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CREATIVE ASSESSMENT PROJECT

On

"DIGITAL IMAGE WATERMARKING USING MATLAB"

BY

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ABSTRACT

Information security is one among the top-level issues that have been addressed since a decade and intensively focused on nowadays. There are numerous techniques available for image and data security, watermarking is one of them.

Digital Watermarking is a technique used to hide data or identifying information within the digital multimedia. Digital Watermarking is becoming popular, especially for adding undetectable identifying marks, such as author or copyright information. The digital watermarking process embeds a signal into the media without significantly degrading its visual qualities. It is different from the encryption in the sense that it allows the users to access, view and interpret the signal but protect the ownership of the content. Digital watermarks are inside the information so that ownership of information cannot be claimed. Some watermarks are visible, most are invisible. In this report we focus on least significant bit (LSB) techniques in spatial domain to perform digital water marking of images.

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INTRODUCTION

Digital Image Processing is the use of computer algorithms to perform image processing on digital images. As a sub category or field of digital signal processing, it has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the built-up of noise and signal distortion during processing.

History

The term "Digital Watermark" was coined by Andrew Tirkel and Charles Osborne in December 1992. The first successful embedding and extraction of a steganographic spread spectrum watermark was demonstrated in 1993 by Andrew Tirkel, Charles Osborne and Gerard Rankin.

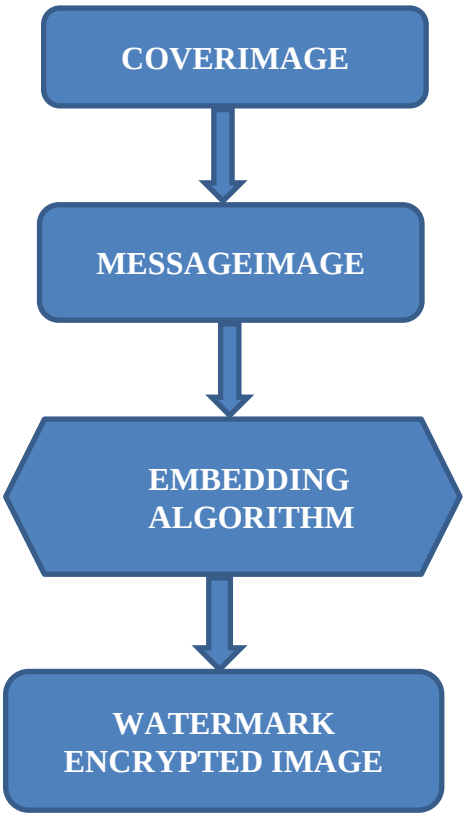
Watermarks are identification marks produced during the paper making process. The first watermarks appeared in Italy during the 13th century, but their use rapidly spread across Europe. They were used as a means to identify the paper maker or the trade guild that manufactured the paper. The marks often were created by a wire sewn onto the paper mold. Watermarks continue to be used today as manufacturer's marks and to prevent forgery.

