A Survey on Different Hybrid Techniques of Image Compression

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Abstract - In recent years wide range of study has been done on wavelet transforms and their use in different applications. Increased use of images has made it compulsory to study the use of wavelets in image compression application. In this paper we review and discuss about image compression, wavelet transformation, hybrid image compression. A combination of wavelet and transform algorithms within the same compression technology is called as hybrid image compression now a days these hybrid techniques are mostly used.

Keywords: - Image compression, wavelet transform, Hybrid wavelet transform

I. INTRODUCTION

A. Image compression:

Image compression is storing images using lesser number of bits than its original size. Image compression leads to less storage space and less bandwidth for transmission. Hence in this world of internet and multimedia applications image compression is of most important and interesting area to work on. It is used to store images in medical image database, to generate image database in biometrics and many other applications. The reduction is possible when the original image contains some type of redundancy. Image compression is field that studies methods for reducing the total number of bits required to represent an image. This can be achieved by eliminating various types of redundancy that exit in the pixel values. In general, three basic types of redundancies that follow.

Psycho-visual Redundancy**:** It is redundancy corresponding to different sensitivities to all image signals by human eyes. Therefore, eliminating some less relative important information in our visual processing may be acceptable.

Inter-pixel Redundancy: It is a redundancy corresponding to statistical dependencies among pixels, especially between neighboring pixels.

Coding Redundancy: The uncompressed image usually coded with each pixel by a fixed length. For example, an image with 256 gray scales is represented by an array of 8-bit integers. Using some variable length code schemes such as Huffman coding and arithmetic coding may produce compression.

B. Basic types of Image compression:

Image compression is divided into two categories: lossy and lossless. Both compression types remove data from an image that isn't obvious to the viewer, but they remove that data in different ways. Lossless compression works by compressing the overall image without removing any of the image's detail. As a result the overall file size will be compressed. Lossy compression works by removing image detail, but not in such a way that it is apparent to the viewer. In fact, lossy compression can reduce an image to one tenth of its original size with no visible changes to image quality Compression ratio and image quality of decompressed image, these are two major things to be considered in image compression as compression ratio increases, quality of reconstructed image starts degrading. There are many compression techniques like vector quantization, predictive coding, differential image coding, transform coding . Transform based techniques are popular for image compression especially at low bit rate. In transform domain, many researchers have worked on image compression and still this area is equally popular to work on. Discrete

Cosine Transform is widely used. It separates an image into different frequency components. Low frequency components are located at top left corner giving high energy compaction. High frequencies are located in bottom right corner. Elimination of these high frequency elements gives transformed image with few low frequency components. If image is reconstructed from such lesser number of transformed, low frequency elements, it gives compressed image without losing much data contents in original image. Wavelet transform coding is preferred over simple orthogonal transform in image compression due to its multi-resolution property. It provides enhanced image quality even at higher compression ratios.

C. Wavelet transformation:

Recently hybrid transformation techniques have come into picture which combines properties of two different transforms [1]. It gives compressed image with visually perceptible image quality. Wavelets are mathematical tools that can be used to extract information from many different kinds of data, including images. Hybrid wavelet transform matrix is formed using two component orthogonal transforms. One is base transform which contributes to global features of an image and another transform contributes to local features. .

II. OVERVIEW OF HYBRID IMAGECOMPRESSION

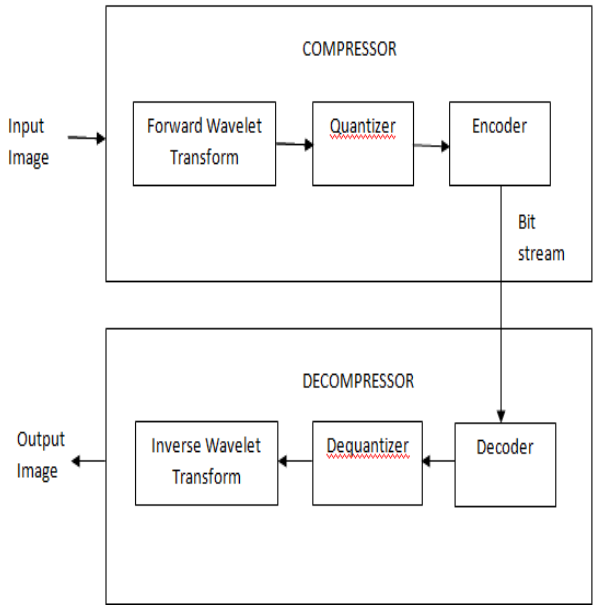

Figure 1. Hybrid Image Compression and Decompression

A simple block diagram of transform based Hybrid image compression and Decompression is shown in the figure 1. Transform based image compression schemes first involve the transformation of spatial information into another domain. For example, the DCT transforms an image into the frequency domain. The goal of the transformation is a compact, complete representation of the image. The transform should decorrelate the spatially distributed energy into fewer data samples such that no information is lost. Orthogonal transforms have the feature of eliminating redundancy in the transformed image. Compression occurs in the second step when the transformed image is quantized (i.e. when some data samples-usually those with insignificant energy-levels-are discarded). The inverse transform reconstructs The transform should decorrelate the spatially distributed energy into fewer data samples such that no information is lost. the compressed image in the spatial domain. Since the quantization process is not invertible, the reconstruction cannot perfectly recreate the original image. This type of compression is called lossy. In transform based image compression, entropy coding typically follows the quantization stage. Entropy coding minimizes the redundancy in the bit stream and is fully invertible at the decoding end. So, it is lossless.

