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COMPARISION OF LSB AND DWT STEGANOGRAPHY TECHNIQUES

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ABSTRACT: *Steganography is the art and science of hiding communication; in steganography we embed data in a cover medium such that this information is not vulnerable to suspicion. In this paper we attempt to compare the two techniques of steganography LSB andDWT and make comparisons on the basis of two parameters Statistical Parameters and Image Quality Parameters. We found that DWT provides low embedding capacity with respect to LSB, which provides more embedding capacity. And the quality of the image is maintained in LSB than DWT.*

***Keywords*:** *Steganography, LSB, DWT, stego-image, PSNR, discrete wavelet transform, Least significant bit.*

I. INTRODUCTION

We live in times of secrecy and espionage, where the security of communication is of prime importance. This is the major reason why steganography has gained significance. Steganography is derived from two Greek words stegos meaning secret and graphic meaning writing. Steganography is the art of hiding information in a cover such that this message is impercievable [1, 2, 3] Steganography has started its journey from a humble 'shaved head method'to highly efficient techniques. It derives its roots from data hiding .steganography is implemented both in spatial domain as well as in frequency domain. In this paper we are choosing one technique from both the domains, namely LSB and DWT respectively. Least Significant bit insertion is the most commonly used approach .In LSB we embed data in a cover by altering the least significant bits in the pixel.this technique is easy to implement but is vulnerable to even small cover modifications. In DWT technique we embed information by changing the cover to frequency domain and then altering certain frequency coefficients.This technique provides more security.

II. LSB TECHNIQUE

Least significant bit (LSB) [6] insertion is a common, simple approach to embedding information in a cover image. For instance, a simple scheme proposed, is to place the embedding data at the least significant bit (LSB) of each pixel in the cover image . The altered image is called stego-image. Altering LSB doesn't change the quality of image to human perception but this scheme is sensitive a variety of image processing attacks like compression, cropping etc [4].

- PROPOSED ALGORITHM

Embedding Algorithm:
Input: cover image, key, secret message
Procedure:
Step1: Take a gray scale image(8-bit).
Step2: Convert the secret message into bit stream.
Step3: Now generate the sequence of indices for bit insertion. Here odd bits of the stream is embedded in IJth location and the even bit is embedded in JIth location. We increase IJ by some stepsize and proceed respectively
Step4: While complete bit stream not embedded
{ Reduce the value of stepsize by some constant value and replace least significant bit of pixel at IJth location.}End.
Output: Stego-Image.
On the receiver side extraction of this secret message is performed. The receiver has the knowledge about the key and the length of the secret message.
Extraction Algorithm:
Input: stego-image, key
Procedure:
Step1: Take the stego-image
Step2: Calculate the pixel positions in the same way as in the embedding algorithm by using the same key.
Step3: Form the secret bit stream by the LSB's of these pixels.
Step4: Convert this bit stream into the corresponding ASCII value by using 8-bit conversion.
End
Output: Secret-Message

- EXPLANATION OF THE ALGORITHM

The fundamental idea in LSB is to insert secret message in the least significant bits of the image. Here we have used five standard images namely; Lena, Mandrill , Boat, Pepper and Fruits. The size of each of this image is 512x512. All these images are gray scale images. We have embedded different lengths of characters in these images to check the effect of LSB on these images.

In the LSB technique that we have implemented we first taken one of these standard images and converted it into a matrix of bits. Next we take the secret message which is to be embedded in the given image (size less than 600 characters), and convert it into ASCII value and then to bit stream, where every 8 bits represent a character. Now we generate a sequence of indices for bit insertion using the key that odd bits of the stream are embedded in IJth location and the even bits are embedded in JIth location. We increase the value for the location , we add a predefine step size. We continue embedding of each bit from the bit stream into the image until the bit stream is completely embedded. The reverse of this technique is used for the extraction of secret message from the stego-image.