The fragile watermarking based on spatial domain

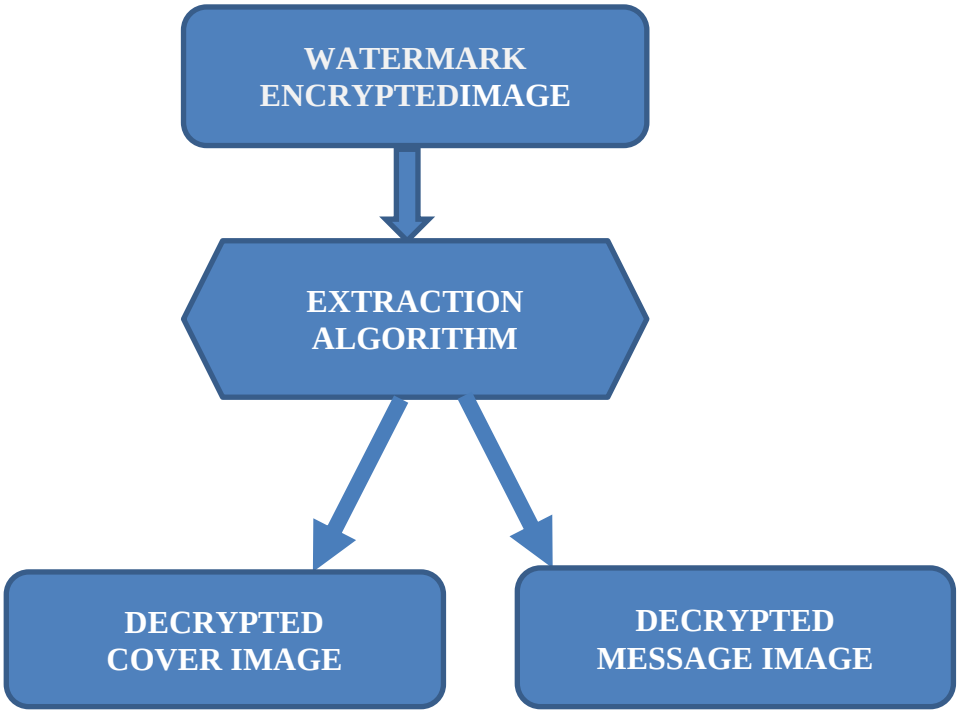
The fragile watermarking algorithm based on spatial domain usually loads the watermark information on original data directly by modifying the pixel value of the image. The most representative one is least significant bit (LSB) method, which modify the minimum valid bit of image pixel value to achieve the purpose of embedding watermark information into the host image. Once the image has been tampered with, the information of the minimum valid bit is also changed, so that we can locate the tampered area through the corresponding detection program.

FLOW CHART

EMBEDDING OF WATERMARK INTO AN IMAGE



EXTRACTION OF WATERMARK



ALGORITHM

For Embedding and Extraction of Images:

Step 1: Take an original image.

Step 2: Take a watermark image.

Step 3: LSB of original image is set to zero.

Step 4: MSB of watermark is extracted.

Step 5: MSB of watermark is inserted into LSB of original image.

Step 6: Display the original image and watermarked image.

Step 7: To get the watermark at different positions use flipud () and rot90() MATLAB functions.

Step 8: To get the watermark at the entire plane of original image use bitset () and bitget () MATLAB functions.

HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE CONFIGURATION:

Processor: Intel(R) Core (TM) i5 CPU M460 @2.53GHz

Installed RAM: 4.00GB (3.80 GB usable)

System type: 64-bit operating system x64- based processor

SOFTWARE CONFIGURATION:

Operating System: Windows 10

Languages used: MATLAB

Version used: R2014a(8.3.0.532)

THE ADVANTAGES OF MATLAB OVER OTHER PROGRAMMING LANGUAGES FOR IMAGE PROCESSING

1. A very large database of built-in algorithms for image processing and computer vision applications.
2. MATLAB allows you to test algorithms immediately without recompilation. You can type something at the command line or execute a section in the editor and immediately see the results, greatly facilitating algorithm development.
3. The MATLAB desktop environment, which allows you to work interactively with your data, helps you to keep track of files and variables, and simplifies common programming/ debugging tasks.
4. Clearly written documentation with many examples, as well as online resources such as webinars.
5. The ability to process both still images and videos.
6. A large user community with lots of free code and knowledge sharing.
7. Bi-annual updates with new algorithms, features and performance enhancements.

MATLAB CODE

Embedding and Extraction of Watermark in LSB bit plane:

```
%Embedding of watermark

a=imread ('cameraman.tif'); %read cover image
b=rgb2gray (imread ('copyright.png')); %read the watermark
[m, n] =size(a); %read the size of image ‘a’ to matrix [m, n]
bresize=imresize (b, [m, n]); %resize the watermark same as cover image
w_bw=im2bw (bresize); %convert the watermark to black and white image
iw=bitset (a,3, w_bw); %set the LSB of cover image with water mark image
figure(1);
subplot (2,2,1); imshow(a); title ('the original img');
subplot (2,2,2); imshow(b); title ('the watermark img');
subplot (2,2,3); imshow(w_bw); title ('the black and white img');
subplot (2,2,4); imshow(iw); title ('the watermarked img');
imwrite (iw,'watermarkimage.jpg','jpg');

%Extraction of watermark

d=imread('watermarkimage.jpg'); %read the watermark image
[m1, n1] =size(iw); %read the size of iw to matrix
watermark=bitget(iw,3); %extract the watermark from the LSB
watermark=2*double(watermark); %scale the recovered watermark image
figure (2);
subplot (1,2,1); imshow(d); title ('the watermarked image');
subplot (1,2,2); imshow(watermark); title ('the watermark ');
```

