into two category first is visible and other is invisible in case of video data visible watermark is satisfactory such as shown in fig. 1 and 2 where fig.1 is for image watermarking while fig. 2 for video watermarking [1]. One of the live example of video watermarking is television where each channel has its own logo on right or left top of the frame. It is obtain from the figure that digital visible watermark is not fruitful in all kind of images, such as in paintings, scenery, etc. So other possibility of watermarking is invisible watermark where watermark information is present in data but it is not seen by naked eyes. So work on this type of watermarking is done in this paper.

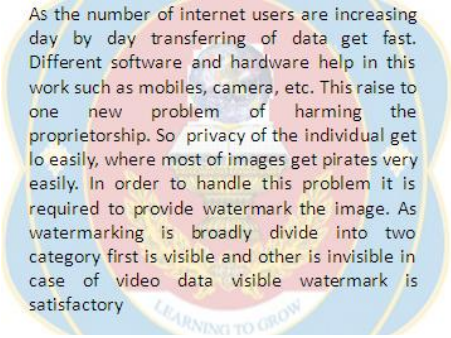


Fig. 1 Example of visible watermark in digital page.

Fig. 2 Example of visible watermark in video.

Most of watermark technique is divide into frequency based and other is spatial based both technique has its own advantage and disadvantages. Our work is based on LSB technique which is spatial techniqy=ue for invisible watermarking. Basic approach of the work is develop technique that not only identify the watermark but also regenerate watermark from the rest.

 

## II. RELATED WORK

In [7], reconstruction of image is done by inverse halftoning with dithered binary version. With the modification in image after embedding watermark act as noise, so restoration of image is not possible.
In [4] DCT technique is use where scatter image blocks is implemented with random Gaussian matrix. Here separate reference information for single block. So whole bit stream is scattered on image. In reverse process of content reconstruction coefficient with in each group is recovered.
In [11] fifth order MSB is used for information collection. Here two different approach is applied first is constant fidelity and other is flexible rotation. With the new approach of pyramidal decomposition of image blocks is done. At last reconstruction of information is done from different scattered binary matrices.
In [6] different fidelity level is use for image reconstruction, One drawback in this paper is that image quality of image get increase by controlling reconstruction of image individually.
In [8] information spreading is done by LT code method on image. Here image fragmentation quality reduce the image reconstruction techniques.
An individual image block is represented with one of multiple defined reference rates, depending on the amount of texture. The primary objective is to improve the reconstruction quality
with simultaneous reduction of the reference payload. In [9], one of the defined rates is null, and its corresponding blocks are recovered with the use of in painting.
In [10] Content adaptively method has adopted, although whole contents of image is not exploit by work proposed in [10], because of erasure channel in traditional bounds.

## III. PROPOSED WORK

This work focus on image quality during transfer of image, and image watermarking for proprietorship. For packet loss recovery fractal codes of the image blocks are done after embedding of image using Least Significant Bit technique.
Reverse process is done at receiver end where fractal codes obtain at receiver end is convert into original image then extraction of watermark is done. Whole work is shown in block diagram of figure 3.
Embedding:

**Read Carrier Image:**

Here as the image is the collection of pixels where each pixel is representing a number that is reflecting a number over there now for each number depend on the format it has its range such that for the gray scale format it is in the range of 0-255. So read a image means making a matrix of the same dimension of the image then fill the matrix correspond to the pixel value of the image at the cell in the matrix.

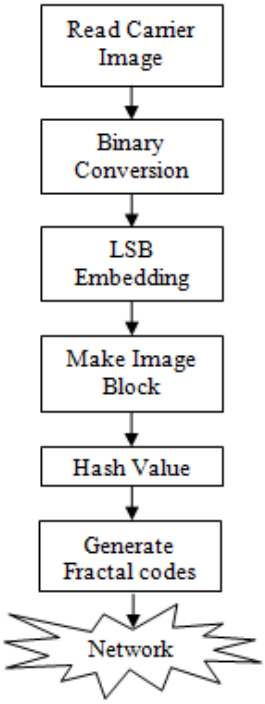


Fig. 3 Block Diagram of Proposed work at sender end.

Binary Conversion
Now convert pixel values in binary form, this is required for the watermarking. As LSB technique is use so pixel value representation should be binary instead of decimal.
LSB Embedding
In this step watermark information which is binary form is replace by least significant bit of the pixel value at edge position. So pixels presenting edge is use for information hiding.

