Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 2, February 2015, pg.18 – 23

SURVEY ARTICLE

A Survey on Medical Image Compression Using Hybrid Technique

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Abstract- This survey is based on image compression under various image compression technique. With motive and need to improve image compression for professional fields such as medical imaging. In Medical fields compression is necessary for big data storage and data transfer for diagnosis. Many compression techniques where used in medical advancement. In this paper presents various image compression technique. This analysis provide better knowledge to identifying the advantages and give better image compression result as compare to the previous as shown in the Matlab Simulations.

Keywords- Image Compression, Hybrid scheme DWT, DCT, Huffman encoding, DPCM.

I. INTRODUCTION

Compression refers to reducing the quantity of data used to represent a file, image or video content without excessively reducing the quality of the original data [1].Image compression is the application of data compression on digital images. The main purpose of image compression is to reduce the redundancy and irrelevancy present in the image, so that it can be stored and transferred efficiently [2]. The compressed image is represented by less number of bits compared to original. Hence, the required storage size will be reduced, consequently maximum images can be stored and it can transferred in faster way to save the time , transmission bandwidth.[3]

Compression of image plays an important role in medical field for efficient storage and transmission. There are many types of medical image compression techniques are available. Different techniques uses in different image like X-ray angiograms (XA), magnetic resonance image (MRI), etc[4].

Compression is achieved by the removal of one or more of three basic redundancies: (1) Coding redundancy, which is present when less than optimal (i.e. the smallest length) code words are used. (2) Interpixel redundancy, which results

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from correlations between the pixels of an image. (3) psycho visual redundancy which is due to data that is ignored by the human visual system(i.e. visually noessential information)[5]. Most of existing image coding algorithm is based on the correlation between adjacent pixels and therefore the compression ratio is not high. Image compression may be lossy or lossless. Lossless compression is preferred for archival purposes and often for medical imaging, technical drawings, clip art. This is because lossy compression methods, especially when used at low bit rates, introduce compression artifacts [6]. Lossy methods are especially suitable for natural images such as photographs in applications where minor loss of fidelity is acceptable to achieve a substantial reduction in bit rate. It is possible to compress many types of digital data in a way that reduces the size of computer file needed to store it, with no loss of the full information contained in the original file.[7]

II. TYPES OF COMPRESSION

Two ways of classifying compression techniques are mentioned here:

A. **Lossless Vs. Lossy compression:** In lossless compression schemes the reconstructed images, after compression is numerically identical to the original image. However, lossless compression can only a achieve a modest amount of compression. An image reconstructed following lossy compression contains degradation relative to the original. Often this is because the compression scheme completely discards redundant information. However, lossy schemes are capable of achieving much higher compression.

B. **Predictive Vs. Transform Coding:** In predictive coding, information already sent or available is used to predict future values and the difference is coded. Since, this is done in the image or spatial domain, it is relatively simple to implement and is readily adapted to local image characteristics. Differential Pulse Code Modulation is one of the example of predictive coding. Transform coding on the other hand, first transform the image from its spatial domain representation to a different type of representation using some well-known transform values (coefficients). This method provides greater data compression compared to predictive method, although at the expense of greater computation.

Discrete Cosine Transform

The discrete cosine transform (DCT) represents an image as a sum of sinusoids of varying magnitudes and frequencies. The DCT has the property that, for a typical image, most of the visually significant information about the image is concentrated in just a few coefficients of the DCT. The DCT works by separating images into the parts of different frequencies. During a step called Quantization, where parts of compression actually occur, the less important frequencies are discarded, hence the use of the lossy. Then the most important frequencies that remain are used retrieve the image in decomposition process. As a result , reconstructed image is distorted.

Discrete Wavelet Transform

All mainstream encoders use the Discrete Cosine Transform (DCT) to perform transform coding. The DCT maps a time domain signals to a frequency domain representation. We can compress the frequency domain spectrum by truncating low intensity regions. However, the DCT has several drawbacks. Computation of the DCT takes an extremely long time and grows exponentially with signal size. To calculate the DCT of an entire video frame takes an unacceptable amount of time. The only solution is to partition the frame into small blocks and then apply the DCT to each block. However, this leads to degradation in picture quality. The Discrete Wavelet Transform (DWT), offers a better solution.
The DWT is another transform that maps time domain signals to frequency domain representations. But the DWT has a distinct advantage, in essence, can be computed by performing a set of digital filters which can be done quickly. This allows us to apply the DWT on entire signals without taking a significant performance hit. By analyzing the entire signal the DWT captures more information than the DCT and can produce better results. The DWT separates the images high frequency components from the rest of the image, resizes the remaining parts and rearranges them to form a new transformed image.