Embedding of Watermark at left up position:

```
%embedding of watermark
clc;
close all;
a=imread('cameraman.tif');
figure; imshow(a); title ('base image');
b=imresize(rgb2gray(imread('copyright.png')),[32,32]);
figure; imshow(b); title('markimage');
[m1 n1] =size(b);
i1=1;
j1=1;
 [m, n] =size(a);
 c=a;
forff=1;
for i=1:32,
      p=1;
for j=j1:j1+n1-1,
d (i, j) =bitxor (a (i, j),254);
temp=bitxor (b (i, p),2^(ff-1));
temp=temp/(2^(ff-1));
c (i, j) =bitand (a (i, j), temp);
       p=p+1;
end
end
   j1=j1+32;
end
figure; imshow(c); title ('marked image');
imwrite(c,'lftbtm.tif','tif');
```

Embedding of watermark at left bottom position:

```
%embedding of watermark
a=imread('cameraman.tif');
figure; imshow(a); title ('base image');
b=imresize(rgb2gray(imread('copyright.png')), [32,32]);
figure; imshow(b); title ('mark image');
[m1 n1] =size(b);
i1=1;
j1=1;
d=flipud(a)
[m, n] =size(a);

c=d;
forff=1;
for i=1:32,
jjj=1;
for j=j1: j1+n1-1,
d (i, j) =bitxor (d (i, j),254);
temp=bitxor (b (i, jjj),2^(ff-1));
temp=temp/(2^(ff-1));
c (i, j) =bitand (d (i, j), temp);
jjj=jjj+1;
end
end
  j1=j1+32;
end
e=flipud(c);
figure; imshow(e); title ('marked image');
```

Embedding of watermark at right up position:

```
%embedding of watermark
a=imread('cameraman.tif');
figure; imshow(a); title ('base image');
b=imresize(rgb2gray(imread('cat.jpg')), [32,32]);
figure; imshow(b); title('markimage');
[m1 n1] =size(b);
i1=1;
j1=1;
[m, n] =size(a);
d=rot90(a,5)
v=rot90(b,5)
 c=d;
forff=1;
for i=1:32,
jjj=1;
for j=j1: j1+n1-1,
d (i, j) =bitand (d (i, j),254);
temp=bitxor (v (i, jjj),2^(ff-1));
temp=temp/(2^(ff-1));
d (i, j) =bitand (d (i, j), temp);
jjj=jjj+1;
end
end
  j1=j1+32;
end
e=rot90(d,7);
figure; imshow(e); title ('marked image');
```

Embedding of watermark at right bottom position:

```
%embedding of watermark
a=imread('cameraman.tif');
figure; imshow(a); title ('base image');
b=imresize(rgb2gray(imread('copyright.png')),[32,32]);
figure; imshow(b); title('markimage');
[m1 n1] =size(b);
i1=1;
j1=1;
d=rot90(a,2)
v=rot90(b,2)
c=d;
forff=1;
for i=1:32,
jjj=1;
for j=j1: j1+n1-1,
d (i, j) =bitxor (d (i, j),254);
temp=bitxor (v (i, jjj),2^(ff-1));
temp=temp/(2^(ff-1));
c (i, j) =bitand (d (i, j), temp);
jjj=jjj+1;
end
end
  j1=j1+32;
end
e=rot90(c,2); figure; imshow(e); title ('marked image');
```

