Journal of The Gujarat Research Society
ISSN: 0374-8588
Volume 21 Issue 8, August 2019

A REVIEW PAPER ON IMAGE COMPRESSION USING DWT-SPIHT ALGORITHM

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Abstract

Health telematics technologies and services are growing with the advancement of communication technology. In view of the increasingly important role played by digital medical imaging in modern health care, vast amounts of image data need to be processed and/or transmitted economically. The creation of image compression systems that combine a high compression ratio with critical information preservation is important. In the field of image compression, wavelets have been a major advancement over the past decade. In this paper, a hybrid scheme is proposed for medical image compression using both discrete wavelet transform (DWT) and discrete cosine transform (DCT). The DWT data, which typically have zero mean and small variance, are applied to DCT, achieving better compression than obtained from either technique alone. Compared with JPEG and set partitioning in hierarchical trees (SPIHT) coders, the results of the hybrid method are compared and the performance of the proposed scheme is found to be better.

Keywords: *Digital Image, Digital Communication, Lossless Compression, Lossy Compression, Storage.*

I. INTRODUCTION

The use of digital images is growing tremendously in this era of increasing technology. A digital image is represented with the aid of pixels, which can be considered as little dots on the screen [1]. Each digital image pixel indicates the colour of the image (for coloured images) or the level of grey at a single point in the image (for monochrome images). A digital image is an array of rectangular pixels, also referred to as a bitmap [2]. Despite rapid advances in mass storage density, processing speeds, and digital communication system efficiency, the demand for data storage space and data transmission bandwidth continues to outperform the capabilities of available technologies [3].

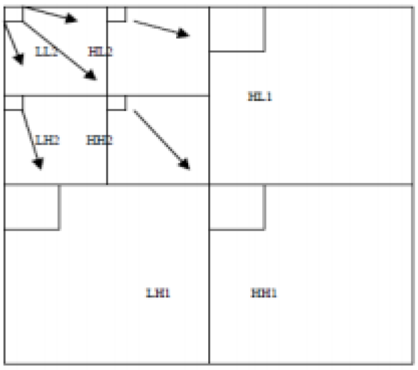

Fig. 1 Illustrates parent child relationship in SPIHT

In order to reduce their storage sizes and to use a smaller space, different techniques may be used to compress the images. We may use two ways to categorise techniques for compression.

A. **Lossy Compression System: -**

Lossy compression techniques is used in images where we can sacrifice some of the finer details in the image to save a little more bandwidth or storage space[4].

B. **Lossless compression system: -**

Lossless Compression System aims at reducing the bit rate of the compressed output without any distortion of the image. The bit-stream after decompression is identical to the original bit stream [5].

C. **Predictive coding: -**

It is a lossless coding method, which means the value for every element in the decoded image and the original image is identical to Differential Pulse Code Modulation (DPCM). The Figure 1 shows the parent child relationship in SPIHT. The correlation analysis of the pictures can be done by using the following equations [6].

$$E(x) = \frac{1}{N}\sum_{i=1}^{N} x_i$$

$$D(x) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))^2$$

$$cov\ (x, y) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))\ (y_i - E(y))$$

Journal of The Gujarat Research Society

ISSN: 0374-8588
Volume 21 Issue 8, August 2019

$$r_{xy} = \frac{cov\ (x,y)}{\sqrt{D(x)}\sqrt{D(y)}}$$

Herein the $\sqrt{D(x)}\ \neq 0, \sqrt{D(y)} \neq 0$

The critical parameter used to calculate the absolute difference between the encrypted image E and the original source image P is MAE. Let us consider the width as well as the height of the source image, respectively, for the W and the H. The MAE expression is given below.

$$MAE = \frac{1}{W \times H}\sum_{i=1}^{H}\sum_{j=1}^{W}|p(i,j) - E(i,j)|$$

$$r_{x,y} = \frac{C(x,y)}{\sqrt{D(x)}.\sqrt{D(y)}}$$

Where $C(x,y), D(x)$ and $D(y)$ can be evaluated by using the following equations.