 

LSB Embedding

In this step embedding message is read for file and generate corresponding ASCII value. Now each value is convert to its equivalent binary number. As ASCII value range between 0-255 so single character representation is done by 8 bits. Each pixel LSB bits are replace by these ASCII bits. In this way embedding of message is done in the original image.

Make Image Block:

Here image is divide into same size of blocks where size may be any such as 3X3 in this case 3 means number of pixel in the row and column so a 3X3 block contain total 9 pixel in that block. In order to make the block exact first it is required to Resize the image so that blocks may get divide the image into fix size.

Generate Fractal Code

Different combination for block of image are pass into function in eq. 1 where n represent number of blocks to send in network, while m represent number of image block. Selection of block is depend on the matrix. Let us consider an image is divide into 60 blocks, then for each six block eight block are generate by fractal code.

$$X = \begin{bmatrix} 10100001 \\ 01100100 \\ 00100101 \\ 10010001 \\ 11001000 \\ 00100110 \\ 01001010 \\ 00010001 \end{bmatrix}$$

$$F_n = XOR(B_m, X_{n,m}, F_n) ----Eq.1$$

Loop 1:n

Loop 1:m

Fn = XOR(Bm, Xn,m, Fn) // Initially Fn=0

EndLoop

EndLoop

Obtained fractal codes are send in network. It has been observed that for every six block of image corresponding eight block is generate by different combination of blocks using selection matrix X.

Receiver end work is shown in fig. 4 where reverse process is done.

Hash Value Checking

In this step blocks obtain from the network may get corrupt to check this hash value is generate from the block and check if this get corrupt then attach bits in fractal block is not same otherwise safe fractal block is receive.

Reconstruct Fractal Blocks

This step is for those fractal blocks whose hash value is same. So uninfected blocks are pass as per the inverse matrix of the selection matrix X. This give ouput of blocks which are same as done at sender end. So if few blocks get corrupt then due to presence of fractal codes image can be reconstruct at receiver end.

LSB Extraction

As proprietorship of image is base on the is validate by watermark so watermark is extract from the image. Here LBB bits present of the edge pixels are extract for watermark construction. For edge detection canny algorithm is use.

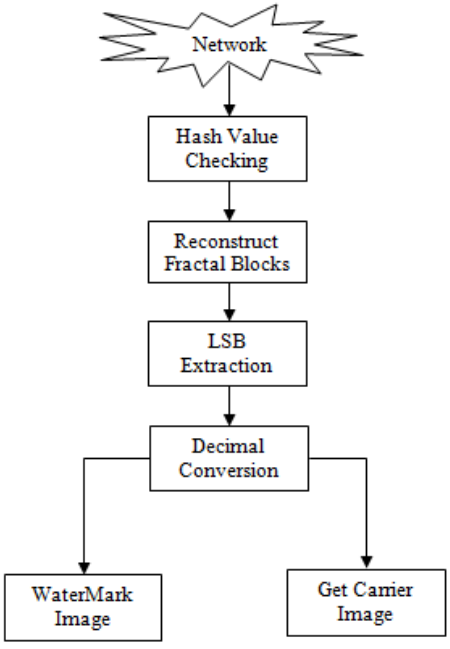


Fig. 4 Block Diagram of Proposed work at sender end.

 

Proposed Sender Algorithm

Input : O, W

OutPut: EI

1. Edges←canny(O)
2. Loop n = 1:W
3. ASCII ←M(n)
4. EndLoop
5. key = Modulus(Edges, M)
6. Loop n=1:W*2
7. Temp←Binary(Edges(count))
8. Temp(LSB)←ASCII(n) // LSB = last four bit
9. Edges(count)←Decimal(Temp)
10. Count = Count +1
11. EndLoop
12. B[m]←Block(Edges)
13. H[m] ←Hash_value(B[m])
14. F[n]←Fractal_Code(H, m)

Proposed Receiver Algorithm

Input : F[n]

OutPut: O, W

1. Loop 1:n
2. If Hash_check( F[n] ) == True
3. B[m]←Fractal_Reconstruct(F, n)
4. EndLoop
5. Block_Image ←Combine_Block(B, m)
6. Edges←canny(Block_Image)
7. Hash_pos = Modulus(Hash_key)
8. Loop n=1: Hash_pos
9. Temp←Binary(Edges(Hash_pos(n)))
10. ASCII(n) ←Temp(LSB) // LSB = last four bit
11. EndLoop
12. M ←Char(ASCII)

## III. EXPERIMENT AND RESULT

Experiment Setup

Hardware and Software

The tests were performed on an 2.27 GHz Intel Core i3 machine, equipped with 4 GB of RAM, and running under Windows 7 Professional. MATLAB 2012a is the tool use for the implementation of this work. It is use because of its rich library which have many inbuilt function that can be directly use in this work for different purpose. Out of different function few are intersection, comparing of the string, etc.