EXPLANATION OF CODES

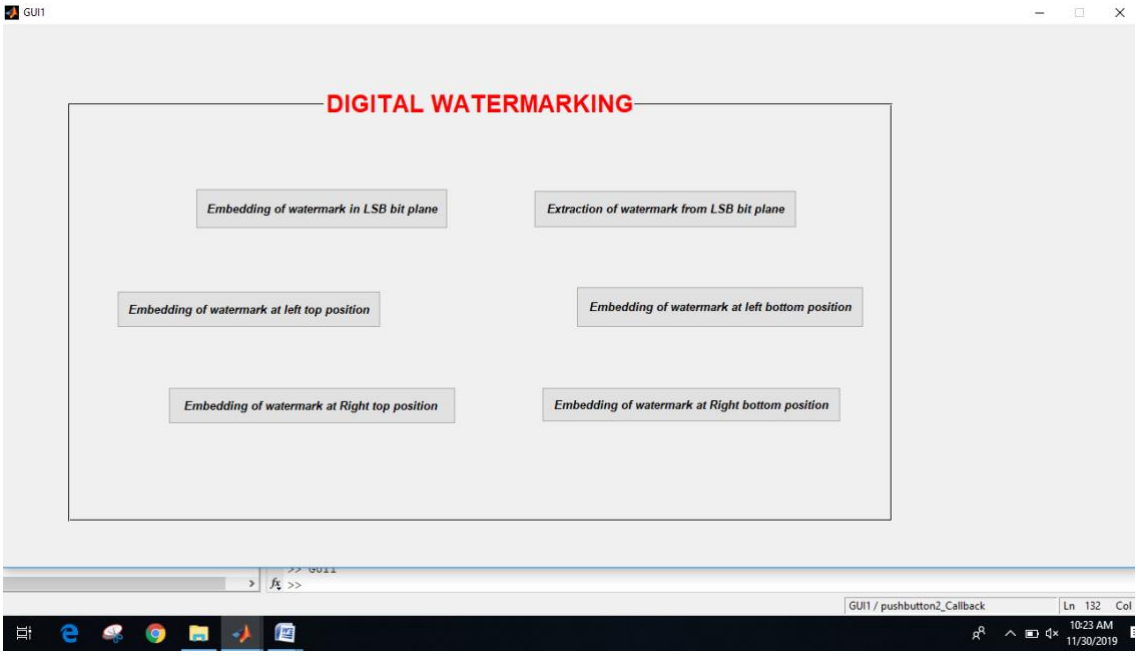
A simple GUI is built for watermarking the original images using MATLAB.
The method used for image watermarking is LSB (Least Significant Bit) method of digital watermarking.

Let us consider a cover image (original image) where we have to embed the watermark. Both cover image and watermark image are converted to RGB to Gray scale images. Resize the watermark image to 1/8 size of original image (i.e. (1/8) *256=32). Store both watermark and cover image into separate matrix. Initialize the first pixel of the cover image to zero. LSB of each pixel of cover image is set to '0' by bit and with 254.Shift the Most Significant Bits (MSB) to the Low Significant Bit (LSB) position of watermark image. LSB of watermark is inserted into the LSB of the cover image by adding the two images. Display the watermarked image along with the images of original image and watermark.

