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LSB - IMAGE HOLDING FUSION USING LSB-ARNOLD FUSION TRANSFORM USING FUZZY LOGIC TECHNIQUE

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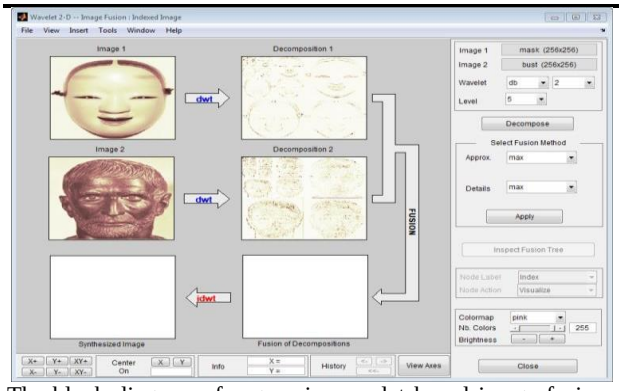
Abstract- In the proposed method, the intensity component is obtained adaptively from the up-sampled MS image at first. Different from traditional IHS-based methods, we subsequently propose a multi-scale guided filter strategy to filter the PAN image to achieve more detail information. Finally, the total detail map is injected into each band of the up-sampled MS image to obtain the fused image by a model-based algorithm, in which an improved injection gains approach is proposed to control the quantity of the injected detail information.
Among these, wavelet transform becomes an important aspect of image fusion research with the merits of multi-scale and multi-resolution. In an algorithm of multi-sensor image fusion using wavelets and Principal Component Analysis (PCA) is proposed and comparison of image fusion with different techniques based on fusion quality performance metrics is done. Multi-resolution wavelet transforms provides good localization in both spatial and frequency domains. Discrete Wavelet Transform (DWT) provides directional information in decomposition levels and contains unique information at different resolutions. Wavelets are suffered with shift variant and edges are not produced in the fused image. Stationary Wavelet Transform (SWT) solves this problem which is shift invariant. Image fusion using SWT with higher levels of decomposition provides better fusion results. Experimental results demonstrated that the proposed method can provide more spatial information and preserve more spectral information compared with several state-of-the-art fusion methods in both subjective and objective evaluations. A fast and effective image fusion method is proposed for creating a highly informative fused image through merging multiple images. The proposed method is based on a two-scale decomposition of an image into a base layer containing large scale variations in intensity, and a detail layer capturing small scale details.

Keywords—Guided filter, image fusion, spatial consistency, two-scale decomposition.

I. INTRODUCTION

The image fusion is a technique of extracting useful data from multiple images. This data is then merged together for forming a single image that contains information from multiple images. Fusion of image is done with the help of stegnography. As human perception and human sense are not trained to look for files that have information inside of them . Stegnography is commonly used for hide a file inside another file [2] . The image stegnography can be split in two ways, one is Spatial domain stegnography in which data is inside the pixels directly and another is transfer domain stegnography in which images are first transformed and then the message is embedded in the image. Least Significant Bit(LSB) is the first most famous and easy spatial domain stegnography technique. It embeds the bits of a message in a sequential way in the LSB of the image pixels [3]. But the problem is that if the image is compressed then the embedded data may be destroyed. Thus there is a fear for damage of the message that may have sensitive information [4]. The idea behind LSB embedding is that if we change the last bit value of a pixel, there won't be much visible change in the color. For example, 0 is black. Changing the value to 1 won't make much of a difference since it is still black, just a lighter shade[5]. Cryptography is also used for encrypt and decrypt data.

