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An Image Compression: - A Survey

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Abstract— Image compression is a challenging field in this era of communication. There is a need to learn and examine the literature of image compression, as the demand for images, video sequences and computer animation has increased at very high rate so that the increment is radically over the years. In this paper we illustrate some current developments that have taken place in still image compression. We deal with about special compression methods and also provide a performance comparison. Functionality and morality of compression methods are discussed in a unified manner. This survey reviews more recent articles on image compression and discuss their role in current research directions. There are several image compression algorithms some of them are lossy and some of them are lossless. Thus medical image, pre press industry, art work, remote sensing images for lossless image compression

Keywords— Compression; image; Lossless; Lossy; GAP; EDP;.

I. INTRODUCTION

The development of computer technology in various fields has simplified the job of human being but it results in large amount of digital data. The challenge lies in managing this large amount of data, i.e. storing and retrieving it. The storing resources required for it also increases the cost of the overall system. If some practice is used to diminish this digital data without losing the original information, then the cost can be reduced. Joint photographic experts group (**JPEG**) was developed in 1980 [1] first international compression standard for continuous tone images. JPEG algorithm included several modes of operations. One of the techniques to reduce data is compression. Image compression technique is used to reduce the number of bits required to represent an image, which helps to reduce the storage space and transmission cost. Storage can be reduced by compression of image. Efficient compression technique should have the property of compressing different types of images giving better Compression Ratio (CR), low Mean Square Error (MSE), Bits per Pixel (BPP) and high Peak Signal to Noise Ratio (PSNR). FELICS (fast, efficient lossless Image compression) was proposed [2] by Paul G.howard et al. in 1993. It is based on context and arithmetic coding. Golomb codes are used here. CALIC (Context based adaptive lossless image codec)[3] is proposed in 1993.unique feature of CALIC is large number of modeling contexts are used. It is divided into two different modes that is binary and continuous mode. In binary mode two distinct intensity values are used 0/1. **GAP** (Gradient Adjustment Predictor) [4] is used in continuous mode for weight the neighboring pixel. It requires more memory spaces. It is 26% better than Huffman coded JPEG and 12% better than arithmetic coded JPEG. **JPEG-LS** proposed in 1999. It provides low complexity lossless compression. Better than JPEG and faster than JPEG2000.

II..LITERATURE SURVEY

TMW (Two way mixing Model)[5] it presented by Meyar in 1983.TMW uses two stage encoding process.

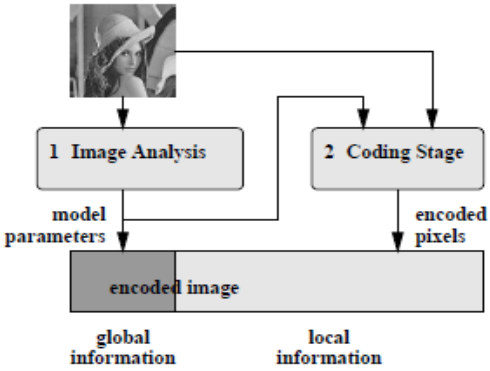

Fig1 : Flow Diagram of TMW

In this figure 1 Analysis stage consists of linear predictors, parameter which is suitable for image and also passed this information to the coding stage like side information. Coding stage consists of local information about the image. TMW

uses multiple probability distribution techniques. Then the probability distributions are blended together, resulting final probability distribution which is then used to encode the pixel. It provides better result than CALIC and History based blending predictors. History based blending predictor uses linear predictor and process pixel-by-pixel manner. Main demerits of History based blending predictor is explicitly detect the edge and edge orientation. CALIC address the problem by choosing from a set of fixed predictor or chooses only one predictor for a whole image. This is unsuitable for certain set of images like shapes test image.TMW provide better result for shapes text image set and also it used for image segmentation.

Edge directed Prediction (EDP) was outlined and evaluated by xin Li in 2001.LS (Least Square) based optimization is used in EDP [6][7]. It improves the prediction in the region of edge areas. It provides better result than CALIC. Instead of performing pixel by pixel basis, EDP perform Edge-by-Edge basis. In GAP, MED detecting edge & estimating the edge orientation explicitly but in EDP LS based approach locally optimized the prediction coefficients inside the casual window. It consists of 12 nearest neighboring pixels. Complexity of LS optimization is computation of covariance matrix. One of the main drawback of EDP, it is performed only for a fraction of pixel in the image EDP performance is based on the input image. If your image contains many edges then it performs well.

MED(H=4.56 bpp) GAP(H=4.39bpp)
EDP(H=4.22bpp)

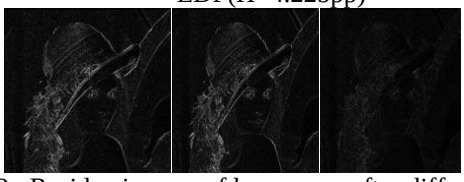

Fig 2 : Residue images of lenna grey after different prediction schemes

Hierarchical Decomposition and Pixel Prediction experimented by seyun Kim & Nam Ik Cho [8] in 2014. Input color image is first converted by RCT(reversible color transform) because of their invertible version.RCT [15] produce YCbCr, Y is compress by default compression like JPEG and the chrominance channel(Cb,Cr) is compressed by hierarchical prediction concepts. Signal variation still large in near the edges.