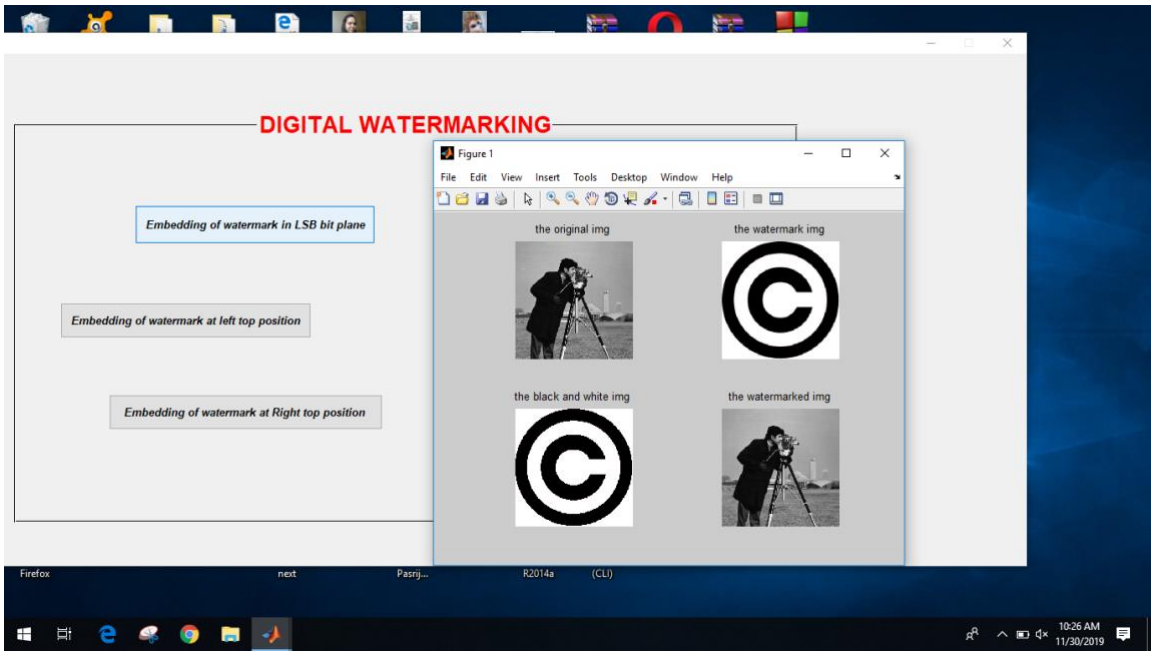
To get the watermark at different position we are using flipud () and rot 90() MATLAB functions. To get the watermark in the entire bit plane we decompose the original and watermark images into their respective 8 bit planes. Embed the MSB plane of your watermark into the LSB plane of cover image using bitset () function to get our watermarked image. Similarly, to extract the watermark from watermarked image we are using bitget () function.

