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Efficient Image Compression Technique using Clustering and Random Permutation

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ABSTRACT
Multimedia data compression is a challenging situation for compression technique, due to the possibility of loss of data as well as it require large amount of storage place. The minimization of storage place and proper transmission of these data need compression. In this dissertation we proposed a block based DWT image compression technique using genetic algorithm and HCC code matrix. The HCC code matrix compressed into two different set redundant and non-redundant which generate similar pattern of block coefficient. The similar block coefficient generated by particle of swarm optimization. The process of particle of swarm optimization is select for the optimal block of DWT transform function. For the experimental purpose we used some standard image such as Lena, Barbara and cameraman image. The size of resolution of this image is 256*256. The source of image is Google.
Keywords **-** DWT, HCC, Transform function, HVS.

I. INTRODUCTION

The computer is becoming more and more powerful day by day. As a result, the use of digital images is increasing rapidly. Along with this increasing use of digital images comes the serious issue of storing and transferring the huge volume of data representing the images because the uncompressed multimedia (graphics, audio and video) data requires considerable storage capacity and transmission bandwidth. Though there is a rapid progress in mass storage density, speed of the processor and the performance of the digital communication systems, the demand for data storage capacity and data transmission bandwidth continues to exceed the capabilities of on hand technologies [13]. Besides, the latest growth of data intensive multimedia based web applications has put much pressure on the researchers to find the way of using the images in the web applications more effectively. Internet teleconferencing, High Definition Television (HDTV), satellite communications and digital storage of movies are not feasible without a high degree of compression. Compression-then-Encryption (CTE) paradigm meets the requirements in many secure transmission scenarios, the order of applying the compression and encryption needs to be reversed in some other situations. As the content owner, Alice is always interested in protecting the privacy of the image data through encryption. Nevertheless, Alice has no incentive to compress her data, and hence, will not use her limited computational resources to run a compression algorithm before encrypting the data. This is especially true when Alice uses a resource-deprived mobile device. To limit the effects of data loss that may occur on the communications channel, the wavelet transformed image data are partitioned into segments, each loosely corresponding to a different region of the image. Each segment is compressed independently, so that the effects of data loss or corruption are limited to the affected segment. The image is actually a kind of redundant data i.e. it contains the same information from certain perspective of view [6]. By using data compression techniques, it is possible to remove some of the redundant information contained in images. Image compression minimizes the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a certain amount of disk or memory space. It also reduces the time necessary for images to be sent over the Internet or downloaded from web pages. Two elementary components of compression are redundancy and irrelevancy reduction. Redundancy reduction aims at removing duplication from the signal source image. Irrelevancy reduction omits parts of the signal that is not noticed by the signal receiver, namely the Human Visual System (HVS). Image compression is an application of data compression that encodes the original image with few bits. The objective of image compression is to reduce the redundancy of the image and to store or transmit data in an efficient form. Section-II gives the information of about introduction of image compression. In section III discuss the method of image compression. In section IV discuss the proposed method. In section V comparative result finally, in section VI conclusion and future scope.

II. PRINCIPALS OF IMAGE COMPRESSION

Communication systems now a day's greatly rely on image compression algorithms to send images and video from one place to another. Every day, a massive amount of information is stored, processed, and transmitted digitally. The arrival of the biometric identity concept demands that governments around the world keep profiles of their citizens, and for businesses to keep profiles of their customers and produce the information over the internet. Image compression addresses the problem of pressing large amounts of digital information into smaller packets (by reducing the size of image and data files) that can be moved quickly along an electronic medium before communication can take place effectively. Compressing images results in reduced transmission time and decrease storage requirements [4]. Whereas uncompressed multimedia files require considerable storage capacity and transmission bandwidth. The good compression system should be able to reconstruct the compressed image source or an approximation of it with good quality. It is an important branch of image processing that is still a very active research field and attractive to industry. Basic components of a data compression system are illustrated in below Figure. There are two different encoding systems in operation within the compression system, the predictive coding, and the transform coding. Predictive coding works directly on the input image pixel values as they read into the system; the spatial or space domain encoder also has the capacity to efficiently expect the value of the present sample from the value of those which have been processed previously. So this type of coding has to search for the relationship that governs the tile pixels and make a decision for the best way of operating them before the coding process start. Transform coding on the other hand uses frequency domain, in which the encoding system initially converting the pixels in space domain into frequency domain via transformation function. Thus producing a set of spectral coefficients which are then suitably coded and transmitted. The background research of this chapter will focus on the transform coding since the Bin DCT algorithm by itself is also transforms the row image in space domain into spatial frequency domain. The decoder on the other side must perform an inverse transform before the reconstructed image can be displayed. The coding technique implemented in this project is the transform coding using multiplier-less approximation of the DCT algorithms.

