Reverse Image Data Hiding Using Transform Techniques

Dr. Neelesh Gupta, FIETE
Department of Electronics Communication Engineering, Ajay Kumar Garg Engineering College,
27 Kmstone, NH-24, Adhyatmic Nagar, Ghaziabad 201009 UP India
guptaneelesh@akgec.ac.in

Abstract — **In this paper, a discrete wavelet transform and discrete cosine transforms algorithmic rule is projected for digital images. Rather than attempting to keep peak signal-to-noise ratio value high, the projected algorithmic rule enhances the contrast of a host image to boost its visual quality. The side info is embedded in conjunction with the message bits into the host image so the initial image is totally retrievable. The proposed discrete wavelet transforms and discrete cosine transform techniques are used. Primary algorithmic rule achieves image contrast enhancement by DWT and DCT. Moreover, the analysis results show that the visual quality is preserved once a considerable amount of message bits have been embedded into the contrast-enhanced images, for contrast enhancement.**

Keywords: Contrast enhancement, DWT, DCT, Location map, Reversible data hiding, Visual quality.

I. INTRODUCTION

DATA hiding plays a very important role in data security. It aims at embedding imperceptible confidential information in media like still pictures, videos, audios, 3D meshes, etc. It consists of many branches like steganography, watermarking, visual cryptography, etc. Reversible data hiding (RDH) has been intensively studied. Referred to as invertible or lossless data hiding, RDH embeds a piece of information into a host signal to induce the marked one, so that the primary signal is exactly recovered after the extracting process. The technique of RDH is useful in some sensitive applications where no permanent modification is allowed on the host signal. In literature, most of the projected algorithms are for digital photos to embed invisible info [1–8] or a visible watermark [9].

In contrast, the additional modern algorithms [5–8] manipulate the additional centrally distributed prediction errors by exploiting the correlations between neighboring pixels, causing less distortion as compared with that caused by information hiding. Though the peak signal-to-noise ratio of a marked image generated with a prediction error based algorithm is kept high, the visual quality can hardly be improved as a result of distortion introduced by embedding operations. For images acquired with poor illumination, raising visual quality is necessary than just keeping the PSNR high. Moreover, contrast improvement of medical or satellite photos is desirable to highlight main points for visual examination. Though the PSNR worth of the improved image is typically low, visibility of image details is improved. Reversible data embedding, that is also known as lossless information embedding, embeds invisible data (which is named a payload) into a digital image in a reversible fashion. An intriguing feature of reversible data embedding is that the reversibility, that is, one will remove the embedded information to restore the initial image.

II. CONTRAST ENHANCEMENT

Contrast enhancement techniques are used widely in image processing. One of the most common automatic procedures is discrete wavelet transform and discrete cosine transform. This is often less effective once the contrast characteristics vary across the image. Adaptive HE [3] (AHE) overcomes this drawback by generating the mapping for every pixel from the image during a surrounding window. AHE doesn't permit the degree of contrast improvement to be regulated. The extent to which the character of the image gets modified is undesirable for several applications. One suggested technique [7] for obtaining a range of effects between full HE and leaving a picture unchanged involves blurring the local image before evaluating the mapping.

Reversible (lossless) information hiding (embedding) technique allows exact recovery of the original host signal upon extraction of the embedded data. A generalization of the well-known LSB (least vital bit) modification is projected because the information embedding technique that introduces further operating points on the capacity-distortion curve. Lossless recovery of the initial data is achieved by compressing parts of the signal that are susceptible to embedding distortion, and transmitting these compressed descriptions as part of the embedded payload. A prediction-based conditional entropy coder WHO utilizes static parts of the host as side-information improves the compression efficiency, and hence the lossless data embedding capacity.

III. TECHNIQUES

We propose reversible image data hiding technique with best quality of image for security. Digital watermarking is the method of embedding data into digital multimedia system content such that data will later be extracted or detected for a range of functions including copy interference and control.

Digital watermarking has become an active and necessary space of analysis. Development and commercialization of watermarking techniques is deemed essential to help address a number of challenges faced by the speedy proliferation of digital content.

Discrete Wavelet Transform: The wavelet transform gained widespread acceptance in signal processing and image compression. Recently the JPEG committee released its new image coding standard, JPEG-2000, which is based upon DWT. Wavelet transform, decomposes a signal into a set of basic functions, called wavelets. Wavelets are obtained from a single prototype wavelet called mother wavelet by dilations and shifting [8]. The DWT was introduced as a highly efficient and flexible method for sub-band decomposition of signals. The DWT is nowadays established as a key operation in image processing. It involves multi-resolution analysis which decomposes images into wavelet coefficients and scaling function. In Discrete Wavelet Transform, signal energy concentrates in specific wavelet coefficients. This characteristic is useful for compressing images [9]. Wavelets convert the image into a series of wavelets that can be stored more efficiently than pixel blocks. Wavelets have rough edges; they are able to render pictures better by eliminating the blockiness. In DWT, a timescale representation of the digital signal is obtained using digital filtering techniques. The signal to be analyzed is passed through filters with different cut-off frequencies at different scales. It is easy to implement and reduces the computation time and resources required.