RESULT

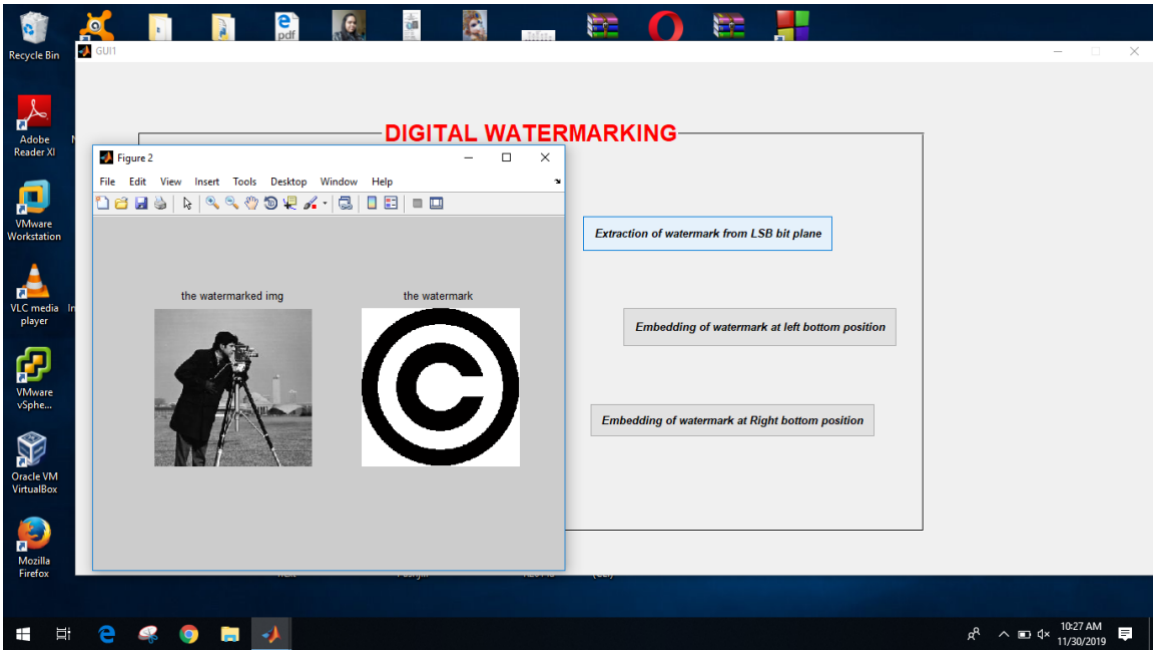
GUI WINDOW



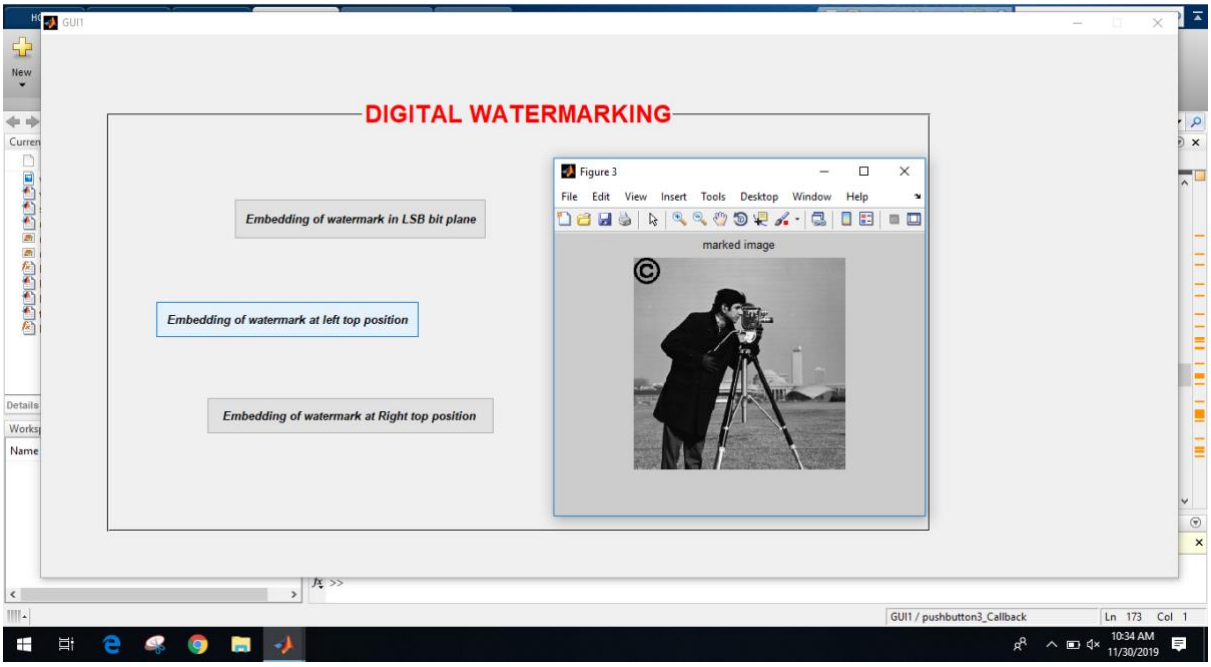
EMBEDDING OF WATERMARK IN LSB BIT PLANE