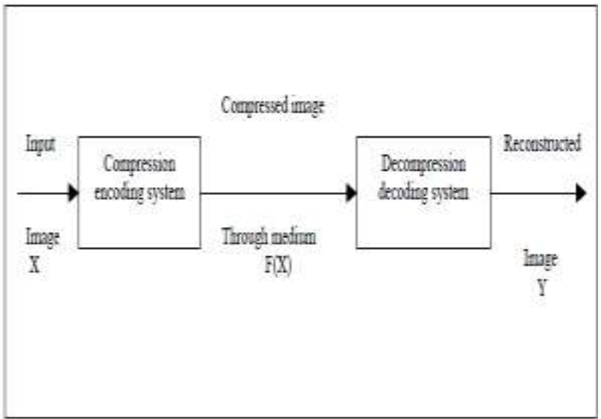

Figure 1: Basic Data Compression System.

Feature extraction process play important role in face detection and pattern detection system based authentication mechanism. The goal of feature extraction is to find a specific representation of the data that can highlight relevant information [7]. This representation can be found by maximizing a criterion or can be a pre-defined representation. Usually, a face image is represented by a high dimensional vector containing pixel values (holistic representation) or a set of vectors where each vector summarizes the underlying content of a local region by using a high level transformation (local representation). In this section we made distinction in the holistic and local feature extraction and differentiate them qualitatively as opposed to quantitatively. It is argued that a global feature representation based on local feature analysis should be preferred over a bag-of-feature approach. The problems in current feature extraction techniques and their reliance on a strict alignment is discussed. Finally we introduce to use face-GLOH signatures that are invariant with respect to scale, translation and rotation and therefore do not require properly aligned images. The resulting dimensionality of the vector is also low as compared to other commonly used local features such as Gabor, Local Binary Pattern Histogram 'LBP' etc. and therefore learning based methods can also benefit from it [9].

III. WAVELET TRANSFORM METHOD

Wavelet transforms have been one of the important signal processing developments in the last decade, especially for the applications such as time-frequency analysis, data compression, segmentation and vision [12]. During the past decade, several efficient implementations of wavelet transforms have been derived. The theory of wavelets has roots in quantum mechanics and the theory of functions though a unifying framework is a recent occurrence. Wavelet analysis is performed using a prototype function called a wavelet. Wavelets are functions defined over a finite interval and having an average value of zero. The basic idea of the wavelet transform is to represent any arbitrary function f (t) as a superposition of a set of such wavelets or basis functions [11]. These basis functions or baby wavelets are obtained from a single prototype wavelet called the mother wavelet, by dilations or contractions (scaling) and translations (shifts). Efficient implementation of the wavelet transforms has been derived based on the Fast Fourier transform and short-length fast-running FIR algorithms in order to reduce the computational complexity per computed coefficient. All wavelet packet transforms are calculated in a similar way. Therefore we shall concentrate initially on the Haar wavelet packet transform, which is the easiest to describe. The Haar wavelet packet transform is usually referred to as the Walsh transform [9].

DISCRETE WAVELET TRANSFORM

Image data input is shown at left in the diagram. The DWT coefficient buffer at right in the diagram stores wavelet coefficients computed by the DWT stage. The program flow in the diagram produces DWT coefficients for a single segment. Once the coefficients corresponding to a segment have been computed and placed in the buffer, the BPE stage can begin encoding that segment. The BPE stage relies on all of the coefficients in a segment being available simultaneously [6]. The calculation of a DWT coefficient depends on image pixels in a limited neighborhood. Consequently, when images are encoded using more than one segment, it is often possible to implement the DWT stage so that DWT coefficients for a segment are produced without requiring input of a complete image frame. For example, in a push-broom imaging application, DWT coefficients may be produced in a pipeline fashion as new image scan lines are produced by the imager.

WAVELET PACKET IMAGE CODING

One practical way of constructing wavelet bases is to iterate a two channel perfect reconstruction filter bank over the low pass branch. This results in a dyadic division of the frequency axis that works well for most signals we encounter in practice. However, for signals with strong stationary high pass components, it is often argued that wavelet basis will not perform well, and improvements can be generally found if we search over all possible binary trees for a particular filter set, instead of using the fixed wavelet tree [19]. Wavelet packet transforms are obviously more general than the wavelet transform, they also offer a rich library of bases from which the best one can be chosen for a fixed signal with a fixed cost function. The advantage of the wavelet packet framework is thus its universality in adapting the transform to a signal without training or assuming any statistical property of the signal.