This is repeated for all the five images

III. DISCRETE WAVELET TRANSFORM

A small wave is called a wavelet. A wavelet is a waveform of effectively limited duration that has an average value of zero .The term wavelet comes from the fact that they integrate to zero .Orthogonality is an important property, it ensures that a data is not over represented, it can be decomposed into various scaled and shifted version of the mother wavelet [1].The wavelet transform is basically a multi –resolution decomposition process. DWT [5] gives an excellent space ,frequency localization. The input image is divided into 4 non over lapping sub bands LL,HL,LH,HH. The LL region has the most significant information .it provides large space for embedding data and is more robust .

Here we are using HAAR wavelet because it is not continuous , small changes in the input does not result in small changes in output and not differentiable. This wavelet was given by AlferdHaar.

- PROPOSED ALGORITHM

Embedding Algorithm:
Input: cover-image , secret message
Procedure:
Step1: Take the cover image and the secret message to be embedded.
Step2: Preform 8x8 blocking on the cover image.
Step3: Take the first block and perform third level of decomposition on it.
Step4: Convert the secret message into bit stream.
Step5: Embed the first bit of the bit stream in the LH3 level of the first block .
Step6: Repeat steps 3 and 5 on the consecutive blocks until all the data is embedded in the image.
End.
Output: Stego-Image.
Extraction Algorithm:
Input: Stego-Image
Procedure:
Step1: take the stego-image.
Step2: Preform 8x8 blocking on the stego-image.
Step3: Now perform inverse DWT on each block.
Step4: Extract the bits from the blocks to form a bit stream and convert them to the ASCII values.
End
Output: Secret-Message

- EXPLANATION OF THE ALGORITHM

The fundamental idea in DWT is to insert secret message in the frequency coefficients of the image. Here we have used six standard images namely; Lena, Mandrill , Boat, Pepper and Fruits. The size of each of this image is 512x512. All theses images are gray scale images. We have embedded different lengths of characters in these images to check the effect of DWT on these images.

In DWT technique we first take one of the six images. We partition this image into blocks each of size 8 bit x8 bit. Now we take the first block and perform DWT decomposition up to third level of decomposition. In the LH3 region we embed the first bit of the secret message. The secret message which is to be embedded in the given image (size less than 400 characters), and convert it into ASCII value and then to bit stream, where every 8 bits represent a character. The reverse of this technique is used for the extraction of secret message from the stego-image.

This is repeated for all the five images.

IV. COMPARISION OF LSB AND DWT STEGANOGRAPHY TECHNIQUES

The above implemented techniques , LSB (spatial domain technique) and DWT (frequency domain technique) have been compared on the basis of two parameters:

1. Statistical Parameters
2. Image Quality Parameters

The Statistical Parameters are used to characterize the content of an image and its texture. The various statistical measures are: mean, standard deviation, covariance and kurtosis. The image quality parameters give us a comparison about the quality of an image after embedding a secret message in the image. These parameters include PSNR and MSE.

- AVERAGE

Average is a first order statistical method. It estimates the properties of individual pixel values ignoring the spatial interaction between image pixels. Commonly average is use to find the average brightness of a region that is the mean of the pixel brightness within that region.

We have implemented the above equation in matlab and the above graphs where obtained for both LSB and DWT. Fig1 shows the average of LSB implemented using the five standard images. The average intensity value changes till 100 characters are embedded in each of the image after which the average remains more or less constant. On the other hand in Fig 2 after applying DWT, we see maximum increase in the average for standard images. ThusDWT technique increases the average brightness of the pixels more than LSB technique

