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A Review on GUI Model of Watermarked Image Embedded by LSB Technique and Removal of Gaussian Noise Using DWT

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ABSTRACT: The digital watermarking is used for security in digital communication. A watermarked image is embedded by least significant bit(LSB) method. After that a gaussian noise is added to the watermarked image. The PSNR and MSE is calculated both for watermarked image and after noise addition to it Discrete wavelet transform (DWT) of Watermarked image has gained widespread recognition and popularity in image processing due to its ability of capturing energy of signal in a few energy transform value. As well as it has also ability to underline and represent time-varying spectral properties of many transient and other nonstationary signals. In DWT denoising is done only in detail coefficient, this offer advantage of smoothness and adaption. However DWT has a lack of Translation invariance .This Translation-variance is a major problem with the use of DWT for transient signal analysis and pattern recognition applications. Denoising of watermarked images with the DWT some time also give visual artifacts due to Gibbs phenomena in neighborhood of discontinuities. Image is naturally corrupted by Gaussian noise which is classical problem in image processing.wavelet thresholding and translation invariant methods of image de-noising to remove noise using orthogonal wavelet basis. As well as an adaptive thresholding technique is also used along with Shift Invariant Wavelet Transform. Denoising of image performance is shown in terms of PSNR. Some other way of result evaluation in terms of MSE and visual performance.

KEYWORDS: Watermarking, LSB technique, gaussian noise, DWT

I. INTRODUCTION

The digital watermarking is a security technology used to embed the important secured information inside a digital content like (text, image, audio or video) using different techniques. The embedded information embedded in a file depends upon the required application. The Embedding of a hidden stream of bits in a file is called Digital Watermarking [1]. The file could be an image, audio, video or text. Nowadays, digital watermarking has many applications such as image authentication , broadcast monitoring, owner identification, proof of ownership, transaction tracking, content authentication, copy control, device control, and file reconstruction[2].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. The process of embedding information into another object or signal is called watermarking. A digital watermarking is a technique for permanently embedding an identification code into digital data such as audio, video or images. Identification code contains information related to copyright protection and data authentication. If the owner of a digital file wants to protect the copyrights of his/her file, they can do so by using digital watermarking techniques. Figure 1.1 shows the watermark embedding process.

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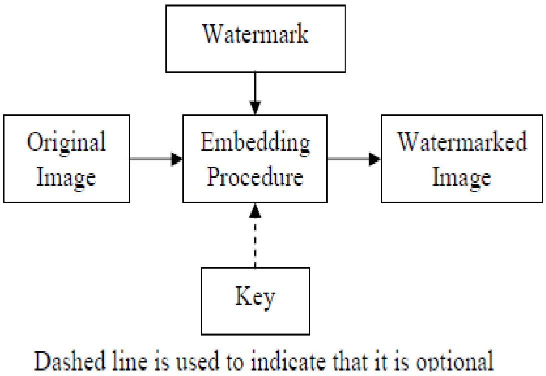

Figure 1.1: Basic block diagram of watermarking system.

Information about the original image such as author, creator, owner, distributor or authorized consumer is called watermark which is embedded into the original image by the embedding procedure. Using a key is optional, it is used to increase the security of the system. Key is used as a seed for a pseudo random number generator.. At this stage, either the watermark or the original image can be provided to the system. The watermark extracting process is shown in Figure 1.2.

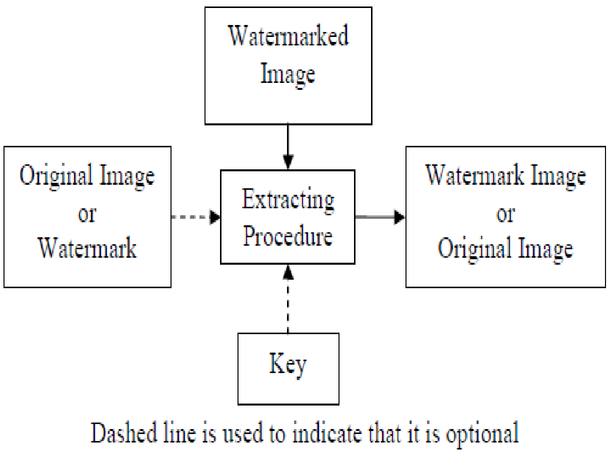

Figure 1.2: Watermarking Extracting system

If the original image is provided, then the watermark can be recovered or if a watermark is presented, then the original image can be obtained. Few extracting procedures extract the watermark without using the original image or the watermark embedded. If the watermarked image is copied and distributed, the watermark is also distributed along with the image which can be detected.