IV. PROPOSED METHOD

In this section describe the proposed algorithm for image compression using wavelet transform and particle of swarm optimization technique. Basically in this algorithm POS are used for removal of redundant structure of packet in common similar block and create separate block and both block supply to HCC matrix and finally image are compressed. For the searching of redundant structure block and non-redundant structure block used fitness constrains function, those structure satisfied the given constraints are called non redundant structure else redundant structure. The proposed algorithm is a combination of integer wavelet packet transform function, particle of swarm optimization and HCC matrix. Now the process of algorithm divided into three sections. Section first discusses the generation of packet, section two discusses the optimization of packet and section three discusses the HCC code matrix for compression. For the grouping of packet used cluster algorithm. Cluster algorithm group the similar packet and dissimilar packet.

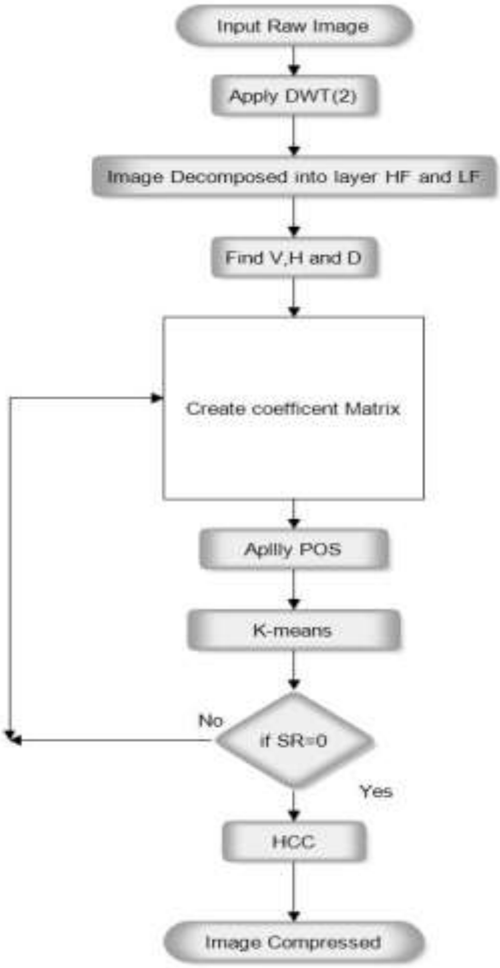

Figure 2: Proposed model of image compression.

V. EXPERIMENTAL RESULT ANALYSIS

The experimental result partitioned by three methods one is JPEG, second is PCRP and third is our proposed technique. There are several lossless image compression algorithms like Lossless JPEG,JPEG 2000,PNG,CALIC and JPEG-LS.JPEG-LS has excellent coding and best possible compression efficiency.

Figure 3: Shows the compression of Data set which includes cameraman compressed image as an output.

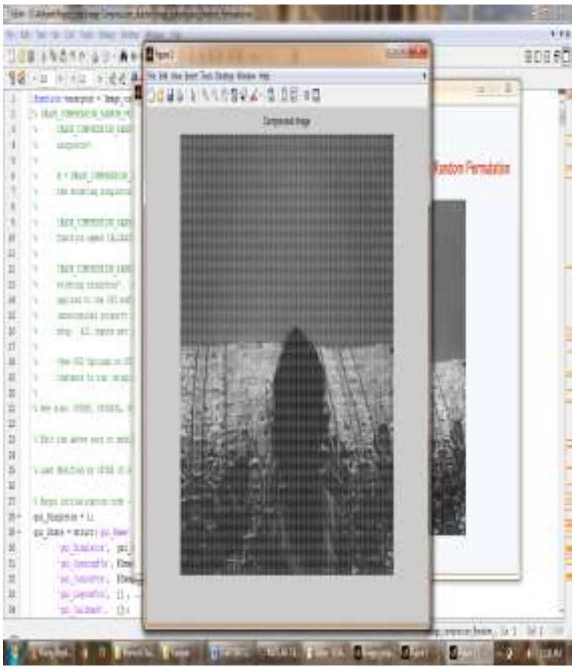

Figure 4: Shows the compression of Data set which includes child compressed image as an output.