Huffman Compression

Huffman algorithm is generating minimum redundancy codes compared to other algorithms. The Huffman coding has effectively used in text, image, video compression and conferencing system such as JPEG, MPEG and H.263 etc. The Huffman coding technique collects unique symbols from the source image and calculates its probability value for each

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symbol and sorts the symbols based on its probability value. Further, from the lowest probability value symbol to the highest probability value symbol, two symbols combined at a time to form a binary tree. Moreover, allocates zero to the left node and one to the right node starting from the root of the tree. To obtain Huffman code for a particular symbol, all zero and one collected from the root to that particular node in the same order.

- Minimum distortion
- High compression ratio
- Removing redundancy

III. LITERATURE SURVEY

To analyze about the medical image compression techniques, the literature survey has been done and discussed. There are many medical image compression using hybrid techniques are evolving every day. Hence, it is need to study a literature about it, to understand the techniques also to use the best methods during compression of medical image.

Embedded Image Coding Using Zerotrees Of Wavelet Coefficients, 1993

Jerome M. Sharpiro [1] proposed Embedded Zerotree Wavelet Algorithm for image compression, having the property that the bits in the bit stream are generated in order of importance, yielding a fully embedded code.

This paper addresses on obtaining best image quality for a given bit rate and accomplishing this task in an embedded fashion. i.e. in a such way tha all encoding of the same image at lower bit rates are embedded in the beginning of the bit stream for the target bit rate.

Image Compression Using The Discrete Cosine Transform, 1994

Andrew B. Watson NASA Ames Research Center [2] have proposed DCT technique for converting a signal into elementary frequency components. It is widely used in image compression And develop some simple functions to compute the DCT and to compress image. Thes functions illustrate the power of *Mathematica* in the prototyping of image processing algorithms.

Performance Evaluation of DWT, DCT and WHT for Compression of Ultrasonic Signals, 2004

Guilherme Cardoso and Jafar Saniie [3] describes data compression performance of the Descrete Wavelet Transform(DWT), Descrete Cosine Transform(DCT) and the Walsh-Hadamard Transform(WHT) is examine using Simulated and experimental Ultrasonic signals. Hence, result shows the relationship between bandwidth of ultrasonic echoes and data compression performance.

Hybrid DWT-DCT Algorithm For Biomedical Image And Video Compression Applications, 2010

Suchitra Shrestha and Khan Wahid [4] present a hybrid algorithm that perform a Descrete Cosine Transform(DWT) on Discrete Wavelet Transform coefficients. In this paper, proposed hybrid algorithm performs much better in term of peak-signal-to-noise-ratio with a higher compression ratio to standalone DCT and DWT algorithms. The scheme is intended to be used as image/video compressor engine in medical imaging and video applications, such as, telemedicine and wireless capsule endoscopy.

A Comparative Study Of DCT, DWT & Hybride(DCT-DWT) Transform,2010

Archana Deshlahra, G. S. Shirnevar, Dr. A. K. Sahoo [5] presents hybride model, comparative analysis of image compression is done by three transform method which are Discrete Cosine Transform(DCT), Discrete Wavelet Transform(DWT) & Hybrid Transform(DCT-DWT) Transform. Matlab programs were written for each of the above method and concluded based on the results obtained that Hybride(DCT-DWT) algorithm performs much better than the standalone JPEG-based DCT, DWT algorithms in terms of peak signal to noise ratio(PSNR), as well as visual perception at higher compression ratio.

Hybrid Transform Coding Scheme For Medical Image Application, 2011

Aree Ali Mohammed, Jamal Ali Hussein [6] presents a proposed scheme for medical image compression based on hybrid compression technique(DWT and DCT). The goal is to achieve higher compression rates by applying different compression thresholds for wavelet coefficients for each DWT bands (LL and HH) while DCT transform is applied on(HL and LH) bands with preserving quality of reconstructed medical image. The retained coefficients are quantized by using adaptive quantization according to the type of transformation. Finally the entropy coding is used to encode the quantization indices. Experimental results show that the coding performance canbe significantly improved by hybrid DWT-DCT algorithm.

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Performance Analysis Of Medical Image Compression Techniques, 2012
Smitha Joyce Pinto , Prof. Jayanand P. Gawande [7] describes comparison of compression methods such as JPEG, JPEG 2000, SPIHT encoding on basis of compression ratio and compression quality. The comparison of these compression methods are classified according to different medical images like MRI and CT. For JPEG based image compression RLE and Huffman encoding techniques are used by varying the bits per pixel. For JPEG-2000 based image compression SPIHT encoding method is used. The DCT and DWT methods are compared by varying bits per pixel and measured the performance parameters of MSE, PSNR and Compression Ratio.