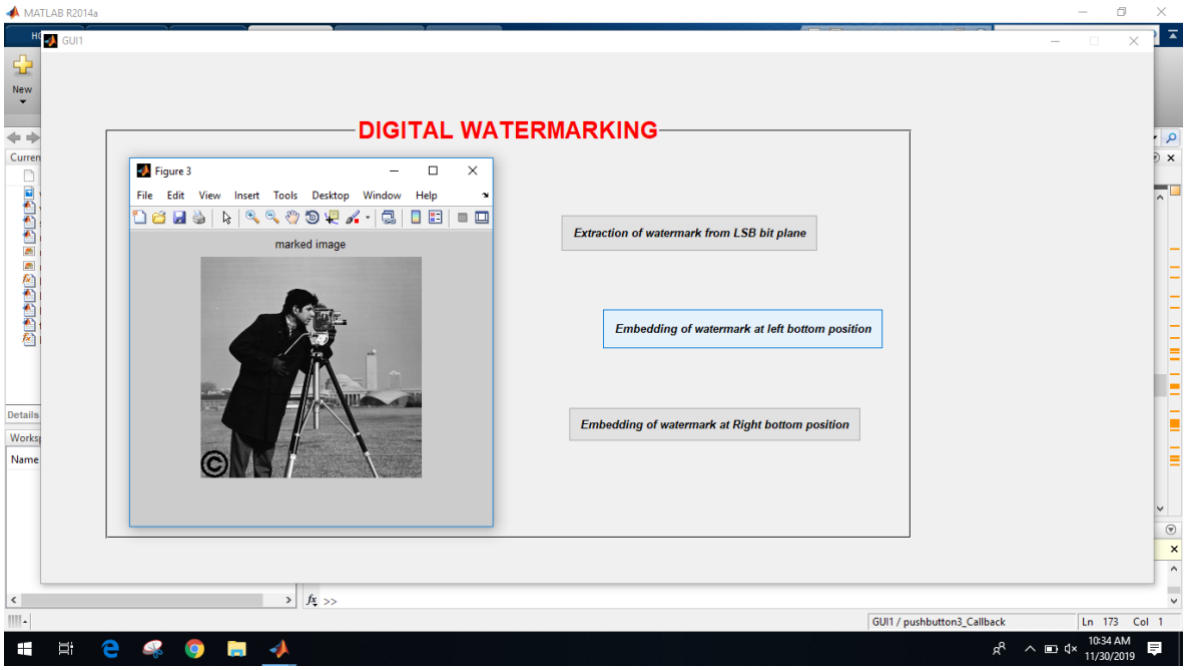
EXTRACTION OF WATERMARK FROM LSB BIT PLANE



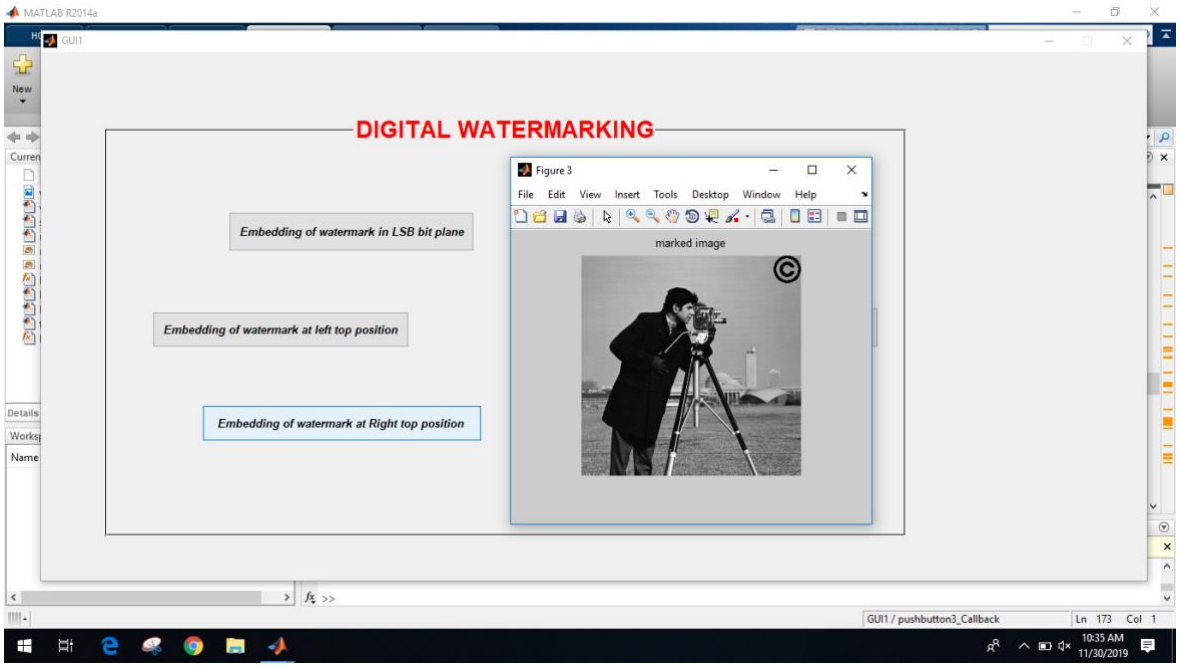
EMBEDDING OF WATERMARK AT LEFT TOP POSITION



