"STUDY OF IMAGE ENHANCEMENT TECHNIQUES AND IMAGE STEGANOGRAPHY"

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ABSTRACT*: Images are the major source of accessing the information from the real world. Images are captured or taken in different situations and position. So there is need for image preprocessing of the captured image for the purpose of removal of noise, unwanted background, making sharp or blur according to application. Image enhancement is the first preprocessing step in image processing, with the help of which the authors propose the image with more clarity. In this paper the going to describes various techniques of image enhancement and compare it with image enhancement techniques, with the help of various error analysis techniques. Image enhancement techniques are assessed using the various metrics.*

Keywords: image enhancement, error analysis, image processing,

1. INTRODUCTION

Image enhancement refers to the sharpening of image features such as edges, boundaries, or contrast to make images clearer understandable than the original image. Image enhancement is applied in different field where images have to be analyzed for e.g. medical image analysis, analysis of images from satellites etc. After enhancing, image can be used for further analysis, detection, segmentation and recognition in image processing. Real world images are acquired with low contrast and unsuitable for human eyes to read, such as medical and industrial X-ray images, so to have a clear perception of the image it is necessary to enhance the image. Image enhancement can be classified into two broad categories: spatial domain and frequency domain. Spatial domain technique operates directly on pixels whereas frequency domain operates on the Fourier transform of an image. The spatial domain technique is having different advantages like it is easy to understand and study, complexity is also less ,thus it can be used in real time applications, but on the other hand it has some drawbacks like it does not provide adequate robustness. Frequency domain image enhancement technique basically works by manipulating Fourier coefficients. This method describes mathematical functions with respect to the frequency and it operates on Frequency transform i.e. Fourier coefficients discrete wavelet transform (DWT), and discrete cosine transform (DCT). The advantages are it is easy for computation complexity and robust. Similarly it has having some drawbacks like it cannot able to enhance all the parts of the image simultaneously very well, difficult to automate the procedure of image enhancement.

2. LITERATURE REVIEW

Jyoti Rao et. al. [1] proposed a system steganography is included to NVSS scheme to securely transfer data by hiding it behind the secret image. To increase the security further this secret data is encrypted before performing steganography. Hence the secret data is in encrypted format. This secret image is then converted into share which is finally embedded in cover image. This proposed scheme is able to share black and white, grey level or color images secretly. Also this scheme is easy to implement.

Rupali Bhardwaja et. al. [2] provide two levels of security through a two step process, rather than hidden the message bits directly in cover image, they are scrambled in a random order generated by 2D Arnold Cat Map after that encrypted message is hidden behind a cover image using basic LSB method. MSE (Mean Square Error) and PSNR (Peak Signal to Noise Ratio) are two common quality measurements to measure the difference between the cover-image and the stegoimage. Results showed that the proposed method gives better results than simple LSB with higher PSNR and lower MSE.

Sadaf Bukhari et. al. [3] provides a technique for the protection of image in open wireless channel. It depends on steganography and cryptography (double random phase encoding). In this method primary step is to cover a message image inside an another image through steganography to make a stego image and then a simple encoding technique; double random phase encoding (DRPE) is perform on stego-image. For the evaluation of proposed technique, statistical tests like entropy, time analysis and peak to signal noise ratio (PSNR) with and without noises (Gaussian, salt n pepper and speckle) are performed which illustrate that the proposed technique provide better security to the transmitted image in wireless channel than the other techniques.

Shreyank N Gowda [4] proposed an algorithm has been significantly enhances the security of the algorithm. An

innovative enhancement is added in terms of increasing the chaos factor of the algorithm by adding the randomness to it. Also it can be seen that the time of execution does not get significantly vary. This ensures the algorithm is as efficient as plausible with regards to time and also security. The proposed algorithm increases the capacity of hiding data since we use more images. This also increases the size of input we need. But with expanding technology, size of data has stopped being a significant drawback for algorithms.

The proposed algorithm takes slightly more time to execute than the standard LSB. This is expected as three additional features are added to the algorithm namely: encryption using Blowfish algorithm, breaking of blocks and formation of hash table. Even then for larger files the time taken is not significant.

3. IMAGE STEGANOGRAPHY

Steganography is divided into many types depending upon the cover object such as audio, video, image, network and text. In image steganography following terminologies are important, first is cover image, second is the message image and third is the stego image which is formed once inserts the message into the cover image. In image steganography many techniques are used to hide from view the secret information into cover image such as spatial domain method, transform domain technique, distortion technique and mask and filtering technique. We use least significant bit technique (LSB) from the spatial domain steganography technique.