III. RELATED WORK

Gerlind Plonka et al. [2] in paper “A New Hybrid Method for Image Approximation using the Easy Path Wavelet Transform” this paper have described first hybrid method that uses the tensor-product wavelet transform for smooth images and the EPWT for a sparse representation of the edges and textures of the image. As most known adaptive transforms for image approximation, the EPWT provides very good compression results but produces a non-negligible amount of extra costs due to the adaptivity of the method. Incorporating these \adaptivity costs, adaptive methods only slightly outperform the non-adaptive methods but with essentially higher computational costs. Also here, the remaining adaptivity costs are not negligible but considerably smaller than for the \pure" EPWT for image approximation.

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H. B. Kekre et al.[3] 2014 in paper"Robust Watermaking Technique Using Hybrid Wavelet Transform Generated From Kekre Transforms and Discrete Cosine Transform" have described novel image watermarking technique using Kekre's algorithm to generate hybrid wavelet transform DKT_DCT from Kekre transform and Discrete Cosine Transform. In the proposed technique, 256x256 hybrid transform is generated using 16x16 Kekre transform and 16x16 DCT whereas, 128x128 hybrid wavelet transform is generated using 32x32 Kekre transform and 4x4 DCT matrix. Generated DKT_DCT transform is applied to host and watermark in three different ways: column wise, row wise and full transform. Performances of these three ways of applying transform are compared against various image processing attacks namely image cropping, image compression, adding noise and image resizing attacks. Column DKT_DCT transform is most robust for compression and resizing attack whereas row DKT_DCT wavelet transform is most robust for cropping, JPEG compression attack and binary distributed run length noise attack for increased run length. Column and row DKT_DCT transform show exceptionally better performance than full DKT_DCT wavelet transform.

Dr. H.B. Kekre, et al.[4] in paper "Performance Comparison of Hybrid Wavelet Transform Formed by Combination of Different Base Transforms with DCT on Image Compression", In this paper, performance of different hybrid wavelet transforms has been compared. Two component orthogonal transforms of different sizes are used to form hybrid wavelet transform. First component transform called base transform is varied and second component transform is selected as DCT. Effect of variation in base transform with different size is observed in terms of root mean square error. It has been observed that DKT-DCT combination gives better performance even at higher compression ratios. Even with variation in size of base transform, DKT-DCT proves to be superior in performance.

Manisha Singh et al.[5] 2012 in paper "Image Compression Technique Using Hybrid Discrete Cosine Transform(DCT) And Discrete Wavelet Transform(DWT)",have described a hybrid scheme combing the DWT and the DCT algorithms under high compression ratio constraint for image has been presented. This paper gives idea about proposed algorithm has better performance as compared to the other stand alone algorithms. Moreover, the proposed algorithm was also compared with some standards and already developed hybrid algorithms. It was observed that the proposed hybrid algorithm performs better than the existing algorithms. required.

R. Krishnamoorthy et al [6] 2012 in paper "Low Complexity Hybrid Lossy To Lossless Image Coder With Combined Orthogonal Polynomials Transform And Integer Wavelet Transform" A new low complexity lossy to lossless hybrid image coder with combined orthogonal polynomials transform and integer wavelet transform is explained in this paper. The lifting based IWT is implemented for subband decomposition and progressive lossy to lossless compression is achieved using EZW subband algorithm. In order to reduce the computational complexity for encoding the lower subband signals using EZW algorithm, a new integer based Orthogonal Polynomials transform coding is applied on lower subbands and residual LL subband is obtained. The Normalization and mapping is done on all the subbands to avoid the subjective redundancy and subbands reorganization and hence the hierarchical subband zero tree structure is utilized for EZW algorithm. This hybrid technique is fast and encodes the image at lower bit rate when compared with existing technique.

IV. CONCLUSION

Now-a-days Hybrid technique is most widely used technique for compressing images. This paper gives basics of image compression and a recent survey of various types of Hybrid techniques which are improve the image compression.

REFERENCES

[1] Rachana Dhannawat, Tanuja Sarode, H. B. Kekre, "Kekre's Hybrid Wavelet Transform Technique with DCT, Walsh, Hartley and Kekre's Transform for Image Fusion", International Journal of Computer Engineering and Technology(IJCET), Vol. 4, Issue 1, Feb 2013, pp. 195-202.

[2] Gerlind Plonka, Stefanie Tenorth and Daniela Ros_ca, "A New Hybrid Method for Image Approximation using the Easy Path Wavelet Transform"

[3] Dr. H. B. Kekre, Dr. Tanuja Sarode, Shachi Natu,"Robust Watermaking Technique Using Hybrid Wavelet Transform Generated From Kekre Transforms and Discrete Cosine Transform",

International Journal of Scientific and Research Publications, Volume 4, Issue 2, February 2014

[4] Dr. H. B. Kekre, Tanuja Sarode, Prachi Natu, "Performance Comparison of Hybrid Wavelet Transform Formed by Combination of Different Base Transforms with DCT on Image Compression", International Journal of Innovative Research in Science, Engineering and Technology, Volume 3, Issue 1, January 2014.

[5]R.Krishnamoorthy, K. Rajavijayalakshmi and R. Punidha, "Low Complexity Hybrid Lossy To Lossless Image Coder With Combined Orthogonal Polynomials Transform And Integer Wavelet Transform" ICTACT Journal on image and video processing May 2012, volume: 02, ISSUE: 04

[6] Bhonde Nilesh, Shinde Sachin, Nagmode Pradip, D. B. Rane, "Image compression Using Discrete Wavelet Transform", International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 3, Special Issue, March-April 2013.

[7] Moh dAli Moustafa Alsayyh, Prof. Dr. Dzulkii Mohamad, "Image Compression Using Hybrid Technique", Information and Knowledge Management ISSN 2224- 5758 (Paper) ISSN 2224-896X (Online)Vol 2, No.7, 2012.