There are various methods for Image Fusion like, image fusion using weighted average, HPF (High Pass Filter), IHS (Intensity Hue Saturation), PCA (Principal Component Analysis, pyramid based decomposition (such as Laplace pyramid decomposition, ratio pyramid, etc.), wavelet transform (WT), etc. Among these, wavelet transform becomes an important aspect of image fusion research with the merits of multi-scale and multi-resolution. In an algorithm of multi-sensor image fusion using wavelets and Principal Component Analysis (PCA) is proposed and comparison of image fusion with different techniques based on fusion quality performance metrics is done. Multi-resolution wavelet transforms provides good localization in both spatial and frequency domains. Discrete Wavelet Transform (DWT) provides directional information in decomposition levels and contains unique information at different resolutions. Wavelets are suffered with shift variant and edges are not produced in the fused image. Stationary Wavelet Transform (SWT) solves this problem which is shift invariant. Since the concept of image fusion is not that certain and crisp, Fuzzy logic is implemented for image fusion in order to incorporate uncertainty to the images [6]. Fuzzy sets are to represent spatial information in images along with their imprecision. By proper tuning of membership functions and by proper formulation of rules, good quality fused image Fuzzy logic has got application in multi-sensor image fusion also.



The block diagram of a generic wavelet based image fusion approach Steganography's main goal is to avoid detection; to deny the existence of sensitive data inside the cover file. "In steganographic applications there are two levels of security. The first is not allowing an observer to detect the presence of a secret message. The other is not allowing the attacker to read the original plain message after detecting the presence of secret information."

Image fusion is used for satellite vision, machine vision, human vision, in military for detecting threats, robotics field in artificial neural network etc [7].

This paper is organized as follows: section II will describe the work done in related field. The problem and challenges that arise are described section III. The tools and technique that are are used for LSB - IMAGE HOLDING FUSION USING LSB-ARNOLD FUSION TRANSFORM USING FUZZY LOGIC TECHNIQUE is mentioned in IV and the conclusion is presented in section V.

II. LITRATURE SURVEY

Lots of researcher are working on image fusion technique from mid nineteen eight and till now. They have presented their different views .The wavelet transform has became an important aspect of image fusion research with the merits of multi scale and multi resolution. Multi-resolution wavelet transforms provides good localization in both spatial and frequency domains. Wavelet transform is a type signal representation that can give the frequency content of the signal at a particular instant of time. In the wavelet based image fusion process proposed in which steps mainly involved are registering source images, performing wavelet transform on each input images, then generating a fusion decision map based on a defined fusion rule and constructing fused wavelet coefficient map from the wavelet coefficients of the input images according to the fusion decision map. In this section we will review the researched work done in image fusion using LSB- Arnold fusion transform using fuzzy logic.

The author[8] Watermarking capacity refers to the amount of information we are able to insert into the image. Low signal to noise ratio is a phenomenon of watermarking channels which severely limits the capacity. The aim of this study was to develop a digital watermarking model which can find out the possibility to embed maximum amount of data in an image without degrading the quality of watermarked image. In this approach, the host image will be partitioned into non-overlapping blocks and passing an imaginary plane in the three critical pixels. The characteristics of this plan should not be changed after embedding message; then the same characteristics will be used to evaluate the embedded capacity in the extracting module. The author [9] attempted to give a comprehensive bibliographic account of the work in linguistic steganography published up to date. As the field is still in its infancy there is no widely accepted publication venue. Relevant work on the subject is scattered throughout the literature on information security, information hiding, imaging and watermarking, cryptology, and natural language processing. Bibliographic references within the field are very sparse. Steganography is the art of hiding the existence of data in another transmission medium to achieve secret communication based on biometrics steganography and the biometric feature used to implement steganography is skin tone region of images [10]. Here secret data is embedded within skin region of image that will provide an excellent secure location for data hiding. The author [6] introduce a new method of embedding secret data within edge of skin of image as it is not much sensitive to HVS(Human Visual System). The author [3] proposed an efficient image steganography technique. In this technique data is firstly preprocessed. This preprocessing reduces the size of the data by a significantly great amount. This preprocessed data is then embedded into the LSBs of the pixels of the image depending upon the intensity of the pixel values. The proposed algorithm is targeted to achieve very high image embedding capacity into the cover image and more security of the secret data. It has high PSNR value and low MSE value. This preprocessing reduces the size of the secret data by a significant amount and thus permits more data into the same image. The author [4] proposed a scheme which is based on hybrid cryptographic techniques based on RSA algorithms to achieve data encryption and compression technique to store large amount of data. The suggested algorithm is modified BPCS (Bit Plane Complexity Segmentation) steganography technique that can replace all the "noise-like" regions in all the bit-planes of the cover image with secret data without deteriorating the image quality. The author [13] proposed an embedding algorithm which embeds messages in the domain. Outguess goes about the embedding process in two separate steps. First it identities the redundant coefficients which have minimal effect on the cover image, and then depending on the information obtained in the first step, chooses bits in which it would embed the message. It is noted that at the time Outguess was proposed, one of its goals was to overcome steganalysis attacks which look at changes in the histograms after embedding. So they, proposed a solution in which some of the coefficients are left unchanged in the embedding process, afterword's these remaining coefficients are adjusted in order preserve the original histogram of coefficients. In last year various approached by the researchers.