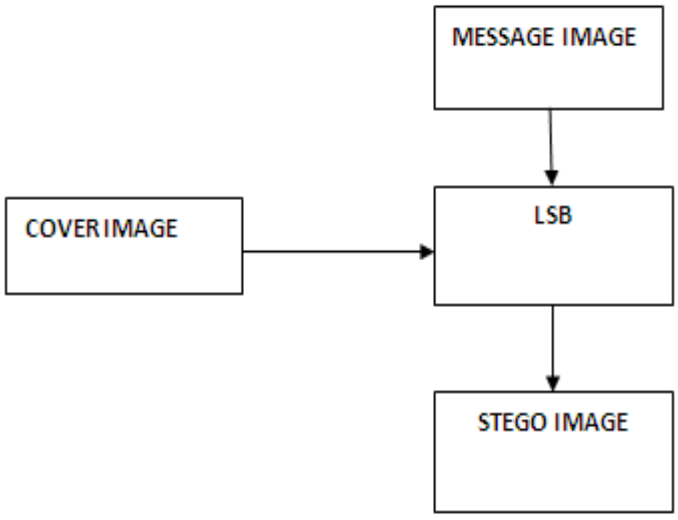

Figure 1: Basic Image Steganography Technique

4. ATTRIBUTES OF STEGANOGRAPHY

The desired attributes of Steganography are imperceptibility, capacity and robustness

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A. Imperceptibility

This is the first and foremost requirement of any Steganographic algorithm. According to this feature, a good Steganographic system should not cause any degradation to the quality of the stego, the secret message should remain invisible and undetectable to normal human vision and there should be no visual difference between the original object and the stego object so as to make it unsusceptible and safe

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B. Capacity

The information hiding capacity of Steganography should be very high in contrast to that of watermarking, which needs to embed only a small amount of copyright information.

C. Robustness

Robustness the system should be robust against statistical attacks and/or image manipulations. Statistical steganalysis is the practice of detecting hidden information through applying statistical tests on image data. Many Steganographic algorithms leave a “signature” when embedding information that can be easily detected through statistical analysis. To be able to pass by a warden without being detected, a Steganographic algorithm must not leave such a mark in the image as be statistically significant.

5. IMAGE ENHANCEMENT TECHNIQUES

5.1 Histogram Equalization (HE)

Histogram equalization is a technique by which the dynamic range of the histogram of an image is increased. It flattens and stretches the dynamic range of the image's histogram and resulting in overall contrast improvement [7]. Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities.

5.2 Local Enhancement Equalization (LHE) technique

The Histogram Equalization discussed above is global method, which means it increases the overall contrast of the image. So this method is suitable for overall enhancement. This method can be easily adapted to local enhancement. The procedure is to define the neighborhood and move the centre of this area from pixel to pixel. At each location, calculate histogram of the points in the neighborhood. Obtain histogram equalization/specification function. Finally this function is used to map gray level of pixel cantered in neighborhood.

5.3 Contrast Stretching

Contrast stretching enhances image by enhancing contrast between various parts of the original image. The basic idea is to improve the image quality by increasing the dynamic range of gray levels.

5.4 Root Mean Squared Error

Root Mean Squared Error is used to find the dissimilarity between the reference image and the fused image. Low RMSE values indicate that the test image is close to the reference image.

5.5 Peak Signal to Noise Ratio

Peak Signal to Noise Ratio measures the quality and the value will be high if the fused image is more identical to the reference image.

5.6 Structural Similarity Index Measure (SSIM)

Structural Similarity Index Measure (SSIM) measures the structural resemblance between two images and this reference metric considers image degradation as a modification in structural information.

5.7 Spatial Frequency

Spatial Frequency (SF) finds the clarity of the resultant fused image with the edge information computed using the row and column frequency. Higher Spatial Frequency indicates the higher clarity of the image.

5.8 LEAST SIGNIFICANT BIT (LSB)

Digital images are mainly of two types (i) RGB (24 bit image) and (ii) Grey (8 bit image). Three bits of hidden information can be embedded in RGB image; one bit in LSB of each plane while in grey image one bit can be embedded. In basic LSB technique (in other words, eight bit technique), bit of bit plane zero of cover image is replaced by bit of the hidden message. Changing the LSB by +-1 does not change the appearance of the stego- image from the cover image a lot; they are lookalike same to each other.

6. CONCLUSION

This paper has presenting the study of various image enhancement techniques. The analysis and usage of different enhancement schemes are elaborated. The various performance metrics, which are used to measure the quality of the fused image were reviewed and analyzed.

7. REFERENCES

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