$$C(x,y) = \frac{\sum_{i=1}^{K}(x_i - E(x))(y_i - E(y))}{K}$$

$$D(x) = \frac{1}{K}\sum_{i=1}^{K}(x_i - E(x))^2$$

$$D(y) = \frac{1}{K}\sum_{i=1}^{K}(y_i - E(y))^2$$

II. LITERATURE REVIEW

A research on image compression based on discrete cosine transformation and multi-stage vector quantization was conducted by Zhou et al. This paper suggests an image compression technique based on discrete cosine transformation (DCT). This device is a hybrid instrument which combines vector quantization (VQ) and differential pulse code modulation (DPCM). This technique begins with the transformation of images from a spatial domain to a frequency domain using DCT. Then the block data is converted into a vector, according to zigzag order, and then truncated. The vector is then split into coefficients of DC and AC [7-9].

III. DISCUSSION AND CONCLUSION

This paper has suggested a new blind image watermarking scheme in the DWT domain using the SPIHT algorithm. Arnold scrambling is added to the watermark picture to further boost the security of the device. Only the private key and dimensions of the watermark image are required during extraction. Since the embedding is done in the low frequency band, even the imperceptibility criterion is accomplished quite well by the proposed scheme. To pick essential coefficients from the DWT coefficients, the SPIHT algorithm is used. A number of attacks measure the robustness of the scheme and the outcomes are compared to those of the current methods. From the substantially distorted image resulting from multiple attack operations such as JPEG compression, additive noise, median filtering, average filtering, Gaussian filtering, histogram equalisation, and cropping and contrast manipulation, the watermark can be effectively extracted. Overall, three important characteristics have been met by the proposed scheme: protection, imperceptibility and robustness, and a trade-off is made between them.

IV. REFERENCES

[1] S. N. Kumar, A. Lenin Fred, and P. Sebastin Varghese, "Compression of CT Images using Contextual Vector Quantization with Simulated Annealing for Telemedicine Application," *J. Med. Syst.*, 2018, doi: 10.1007/s10916-018-1090-7.

[2] L. Theis, W. Shi, A. Cunningham, and F. Huszár, "Lossy image compression with compressive autoencoders," *arXiv*. 2017.

[3] O. Rippel and L. Bourdev, "Real-time adaptive image compression," 2017.

[4] R. A.M, K. W.M, E. M. A, and W. Ahmed, "Jpeg Image Compression Using Discrete Cosine Transform - A Survey," *Int. J. Comput. Sci. Eng. Surv.*, vol. 5, no. 2, pp. 39–47, 2014, doi: 10.5121/ijcses.2014.5204.

[5] M. Pooyan, A. Taheri, and M. Moazami-Goudarzi, "Wavelet Compression of ECG signals using SPIHT algorithm," *J. signal*, 2004.

[6] S. NirmalRaj, "SPIHT: A set partitioning in hierarchical trees algorithm for image compression," *Contemp. Eng. Sci.*, 2015, doi: 10.12988/ces.2015.519.

[7] Sanjeev Kumar, "Triple Frequency S-Shaped Circularly Polarized Microstrip Antenna with Small Frequency-Ratio," *Int. J. Innov. Res. Comput. Commun. Eng.*, vol. 4, no. 8, 2016.
[Online] Available: http://www.ijircce.com/upload/2016/august/24_Triple_new.pdf.

[8] M. H. Horng, "Vector quantization using the firefly algorithm for image compression," *Expert Syst. Appl.*, 2012, doi: 10.1016/j.eswa.2011.07.108.

[9] X. Zhou, Y. Bai, and C. Wang, "Image compression based on discrete cosine transform and multistage vector quantization," *Int. J. Multimed. Ubiquitous Eng.*, 2015, doi: 10.14257/ijmue.2015.10.6.33.