1.5 Watermarking Application

Video Watermarking. In this case, most considerations made in previous sections hold.However, now the temporal axis can be exploited to increase the redundancy of the watermark. As in the still images case, watermarks can be created either in the spatial or in the DCT domains. In the latter, the results can be directly extrapolated to MPEG-2 sequences, although different actions must be taken for I, P and B frames. Note that perhaps the set of attacks that can be performed intentionally is not smaller but definitely more expensive than for still images.

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Audio Watermarking. Again, previous considerations are valid. In this case, time andfrequency masking properties of the human ear are used to conceal the watermark and make it inaudible. The greatest difficulty lies in synchronizing the watermark and the watermarked audio file, but techniques that overcome this problem have been proposed.

Hardware/Software Watermarking. This is a good paradigm that allows us to understandhow almost every kind of data can be copyright protected. If one is able to find two different waysof expressing the same information, then one bit of information can be concealed, something that can be easily generalized to any number of bits. This is why it is generally said that a perfect compression scheme does not leave room for watermarking. In the hardware context, Boolean equivalences can be exploited to yield instances that use different types of gates and that can be addressed by the hidden information bits. Software can be also protected not only by finding equivalences between instructions, variable names, or memory addresses, but also by altering the order of non-critical instructions. All this can be accomplished at compiler level.

Text Watermarking. This problem, which in fact was one of the first that was studied withinthe information hiding area can be solved at two levels. At the printout level, information can be encoded the way the text lines or words are separated (this facilitates the survival of the watermark even to photocopying). At the semantic level (necessary when raw text files are provided), equivalences between words or expressions can be used, although special care has to be taken not to destruct the possible intention of the author.

Executable Watermarks. Once the hidden channel has been created it is possible to includeeven executable contents, provided that the corresponding applet is running on the end user side
Labeling. The hidden message could also contain labels that allow for example to annotateimagesor audio. Of course, the annotation may also been included in a separate file, but with watermarking it results more difficult to destroy or loosethis label, since it becomes closely tied to the object that annotates. This is especially useful inmedical applications since it prevents dangerous errors.

Fingerprinting. This is similar to the previous application and allows acquisitiondevices(such as video cameras, audio recorders, etc) to insert information about the specific device (e.g., an ID number) and date of creation. This can also be done with conventional

II. LITERATURE REVIEW

In the area of digital watermarking, image watermarking predominantly has engrossed a lot of interest in the research community. The majority of the research work is devoted to image watermarking as compared to audio and video. Some of the reasons are described below.
The test images are readily available.
Images carry sufficient redundant information so that watermarks can be embedded easily.
It may be assumed that any successful image watermarking algorithm may be upgraded for the video also.
Images are represented in spatial domain as well as in frequency domain. The image in the transform domain is represented in terms of its frequency coefficients and in spatial domain it is represented by pixels. Simply, transform domain means the image in the form of multiple frequency bands. To represent an image in the transform domain, reversible transforms like Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT) or Discrete Fourier Transform (DFT) can be used. Each of these transforms has its own features and represents the image in its own ways. Watermarks can be imposed within images by changing the transform domain frequency coefficients. In case of the spatial domain, simple watermarks could be imposed in the images by modifying the pixel values or the Least Significant Bit (LSB) values.

III. PROBLEM IDENTIFICATION

The significance of privacy in some of the application areas like fingerprinting and copyright protection is very high and as of now no successful algorithm seems to be available to prevent illegal copying of the multimedia contents. The

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primary goal of this research work is to develop watermarking schemes for images which are stored in the spatial domain as well as in transforming domain that should be able to sustain the known attacks and various image manipulation operations. Out of all the multimedia contents such as image, audio and video, any image watermarking algorithm which is lucrative can be extended as video watermarking, hence, image watermarking is intended. With future augmentation in mind, the cover medium chosen is an imageThe basic idea behind this research work is to remove Gaussian noise from an watermarked image. It is also referred to as image "denoising". There are various methods to help restore an image from noisy distortions. Selecting the appropriate method plays a major role in getting the desired watermarked image. The denoising methods tend to be problem specific. For example a method that is used for de noising satellite image cannot be use for denoising medical image. In this research work watermarked image which is corrupted by Gaussian noise is used. Actually watermarked image contain a large of spatial redundancy in plane area where adjacent pixel almost contain same value which means pixels are highly correlated. This can be resolve by using discrete wavelet transform but it required mathematical function thus coding scheme is more complex and not applicable in real time situation as well as gives Gibbs phenomena. The denoising method uses hard and soft thresholding which associated with their own problem. Hard thresholding denoising method may lead to the oscillation of the reconstructed signal. The soft-thresholding denoising method may reduce the amplitudes of signal. The denoised signal reconstructed from the transform will present alternative overshoot and undershoot. These peak value are not contained in original signal itself. They are created by artificial interference in transform process. To overcome the disadvantage mention over Shift invariant method is used.