III. PROPOSED WORK

The main objective of this work is to improve quality of the Stego image and provide security to the secret image by RSA encryption with bit shift method. The algorithm is implemented on MATLAB 7.11 and the quality of the image is analyzed on the basis of PSNR and MSE values. The quality of the image must not be distorted after hiding the data in it so that the presence of the image is not recognized to human eye. For this to be achieved PSNR of the stego image to cover image must be high and the MSE must be low.

1.
2. **PROPOSED ALGORITM:**

As there are various steps to implement the steganography here.

Step 1: Cover image is loaded & skin color detection is performed for the biometric image.

Step 2: If the image is not biometric then apply canny edge detector algorithm for the non- biometric image.

Step 3: Once the edges of cover image are found then load the secret image.

Step 4: After loading the secret image, DWT technique is applied to compress the secret image as compressed image will less distort the cover image.

Step 5: Then RSA encryption algorithm with bit shift method is performed.

Step 6: Encrypted message is then embed behind the cover image.

Step 7: Stego image with better quality is obtained.

All the above steps are followed to hide the secret data over the cover image. The correlation property is exploited in a proposed technique.

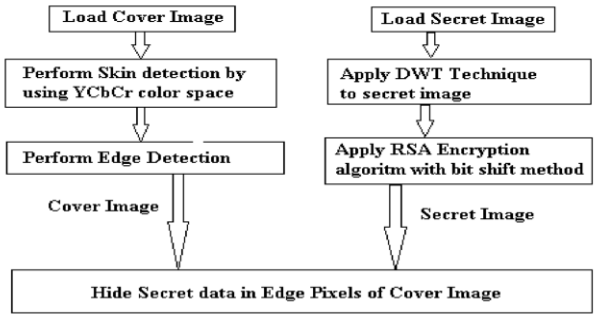


Figure 4.2 Flowchart to Hide Secret data

IV. RESULTS AND DISCUSSION

The results are analyzed based on two parameters PSNR (Peak Signal to Noise Ratio) value and MSE (Mean Square Error). As steganography is based on obscurity, the most important tests are related to the human perception. These types of tests evaluate the invisibility or transparency. The most used tests are the Subjective and the Peak-Signal to- Noise-Ratio PSNR in dB (decibel). The subjective tests are carried out by people who look for visual differences between the images (original and stego image) trying to find which one of them is the original. If the percentage of success goes 50%, it can be concluded that the message is invisible. Unlike the subjective approach which is vulnerable to human vision, PSNR (Peak Signal to Noise Ratio) is a technical approach usually used to evaluate the real quality of stego image [27]. The PSNR is most commonly used to measure the quality of reconstruction in an image; by comparing the stego image with the original image. PSNR can be calculated using the mathematical models/formulas in Equations below.