Discrete Cosine Transform: The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. It is widely used in image compression. Here we develop some simple functions to compute the DCT and to compress images. The DCT is a close relative of the discrete Fourier transform (DFT). Its application to image compression was pioneered by Chen. In this work we develop some simple functions to compute the DCT and show how it is used for image compression.

Taking these aspects into account, operating in a frequency domain becomes attractive. The classic and still most popular domain for image processing is that of the Discrete-Cosine-Transform, or DCT. The DCT permits a picture to be shifted into completely different frequency bands, making it easier to embed watermarking data into the center frequency bands of an image. The center frequency bands are chosen to avoid the most visual necessary parts of the image (low frequencies) whereby not over-exposing themselves to removal through compression and noise attacks (high frequencies).

One such technique utilizes the comparison of middle-band DCT coefficients to code one bit into a DCT block. To begin, we tend to stipulate the middle-band frequencies (FM) of an 8x8 DCT block as shown below in figure. FL is employed to denote the bottom frequency components of the block, whereas FH is utilized to denote the upper frequency components. FM is chosen because the embedding region provides resistance to lossy compression techniques, while avoiding vital modification of the image.

IV. PROPOSED METHOD

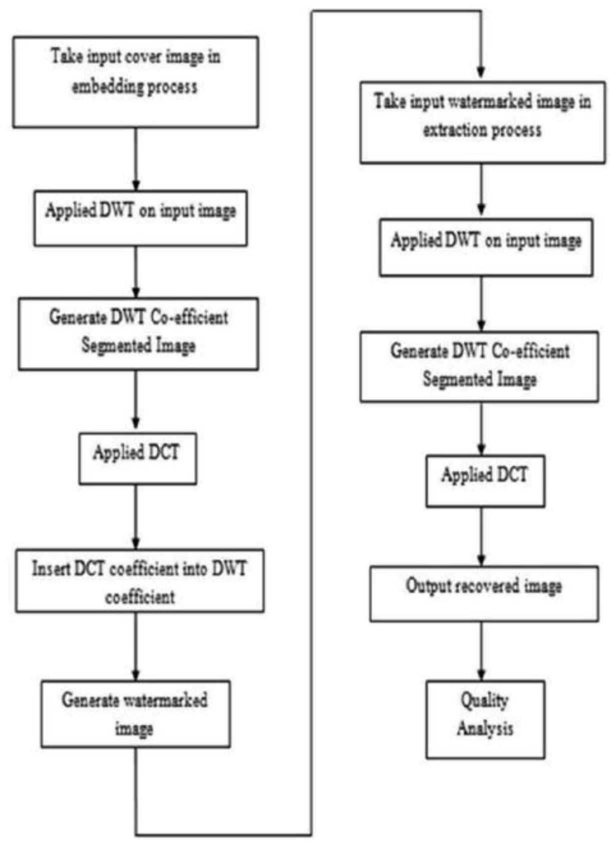


Figure 1. Flow diagram of proposed method.

First, we run the code then open the window. After that we write the guide in command window then open data hiding following steps window. In the data hiding embedding window firstly we browse the original image that is input image then apply discrete wavelet transform in the input image. We get the four segmented images after applying the DWT: Lower resolutions image, Vertical band, Horizontal band and Diagonal band. Then discrete cosine transform is applied. After that we browse logo for data hiding. Then perform the embedding process after which we obtain the watermark image in the output of embedding process.

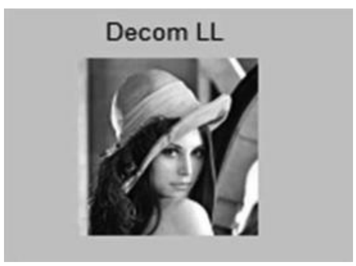
Thereafter perform the data hiding extraction process after which we obtain the recovered data logo that is extracted output in the extraction process. Lastly we optimize image quality by the quality analysis process.

V. SIMULATION RESULTS

Simulation results are as follows:

Figure 2 Third input image

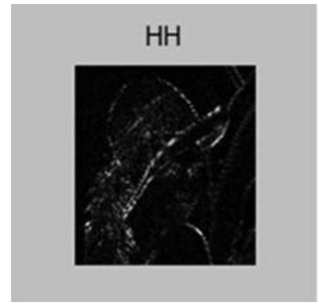
Figure 2 shows the input image for Secure Data Hiding using DWT and DCT.



(*a*) Lower resolution image

(*b*) Vertical band

(*c*) Horizontal band



(*d*) Diagonal band

Figure 3. Segmented images.

Figure 3 shows the segmented image. The DWT is applied on the input image after we get the segmented image. Four segmented images are: Lower resolution image, Vertical band, Horizontal band and Diagonal band.