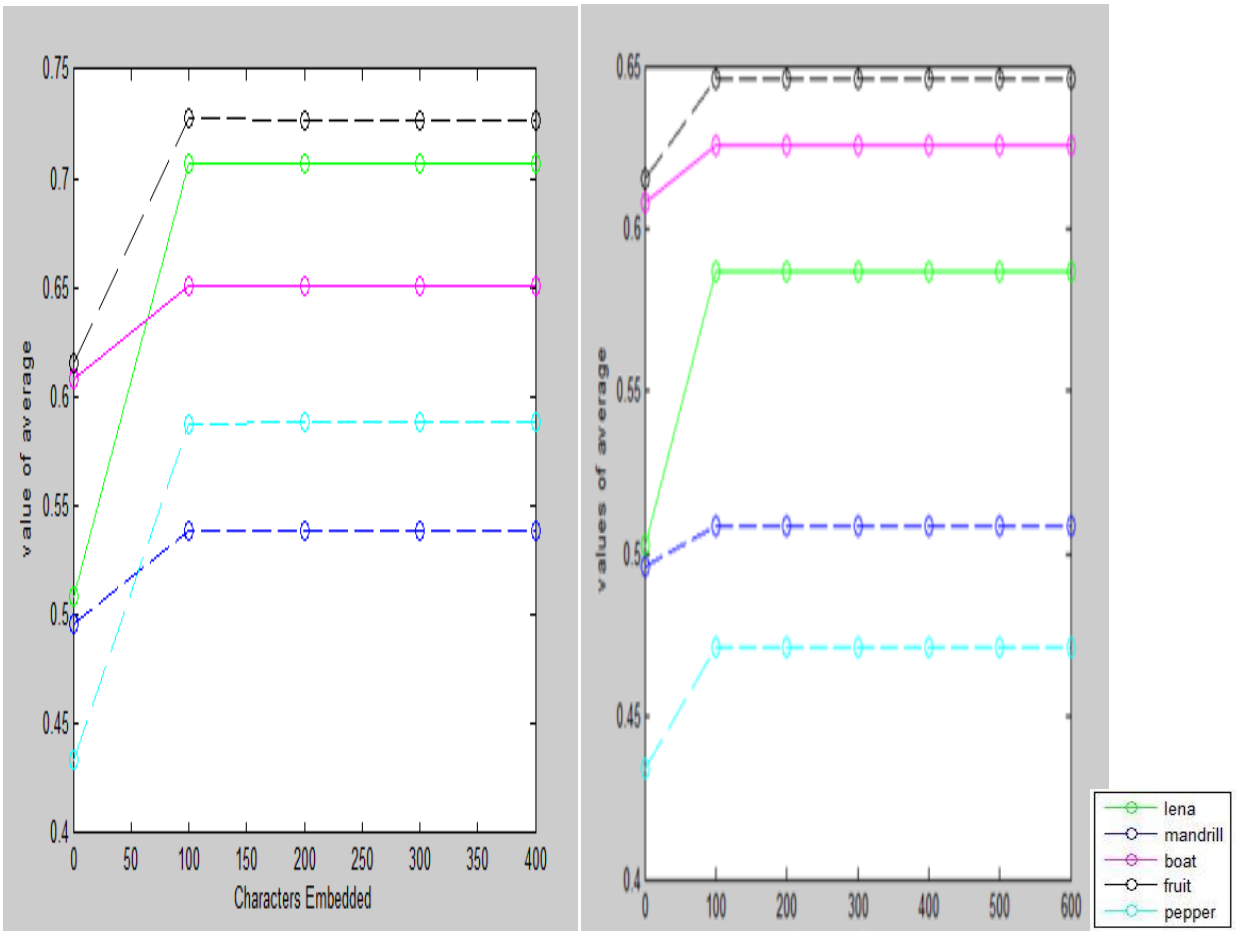
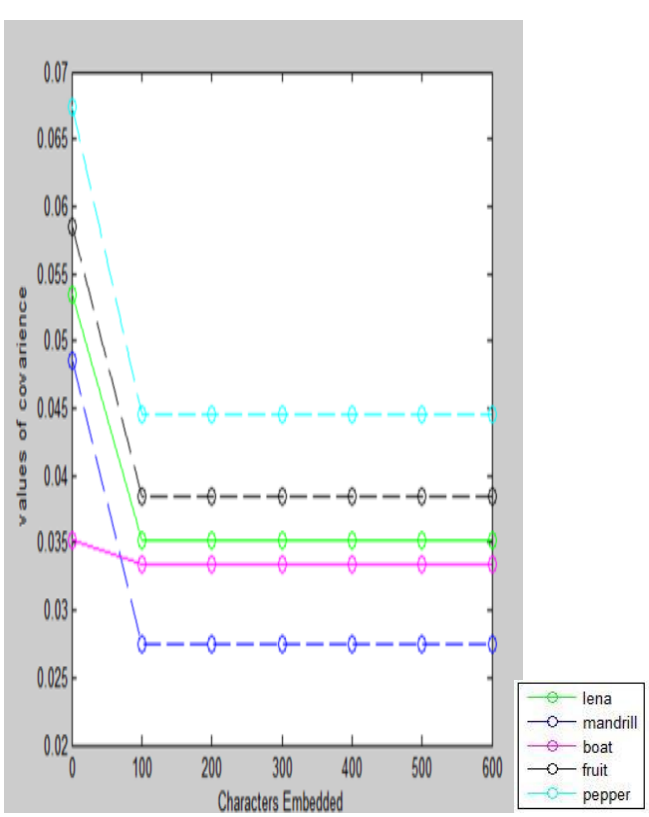