IV. PROPOSED ALGORITHM

The main goal of our algorithm is to remove noise without interfere another feature of the watermarked images. In this proposed algorithm we use two method DWT and Shift Invariant method. First denoising is performed with conventional discrete wavelet transform then we applied our proposed algorithm by using Translation Invariant wavelet thresholding.

LEAST SIGNIFICANT BIT ALGORITHM

The LSB method is used for generating the watermarked image from the standard image, the hard and soft thresholding method is used to compose the noisy data into an orthogonal wavelet basis in order to suppress the wavelet coefficients to be smaller than the given amplitude and to transform the data back into the original domain. One original image is applied with Gaussian noise with variance. The methods proposed for implementing image de-noising using Shift Invariant wavelet transform take the following form in general. In normal threshold Estimate the Threshold using 'sureshrink' Sure Shrink suppresses noise by thresholding the empirical wavelet coefficients.

Algorithm using Discrete Wavelet Transform Technique

This section describes the watermarked image denoising algorithm, which achieves near optimal soft thresholding in the wavelet domain for recovering original signal from the noisy one. The algorithm is very simple to implement and computationally more efficient. It has following steps:

1. Read the original standard image.
2. Resize the loaded image to a standard size of 256 × 256. For large sized images, such as 512× 512, the computation time for denoising is found to be more. And if the image size is taken smaller than 256× 256, then the useful data is liable to get lost.
3. Add a secret massage with the image and formed a watermarked image with LSB method.
4. Add Gaussian Noise of given mean and variance is added to given watermarked Image.
5. The image is transformed into the orthogonal domain by taking the wavelet transform. As describe in section 3.2.1. A well-known orthogonal basis expansion is obtained by discrete wavelet transform WT^d, by which a map $f \rightarrow w$ is implemented via a bank of quadrature mirror filters, by $w = W^d f$ and coefficients at high/low scales (with high and low frequency content, respectively) are obtained.
6. Estimate the Threshold using 'sure shrink'. (Threshold selection using principle of Stein's Unbiased Risk Estimate). The sure shrink threshold t* is defined as $t^* = \min(t, \sigma\sqrt{2\log n})$. Where t* denotes the value that minimize Stein's Unbiased Risk Estimator, σ is the noise variance, and n is the size of the image. Sure Shrink follows the soft

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thresholding rule. The thresholding employed here is adaptive. A threshold level is assigned to each dyadic resolution level by the principle of minimizing the Stein's Unbiased Risk Estimator for threshold estimates. This method is much better than VisuShrink. The sharp features of image are retained and the MSE is considerably lower. This because Sure Shrink is sub band adaptive [25].

7. Perform N Level Discrete Wavelet Decomposition of Image using given Wavelet.
8. Apply Soft or Hard Thresholding on Decomposed Wavelet Coefficients.
9. Perform N Level Inverse Discrete Wavelet Transform using given Wavelet.
10. Calculate the PSNR and MSE.

Algorithm using Shift Invariant wavelet Technique

1. Resize Image to 256x256 pixels Size.
2. Add a secret massage with the image and formed a stego image with LSB method.
3. Add Gaussian Noise of given mean and variance to Image.
4. Estimate the Threshold using 'suresrink' (Threshold selection using principle of Stein's Unbiased Risk Estimate).
5. Perform N Level shift Invariant Wavelet Decomposition of Image using given Wavelet.
6. Apply Soft or Hard Thresholding on Decomposed Wavelet Coefficients.
7. Perform N Level Inverse Shift Invariant Wavelet Transform using given Wavelet.
8. Calculate the PSNR and MSE.

About Estimator

'sure rink' is an normal threshold selection based Stein's unbiased likelihood estimation principle. For a given threshold t, getting its likelihood estimation first, then minimize the no likelihood, so the threshold has been obtained. It is a software threshold estimator.

- **PSNR –** PSNR is most commonly used as a measure of quality of reconstruction of lossy compression code's (e.g., for image compression). PSNR stands for the peak signal to noise ratio because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale. It is calculated as the following:

$$PSNR = 10\log_{10}(255^2 / MSE) \qquad (4.1)$$

- **MSE** – It stands for mean squared error. It refers to a greater difference between the original and denoised image. MSE indicates average error of the pixels throughout the image. In our work, a definition of a higher MSE does not indicate that the denoised image suffers more errors instead. This means that there is a significant speckle reduction. The formula for the MSE calculation is given in equation (4.2).

$$MSE = (1/(M \times N))\sum_{i=1}^{M}\sum_{j=1}^{N}(X_{ij}Y_{ij})^2 \qquad (4.2)$$

where I and K are the original and noisy/ denoised image, respectively. I MAX is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is equivalent to 255, and in this work as well it is 255 [20].