A New Entropy Algorithm For Image Compression Using DCT, 2012
D. Malarvizhi , Dr. K. Kuppusamy [8] introduced new alternative method for simultaneous image acquisition and compression called adaptive compressed sampling. It is also extend the need for image reconstruction on compressed images. Image reconstruction has to be defined in this context. Whereas image enhancement strives to bring out certain features in an image simplify the extraction Of image compression, image reconstruction is the attempt to retrieve information that has been lost or obscured in the imaging process itself.

Image Compression Using Descrete Cosine Transform & Descrete Wavelet Transform, 2012
Er. Ramandeep Kaur, Navneet Randhawa [9] describes an architecture of DCT and DWT standard of an image compression. DWT can be used to reduced the image size without losing much of the resolutions computed and the values less than pre-specified threshold. The paper covers some backgrounds of wavelet analysis, data compression and how DCT and DWT can be used for image compression and we proposed hybrid (DWT-DCT) algorithm for image compression and reconstruction taking benefit from advantages of both algorithms. The algorithms performs the Descrete Cosine Transform(DCT) on Descrete Wavelet Transform(DWT) coefficients.

Image Compression Using Hybrid Transform Technique, 2013
Nikita Bansal, Sanjay Kumar Dubey [10] have proposed a scheme for Image Compression using DCT and DWT named as hybrid compression technique. DCT has high compaction property and often require less computational resources and DWT is multiresolution transformation. The goal is to achieve higher compression rates with preserving quality of reconstructed image.

Survey of Lossless and Lossy Image Compression Techniques, 2013
Manjinder Kaur , Gaganpreet Kaur [11] describes to analyze and lossless image compression techniques , which provides high compression ratio than lossless compression scheme. Lossy compression is used for more compression ratio and lossless compression ratio is used when the original image are to be identical.

Improved Image Compression Using Wavelet Transform and Differential Pulse Code Modulation Technique, 2013
Akshay Kekre , Dr. Sanjay Pokle [12] describe the performance of image compression algorithm based on wavelet transform and differential pulse code modulation(DPCM). The simulation result show a improvement in the performance compared to the wavelet transform technique. The comparison also made by choosing various combinations of band and measuring compression ratio and PSNR.

A Survey On Various Medical Image Compression Techniques, 2013
Neelesh Kumar Sahu , Chandrashekhar Kamargaonkar [13] performed a survey on various compression techniques. This paper outlines the comparison of compression methods such as JPEG-LS and Interframe Coding, Optimized Volume of Interest , Motion Compensation and Customized Entropy Coding. EZW Encoding with Huffman Encoder, Curvelet Transform, Visually Lossless Compression, Simple Selective Scan Order with Bit Plane Slicing on the basis of compression ratio and compression quality.

Analysis Of Image Compression Algorithm Using DCT And DWT Transforms, 2014
Navpreet Saroya , Prabhpreet Kaur [14] presents Discrete Cosine Transform(DCT) and Discrete Wavelet transform(DWT) implementation because these are lossy techniques. This paper aims at compression using DCT and Wavelet Transform by selecting proper method, better result for PSNR (Peak Signal To Noise Ratio) have been obtained.

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A Survey On Medical Image Compression Based On Transform, 2014
R. Bhavithra, L. Ayeesha Begame, K.S.L. Deepika [15] performed survey based on image compression under various image compression technique using transform. Motive and need to improve image compression for professional fields such as medical imaging. In Medical fields compression is necessary for big data storage and data transfer for diagnosis. This analysis provides knowledge to identifying the advantages and choosing correct method for compression.

An Enhanced Hybrid Technology For Digital Image Compression, 2014
Malvika Dixit , Harbinder Singh [16] presents discrete approach towards MATLAB implementation of Discrete Wavelet Transform(DWT) and Vector quantization for compression. A new image compression theme primarily based on Discrete Wavelet Transform is proposed in this paper that provides high compression ratio with no considerable degradation of image quality. To demonstrate the performance of the project methodology, a comparison between the project technique and different common compression technique applied.

Mixed DWT-DCT Approched Based Image Compression Technique, 2014
Mahinderpal Singh , Meenakshi Garg [17] describes Mixed approached (DWT-DCT) mainly used for transformation. DCT has high energy compaction property and requires less computational resources. On other hand, DWT is multiresolution Transformation. In this paper, proposed mixed (DWT-DCT) algorithm for image compression and reconstruction taking benefit from the advantages of both algorithms.

IV. CONCLUSION

In this paper, investigates mainly on the various types of medical image compression techniques that are existing and putting it together for literature survey. In these techniques unique characteristics is used to compress medical image with some drawbacks. All compression techniques are useful for real time medical image transmission and storage. Everyday new compression technique is evolving selection of high PSNR value will lead to maintain the quality of the image and success in compression process.

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