Fig1:Average Of LSBFig 2:Average Of DWT

- COVARIANCE:

It's a measure of how much two components change together. It's a first order statistical method and it does not consider pixel neighbourhood relationships. Covariance is used for edge detection in an image and provide image orientation information



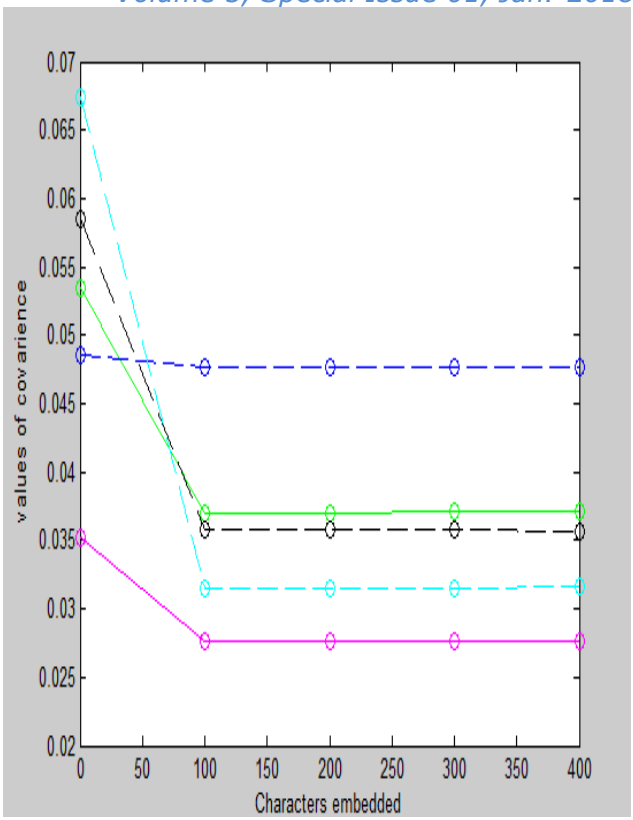


Fig 3:Covariance Of LSBFig 4:Covariance Of LSB

The graph shown in fig3 and fig4, shows that the covariance decreases when we use LSB technique to embed message in the image here the steepness of the slope indicates that covariance decreases more in DWT than in LSB . In both the techniques the covariance decreases till 100 characters are embedded after which it remains more or less constant, this indicates that the stego-images of LSB are more related to the original than the stego-images of DWT.