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Flow chart of Algorithm

The algorithm in form of flow chart is shown in figure 4.1

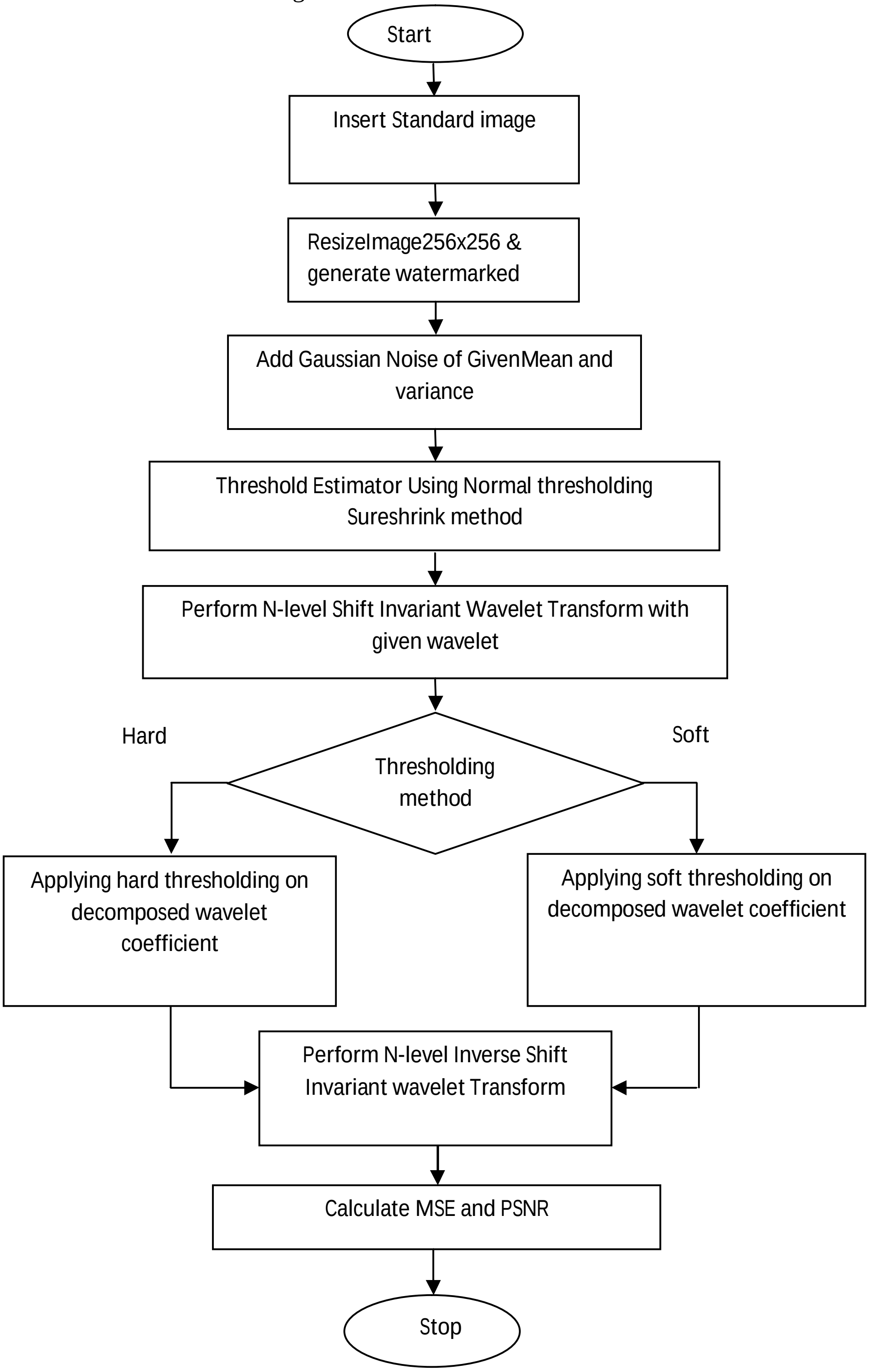

Figure 4.1: Flowchart for Image Denoising Algorithm through Wavelet Transform

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V. EXPECTED OUTCOME

The PSNR value of the noisy image shows that higher the PSNR value is closer to the original image. As per analysis of table1, 2, 3 and 4 the PSNR value and MSE of noisy image for different wavelet analyser. All experiment has been done for camera man image with noisy PSNR (dB): 20.3754, MSE: 596.4104, mean: 0.0, variance: 0.01.The following result has been obtained from our proposed algorithm-Generation of the watermarked image using the LSB method According to analysis with respect to PSNR value and MSE of denoise image shift Invariant gave better performance than conventional wavelet transform in both the case either in soft thresholding or hard thresholding.

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