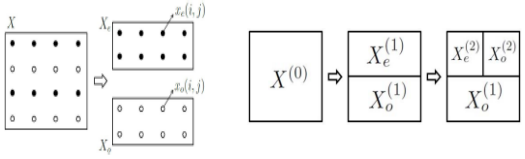

Fig 3: decomposition of input Image

Like in Fig 2 the chrominance image is decomposed into two sub images even number of rows (Xe) and a set of odd n umber of rows (X0). Xe is encoded by using the pixel in Xo,Xo is encoded by using Xe. Directional prediction is employed to avoid large prediction errors around the edges. If the horizontal edge is strong means horizontal prediction is used otherwise vertical prediction is used. It provides better result than JPEG 2000.

A lossless Image Compression Algorithm Using Variable Block Size Segmentation was developed . It segments the image into variable size blocks and encodes them depending on the characteristics exhibited by the pixels within the block. It outperforms other lossless compression schemes such as the Huffman, the arithmetic, the Lempel-Ziv and the JPEG. The block-based Maximum a Posteriori (MAP) segmentation for image compression was introduced [9]. Here, the segmentation algorithm using the MAP criterion was used. The conditional probability in the MAP criterion, which is formulated by the Bayesian framework, is in charge of classifying image blocks into edge, monotone, and textured blocks.

One of the lossy image compression is vector quantization.[10]. Image information can be losed by quantization steps. First image is splitted into fixed size block called training set and also develop a code book which has indexed image block of the equal size of specifying types of image block. Then it prepares a string for image by finding matching block index and arranging and quantized them.

The multistage segmentation for image compression is developed [11]. Multistage segmentation is obtained using a transform [12] which provide a tree-structured segmentation of the image. An image model is consumed for comprising different descriptions of pixels mendacious near the boundaries of a region and those lying in the inside. A Set Partition In Hierarchical Trees (SPIHT) and Vector Quantization (VQ) for image compression were used in hybrid coding system. Here the wavelet coefficients of the input image are rearranged to form the wavelet trees that are composed of the corresponding wavelet coefficients from all the sub bands of the same orientation. A simple tree classified based on amplitude distribution. It has been used to group wavelet trees into two classes. Each class of wavelet trees is encoded using an appropriate procedure, purposely either SPIHT or VQ.

Distributed source coding theorem based region of interest image compression method is available [13]. Region-of-interest (ROI) image compression is a new aspect in JPEG2000, which allows the ROI to be encoded with better quality than the rest of an image, i.e. background (BG).

JPEG was designed for compressing full-color or grayscale images of natural, real-world scenes [14-15]. And it is a lossy compression technique. The useful property of JPEG is that the degree of looseness can be different by adjust the compression parameters. Another important aspect of JPEG is that decoders can trade off decoding speed against image quality by using fast but inaccurate approximations to the required calculations.

Quad tree algorithms are the simple compression technique. Qualitative Image Compression Algorithm Relying on Quad tree was proposed [16]. The quad tree algorithms are considering on the simple averages and comparisons. A quad tree is a tree-like data structure where each node either terminates on a leaf containing useful information, or branches into four sub-level quad trees [1]. Here, a qualitative algorithm is designed based on the quad tree to split the image. This technique split the image into blocks and save them in a way that can return the blocks again quickly. Two stacks are used during the process of dividing the original image into blocks based on a threshold value. These stacks are used as an option of tree, and the separated blocks are numbered successfully to decide these blocks properly. This is designed to restore compressed images again in easy way. The compression ratios are dependent on the threshold values, which can be affected the quality of compression.

The proposed method uses the benefits of various methods to reduce redundancy present in low intensity pixels. The results of the proposed method are compared with JPEG and some of recent methods.

Five modulus methods were developed by Firas A.Jassim in 2013. This algorithm was called FJPEG [17] (Five JPEG). The compression ratio of JPEG could be increased by embedding the Five Modulus Method into the JPEG algorithm. The main concept of this method is to convert the value of each pixel into multiples of five. This conversion used to reduce the signal variation. Divide the image into 8X8 blocks. After that each pixel in every block can be converted into a number divisible by 5. This transformation will not be noticed by HVS (Human Visual System). To complete the FFM method, the 8X8 block divided by 5 to reduce the pixel values into lesser values.FMM used to reduce the pixel variation.

H.Asghari proposed Discrete Anamorphic Transform at 2014. It is Physics based Transformed Technique [18]. It reduces data size by using space bandwidth compression. Brightness bandwidth is also compressed by this technique. It is also jointed with vector quantization & entropy encoding to further reduce the image data size. The resample image can be compressed further by using a secondary compression like JPEG, JPEG 2000. It produce more than twice compression factor.

Huber-leener proposed Hyper Spectral Images at 2014. In this method all pixels are processed identically, with no unique treatment for pixels [19]. After that the background information is extracted from the original image. Decoding process is reverse process for the encoding process. This compression process consists of two stages PCA (Principal Component Analysis) & DCT. The PCA process is utilized to capture background information of the HSI. The background information is subtracted from the original image, producing the original image. The DCT is then applied to the residual image with irreversible quantization. This technique is used mainly spatially busy (noisy) images.

III. CONCLUSION

Coding schemes discussed in this study are implemented in different fields for various applications owing to their unique characteristics. For wide commercial usage there various available schemes but for improved performance there is need of newer and better techniques to be developed.

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