Data Set	Technique	PSNR (dB)	Compression Ratio	Elapse Time(Sec)
Cameraman Image	JPEG	13.56047	0.18335	10.871784
	PCRP	21.56047	1.4834	11.151017
	PROPOSED	23.56047	1.8834	6.728327
Image 11	JPEG	8.768957	0.42525	11.821748
	PCRP	16.768957	1.7253	12.584048
	PROPOSED	18.768951	2.1253	14.682364
Image 22	JPEG	6.029492	0.70117	13.358795
	PCRP	14.029492	2.0012	12.565998
	PROPOSED	16.029492	2.4012	12.539689

Table 1: Shows the comparative PSNR, Compression ratio, Elapse time of image Compression using various techniques.

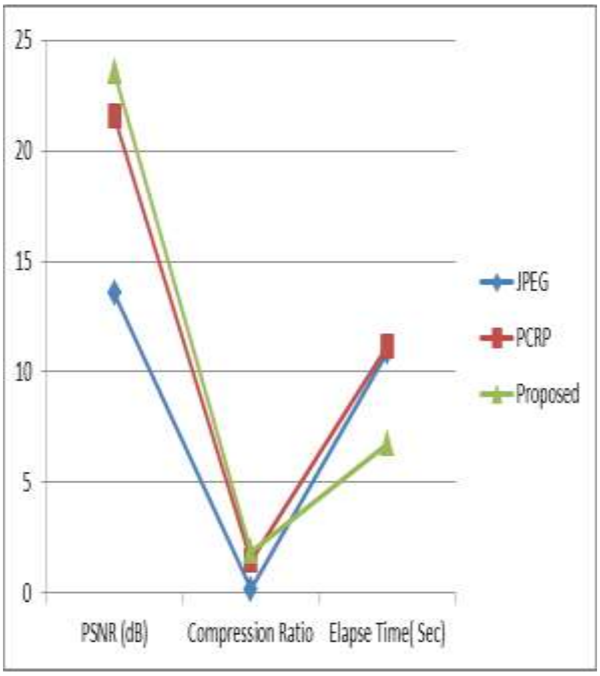

Figure 5: Shows that performance of data set cameraman counts of data and rate of PSNR, Compression ratio and elapse time.

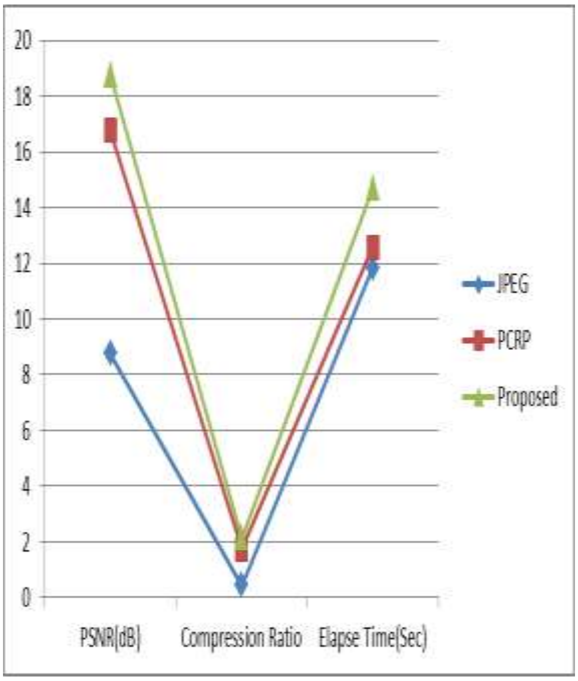

Figure 6: Shows that performance of data set image counts of data and rate of PSNR, Compression ratio and elapse time.

VI. CONCLUSION AND FUTURE WORK

In this paper we proosed a cluester based image compression technique.the cluester based image compression techniqe used k-means cluestering technique for the grouping of packet. In the particle of swarm optimization process define the fitness constraints according to the diffrence value of structure refrence packet. if diffrence of packet is zero value assigned 1 and the diffrence value get value assined 0. both similar and disimilry packet collect in two different unit and paases throgh HCC matrix after that image is compressed. the proposed algorithm implemenrt in matlab software with version 7.14.0. algorithm used hear wavelet faimly process for decompostion of image. the decomposed transfrom function passes through coding and generates packet transfrom. for the valiadtion of proposed algorithm used another image compression technique such as JPEG,PCRT and compostie algorithm. for the valuation of parameter used two standard parameter one is PNSR and another is compression ratio. our emprical valaution of PSNR and C.R shows that better value in comression of other compression algorithm. The proposed algorithm is very efficient in terms of PSNR value and C.R instead of PCRT algorithm and JPEG based compression technique. But little point of disappoint in terms of computational time because the search and optimization of structure reference packet more

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