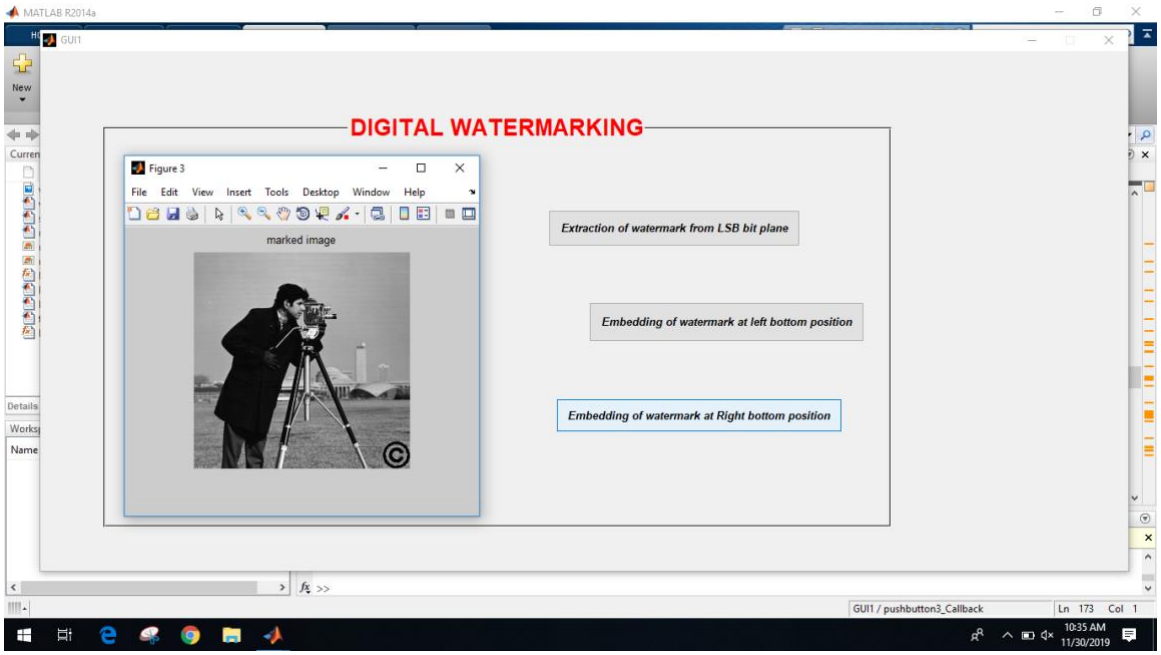
EMBEDDING OF WATERMARK AT LEFT BOTTOM POSITION



EMBEDDING OF WATERMARK AT RIGHT TOP POSITION



EMBEDDING OF WATERMARK AT RIGHT BOTTOM POSITION



CONCLUSION

There are different techniques used in watermarking for security of images such as frequency domain spatial domain and spread spectrum. In this project, we use spatial domain LSB method for security of images which is easy and simple and less computational method.

The drawback of LSB method is its poor robustness to common signal processing operation because by using this technique watermark can easily be destroyed by any signal processing attacks. It is not vulnerable to attacks and noise but it is very much imperceptible.

In order to overcome this drawback of this LSB technique, we can use frequency domain method of watermarking such as Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT). In future LSB may also be used for other type of data and test on different types of images.

APPLICATIONS

Digital watermarking may be used for a wide range of applications, such as:

1. Copyright protection
2. Source tracking (different recipients get differently watermarked content)
3. Broadcast monitoring (television news often contains watermarked video from international agencies)
4. Video authentication
5. Software crippling on screen casting and video editing software programs, to encourage users to purchase the full version to remove it.
6. ID card security
7. Fraud and Tamper detection.
8. Content management on social networks.

FUTURE SCOPE

The increasing amount of security threats we need large security needs. Multimedia documents and specifically images are affected. In the current state of research, it is difficult to affirm which watermarking approach seems most suitable to ensure an secure transfer of Data. The tool used for execution of this algorithm was MATLAB. The aim of the program is to replace the LSB of the base image with the MSB of the watermark. In future LSB may also use for other type of data and test on different type of images and we can get more noise free images with improved PSNR values.

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