First MSE is calculated using the following equation:

$$MSE = \frac{i}{mn}\sum_{i=0}^{m-1}.\sum_{j=0}^{n-1} I(i,j) - K(i,j)^2$$

----- *(1)*

Where MSE is the Mean Squared Error of m × n monochrome images I and K, where one of the images isconsidered a noisy approximation of the other, where loweris better. Thereafter, PSNR can be calculated using the following equation:

$$PSNR = 10.\log_{10}\left(\frac{MAX_i^2}{MSE}\right) = 20.\log_{10}\left(\frac{MAX_i}{\sqrt{MSE}}\right)$$

------ *(2)*

Where, MAX_i is the maximum pixel value of the image and MSE is mean squared error value.

EXPERIMENTAL RESULTS:

DWT algorithm and RSA algorithm with bit shift method was implemented and executed using MATLAB 7.11. The cover and stego images are compared on the basis of MSE and PSNR. PSNR and MSE are the most commonly used metrics for measuring the quality of stego image. The experimental results convey that this technique provides sufficiently good PSNR value.

Fig1. Baby. Jpg original image and stego image

Fig1. Lion. Jpg original image and stego image

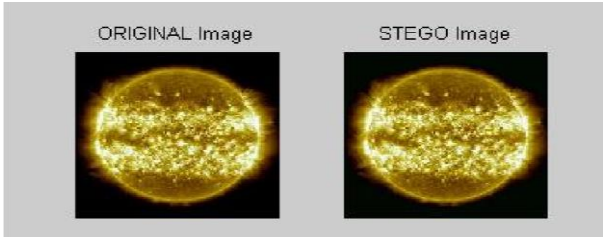


Fig3. moon. Jpg original image and stego image

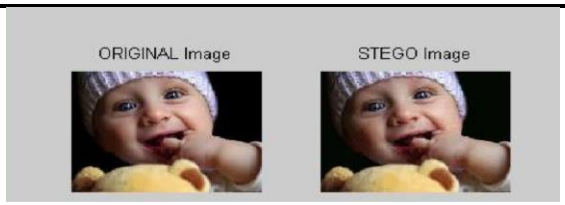


Fig4. baby. Jpg original image and stego image

Fig5. Flowr. Jpg original image and stego image

Cover Images	Secret Images	PSNR value by LSB method	PSNR value by Proposed algo	Time Taken(sec)
Baby.jpg	Flowr.jpg	32	33.667	2.953
Lion.jpg	Rose.jpg	33	34.083	4.187
moon.jpg	Child.jpg	35	37.864	3.108
lion.jpg	Teddy.jpg	32	34.083	3.046
baby.jpg	Moon.jpg	42	43.667	3.078

Fig. 6 Experimental results

V. CONCLUSION

This work deals with the techniques for steganography in discrete wavelet transform as associated to gray scale images and binary images. A new and secure steganography method for embedding secret image into cover image without producing any major change has been proposed. In future secret image could be extracted only with stego image without the availability of cover image.The main focus of this research is on image enhancement using fuzzy image enhancement techniques. Many images like medical images, satellite images, microscopy images, aerial images and even real life photographs suffer from poor contrast and noise. It is necessary to enhance the contrast and remove the noise to increase image visual quality. In the work one membership function is defined to enhance the image and algorithm is proposed.

Steganography is the embedding of secret message in ordinary communication medium [8]. Least Significant Bit Replacement [6] is the most commonly used steganographic technique. It involves the hiding of secret message bits in the least significant bit (LSB) plane of the image. Thus if the pixel intensity value is 144 and the message bit is 1 then the pixel value is changed to either 145 or 143 so that it's LSB matches with the message bit. The Arnold transform [5] is an image scrambling technique that can be used to encrypt and decrypt image data. The transform is area preserving and invertible without loss of information. It is also known as cat map. The mapping can be done successively several times to completely obscure the image beyond recognition.

In future, this technique may be modified by preprocessing the data in a different way. A different compression algorithm like LSB - IMAGE HOLDING FUSION USING

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(Discreet Cosine Transform), Vector Quantization, Huffman coding, RLE (Run Length Encoding), string-table compression, LZW (Lempel Ziff Welch) can be used according to the efficiency required

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