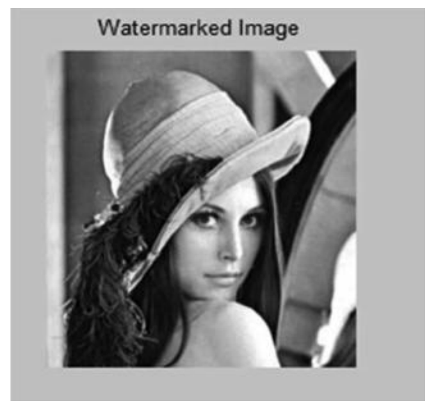
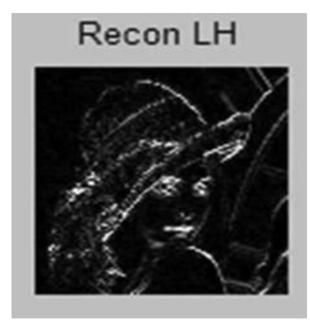
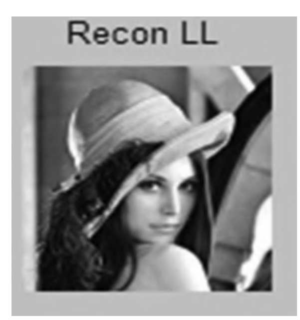


Figure 4. Emedding output image



(*a*) Lower resolution image



(*b*) Vertical band

(*c*) Horizontal band

(*d*) Diagonal band

Figure 5. Segmented images.

Figure 5 shows the segmented image. The DWT applied on the data hides image after which we get the segmented image. The four segmented images are: Lower resolution image, Vertical band, Horizontal band and Diagonal band.

Figure 6. Extracted output image.

Figure 6 shows the extracted output image.

TABLE 1 -- COMPARISON TABLE

Input	**PSNR**	**SSIM**	**Payload**
Existing Method	30.34	0.9694	0.270
Proposed Method	65.0751	0.9991	0.210

The comparison tables of previous paper and proposed work PSNR, and SSIM (Structural Similarity Image Metric) values are shown in this section. Calculated parameters are better than existing technique.

VI. CONCLUSION

In this paper the discrete wavelet transform and discrete cosine transform methods are used for hiding data. DWT and DCT can be applied on the image for obtaining the high frequency pictures and for robustness in geometrical treatment PSNR value obtained is higher than that of the previous work. So, our image quality turns out to be better than the previous image result.

REFERENCES

[1] Hao-Tian Wu, Jean-Luc Dugelay and Yun-Qing Shi, "Reversible image data hiding with contrast enhancement", *IEEE Signal Processing Letters*, vol. 22, no. 1, January 2015.

[2] Xinpeng Zhang "Reversible data hiding in encrypted image", *Ibid.*, vol. 18, no. 4, April 2011.

[3] Wei-Liang Tai, Chia-Ming Yeh and Chin-Chen Chang, "Reversible data hiding based on histogram modification of pixel differences," *IEEE Trans. Circuits and Systems for Video Technology*, vol. 19, no. 6, June 2009.

[4] Jun Tian "Reversible data embedding using a difference expansion," *Ibid*., vol. 13, no. 8, August 2003.

[5] Yongjian Hu, Heung-Kyu Lee and Jianwei Li. "DE-Based reversible data hiding with improved overflow location map," *Ibid.*, vol. 19, no. 2, February 2009.

[6] Z. Zhao, H. Luo, Z-M. Lu and J.S.Pan, "Reversible data hiding based on multilevel histrogram and sequential recovery," *Int. J. Electron. Commun.* (AEU), vol. 65, pp. 814-826, 2011.

[7] M. Kuribayashi and H. Tanaka, "Fingerprinting protocol for images based on additive homomorphic property," *IEEE Trans. Image Process*., vol. 14, pp. 2129–2139, 2005.

[8] Y.T. N. Memon and P. W. Wong, "A buyer-seller watermarking protocol," *Ibid.*, vol. 10, no. 4, pp. 643–649, Apr. 2001.

[9] S. Lian, Z. Liu, Z. Ren and H. Wang, "Commutative encryption and watermarking in video compression," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 17, no. 6, pp. 774–778, 2007.

[10] L. Luo, Z. Chen, M. Chen, X. Zeng and Z. Xiong, "Reversible image watermarking using interpolation technique," *IEEE Trans. Inf. Forensics Secur*., vol. 5, no. 1, pp. 187–193, 2010.

Dr. Neelesh Gupta, FIETE (b 12.10.1979) obtained Ph.D in Electronics and Communication from Rajiv Gandhi Technical University, Bhopal, India. Possesses over 16 years of teaching experience. Presently, working as a Professor in EC AKGEC, Ghaziabad. Earlier he served as HoD and Professor in EC in Truba Institute of Engineering and Information Technology, Bhopal.

Obtained BE in electronics and telecommunication in 2002 from LNCT, Bhopal and MTech degree in microwave and millimeter waves in 2007 from MANIT, Bhopal. His research interests include: wireless communication, microwave and digital signal processing. Presented research papers in conferences in India and abroad and published number of papers in international journals. Guided M. Tech students.

He is reviewer and editorial member of international journals**.** Adjudged Best teacher in Srijan-2015 ; honoured with Guru Faculty Award and by IETE on the occasion of Teacher's Day. Co-Authored *Fundamentals of Electronics Engineering*, Techmax Publications, Pune.