- ENTROPY:

It gives the spread of a state of a system. In an image a state refers to the gray level value a pixel has. High entropy means a 8bit pixel has 256 states. If all states are equally occupied then it has high entropy . When only 2 states are occupied then it has low entropy. If all the pixels have same value when it had zero entropy.
In LSB technique the stego-image shows less deviation in terms of entropy from the original image. Since entropy gives the information content thus the graph shows that LSB technique retains most of the significant information present in an image. On the other hand the graph for DWT remains more or less constant for the stego-images but the deviation from the original is more as compare to LSB. High entropy gives us high contrast and high dynamic range.

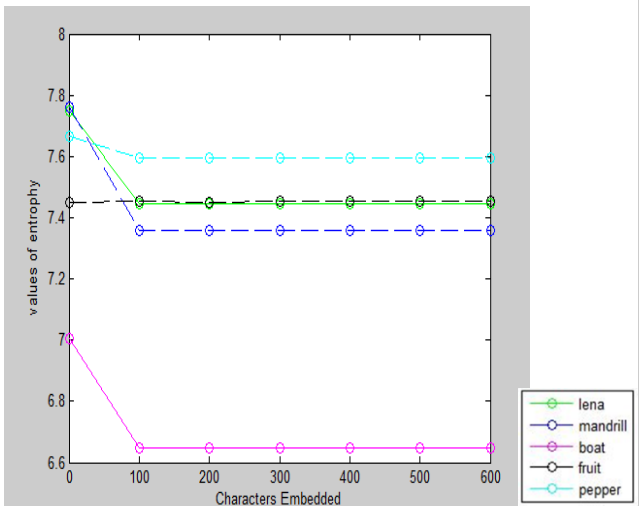


Fig 5: Entropy Of LSB

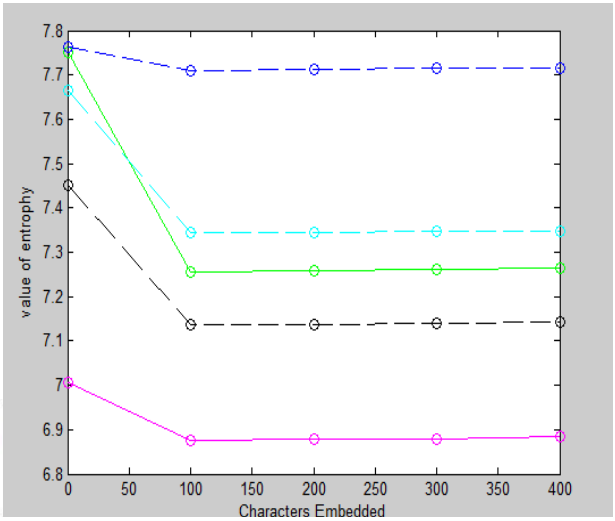


Fig 6: Entropy Of DWT

- PSNR:

It gives us peak signal to noise ratio. PSNR give us power content of both signal and noise. PSNR is a good measure for comparing restoration results for the same image. If an image has high PSNR it means that the resulting signal has little effect of noise on it and hence is faithfully restored. The formula of PSNR is as follows:

$$\text{PSNR} = 10 \times \log\left(\frac{255^2}{\text{MSE}}\right)$$

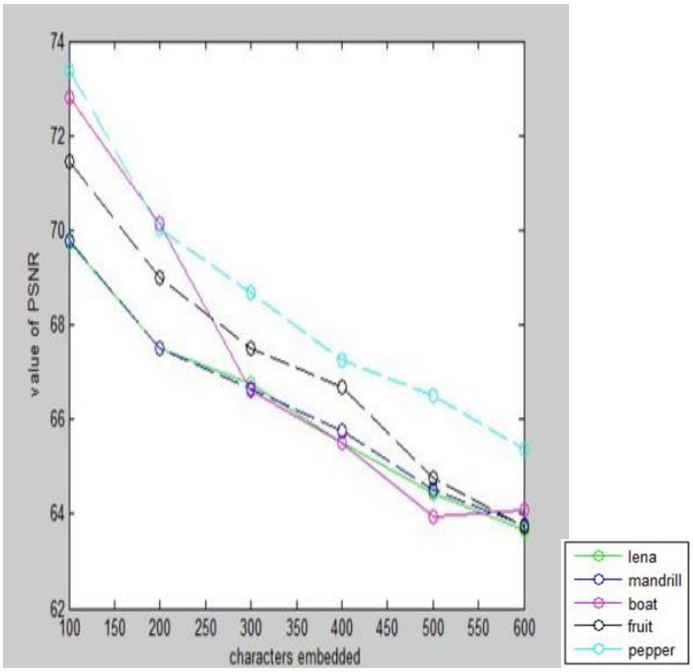


Fig7: PSNR Of LSB

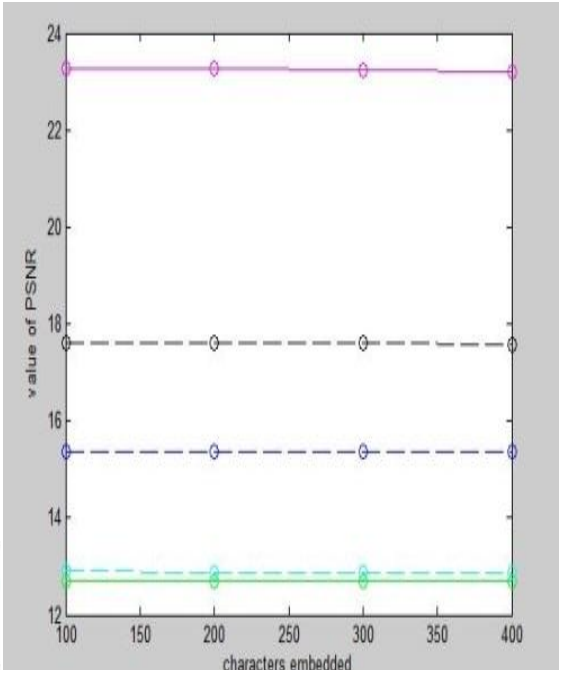


Fig 8: PSNR Of LSB

The comparision between the two garphs show that the PSNR value of standard images in case of LSB is more as compared to that of DWT. This indicates that the noise content in LSB is less as compare to that of DWT.The inferance that we draw regarding the quality of images is that in LSB the quality of image is better than DWT. As per the graph, as the number of characters that are embedded in the image increases, in LSB the quality of the stego-image is degrading where as in DWT this quality is maintained.

V. CONCLUSION

This paper proposes comparison between LSB technique and DWT technique. Comparisons are made on the basis of various parameters, statistical parameters and image quality parameter. The spatial domain technique that is LSB provide high PSNR, high perceptual quality and high embedding capacity than DWT in which the quality, embedding capacity and PSNR is low.

REFERENCE

[1]. Ali Al-Ataby and Fawzi Al-Naima, "A Modified High Capacity Image Steganography Technique Based on Wavelet Transform", The International Arab Journal of Information Technology, Vol. 7, No. 4, October 2010.
[2]. Abbas Cheddad, Joan Condell, Kevin Curran and Paul McKevitt "Digital image steganography:survey and analysis of current methods''. Signal processing,volume 90,March 2010,pages 727-752.
[3]. Hong-Juan Zhang, Hong-Jun Tang, "A Novel Image Steganography Algorithm Against Statistical Analysis", Proceedings of the Sixth International Conference on Machine. Learning and Cybernetics, Hong Kong, 19-22 August 2007.
[4]. Fahimirfanalam , Fatehakhanambappee , Fariduddinahmedkhondker "An investigation into encrypted message hiding through images using lsb" Vol. 3 No. 2 Feb 2011
[5]. TanmayBhattacharya ,NilanjanDey and S. R. BhadraChaudhuri:"Novel session based dual steganographic technique using dwt&spread sprectrum": Vol.1, Issue1, pp-157-161.
[6]. Chan, C. K. and Cheng, L. M. 2003. Hiding data in image by simple LSB substitution. Pattern Recognition, 37:469-474.