Dataset

Here for the experiment different images are use at the initial level but as the standard images for watermarking are use such of lena.jpg 256X256, modrila 512X512, few of random images of Tajmahal.jpg 225X225 dimension.

Evaluation parameter

Peak Signal to Noise Ratio

It is use to find the amount of data present from the received signal as it may corrupt by the presence of some noise. So it is term as the peak signal to noise ratio. The ratio between the maximum possible data and the noise that affects the fidelity of its representation.

$$\text{PSNR} = 10\log_{10}\left(\frac{Max\_pixel\_value}{Mean\_Square\_error}\right)$$

Structural Similarity index

SSIM term is a method for finding the similarity between two images. The SSIM method use for evaluating the image quality based on an initial uncompressed or distortion-free image as reference. It is introduce to improve the traditional schemes like PSNR and MSE, which have proven to be inconsistent with human eye perception.

Extraction Rate

The extraction rate $\eta$ is defined as follows:

$$\eta = \frac{n_c}{n_a} \times 100$$

where *nc* is the number of correctly extracted bits, and *na* is the total number of embedded bits.

Results

 

Table. 1 Filter attack on previous Self Embedding method [2] method.

| PREVIOUS [2] FILTER ATTACK | | |
|---|---|---|
| Obama | SNR | PSNR |
| Obama | 36.1613 | 24.1106 |
| Lena | 36.131 | 24.0728 |
| Mandrila | 36.1432 | 24.085 |

Table. 2 Filter attack on previous Proposed Work [2] method.

| PROPOSED WORK FILTER ATTACK | | |
|---|---|---|
| Images | SNR | PSNR |
| Obama | 36.6978 | 24.6471 |
| Lena | 36.5496 | 24.4914 |
| Mandrila | 36.5238 | 24.4656 |

From above table 1 and 2 it is obtain that three images are chosen for testing, in presence of filter attack. It is observed that proposed work is better as compare to the Self Embedding method in [2]. As in proposed work watermark information is add in the image separately.

Table. 3 Noise attack on previous Self Embedding method [2] method.

| PREVIOUS [2] NOISE ATTACK | | |
|---|---|---|
| Images | SNR | PSNR |
| Obama | 36.742 | 24.6913 |
| Lena | 36.562 | 24.5038 |
| Mandrila | 36.5199 | 24.4617 |

Table. 4 Noise attack on previous Proposed Work [2] method.

| PROPOSED WORK NOISE ATTACK | | |
|---|---|---|
| Images | SNR | PSNR |
| Obama | 36.7355 | 24.6848 |
| Lena | 36.5425 | 24.4843 |
| Mandrila | 36.5444 | 24.4862 |

From above table 3 and 4 it is obtain that three images are chosen for testing, in presence of filter attack. It is observed that proposed work is approximately same as compare to the Self Embedding method in [2]. As in proposed work watermark information is add in the image separately.

Table. 9 SSIM Value of watermark information after attack on previous Proposed Work [2] method.

| PROPOSED WORK SSIM | | |
|---|---|---|
| Images | NOISE | FILTER |
| Obama | 57.9545 | 64.7727 |
| Lena | 69.3182 | 60.2273 |
| Mandrila | 64.7727 | 63.6364 |

From above table 5 it is obtain that SSIM values of the information received has 69 percentage of recovery in presence of noise attack. While SSIM values of the information received has 64 percentage of recovery in presence of filter attack.

## VIII. CONCLUSION

In this paper a new approach of watermarking is studied in detail. Based on human perception view, watermarking process is classified into two broad categories so here it make a invisible watermarking technique. Results shows that the proposed work is producing the results which maintain the image quality as well as robustness against the various attacks. Watermark obtain from the extraction method is having 69% of originality which is quit impressive results for all the researchers. This combinational approach of self reconstruction and watermarking tends to solve two purpose of the system. In future one can embed video using same approach for saving resource utilization.

 

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