An Extensive Survey on Cross Space Distortion Directed Color Image Compression

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Abstract-image compression is basic for beneficial transmission and capacity of pictures. Colossal request of wireless communication and media getting to the sight and sound information through Internet is growing viciously Image compression is a capacity of information compression Images are a fundamental advanced archive now days; image join distinctive information e.g. human bodies in restorative pictures that are used for various reason like medicinal security and unmistakable plans. Compression of pictures is utilized in a few applications like ID data and transmission framework. a novel compression plot for color pictures are infer in the connection for the distortion space. To figure with them in an exceedingly couple of utilizations they must be packed a ton of or less looking on the point of the machine. Respect to centrality of pictures information lossless or lossy compression is favored. Lossless compressions are JPEG, JPEG-LS and JPEG 2000 are some remarkable methodologies for lossless empathizing use differential heartbeat code modulator for picture compression with Huffman encoder, which is one of the most recent and gives great compression proportion, top flag commotion proportion and least mean square error.

Keywords-Image Compression, Distortion, Discrete cosines transform, lossy and lossless compression.

I. INTRODUCTION

Any given scene viewed by a human observer is detected using roughly seven million receptors. This visual information is then automatically compressed so that it can be transmitted by the one million or so optic neurons to the brain. This means that the human visual system routinely achieves a visually lossless level of compression of about seven to one. It is encouraging to realize that such levels of compression of visual information have been occurring right under our noses for hundreds of thousands of years. However, it has only been within the past decade that the same level of compression has been possible with digital color images.

What is the so-called image compression coding. Image compression coding is to store the image into bit-stream as compact as possible and to display the decoded image in the monitor as exact as possible. Now consider an encoder and a decoder as shown in Fig. 1.1. When the encoder receives the original image file, the image file will be converted into a series of binary data, which is called the bit-stream. The decoder then receives the encoded bit-stream and decodes it to form the decoded image. If the total data quantity of the bit-stream is less than the total data quantity of the original image, then this is called image compression.

An image is a two dimensional function f(x,y where x and y are spatial coordinates, and the amplitude off at any pair of coordinates (x, y) is called the depth or gray stage of the photograph at that point. In layman language, an image can be defined a 2-D matrix or an array of rectangular pixels prepared inside the form of rows and columns. when author numerically represent the 2-D photograph, it's far called digital picture.

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. Fig 1.1 shows the block diagram of the general image storage system. The main goal of such system is to reduce the storage quantity as much as possible, and the decoded image displayed in the monitor can be similar to the original image as much as can be.

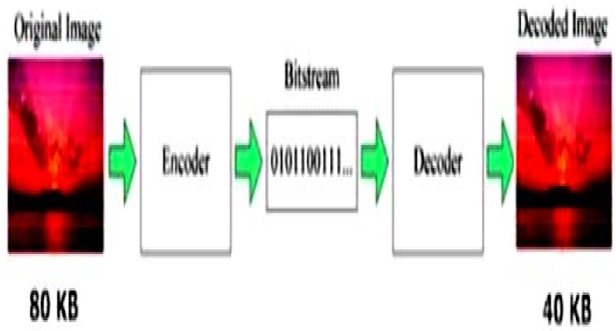

Fig.1.1 General Image Storage Diagram.

Lossless and Lossy compression

There are three sorts of redunIn lossless compression contrives, the duplicated image, after compression, is numerically undefined to the primary image dancies. However lossless compression can just an accomplish a humble measure of compression. Lossless compression is favored for chronicled purposes and frequently medicinal imaging, specialized illustrations, cut workmanship or funnies. This is on account of lossy compression techniques, particularly when utilized at low bit rates, present compression antiquities. An image recreated following lossy compression contains degradation in respect to the original image. Frequently this is on account of the compression conspire totally disposes of repetitive data. Be that as it may, lossy plans are equipped for accomplishing substantially higher compression. Lossy techniques are particularly reasonable for natural images, for example, photographs in applications where minor (now and again vague) loss of devotion is adequate to accomplish a considerable lessening in bit rate. The lossy compression that produces intangible contrasts may be termed visually lossless.

II. SPACES DISTORTION IN IMAGE COMPRESSION

The Rate-Distortion theory comes under the umbrella of source coding or compression and it is concerned with the task to find the best trade-off between the quality of the reconstruction (distortion D) and the loss of information (bit rate cost R). In other words, RD theory seeks for the fewer number of bits possible to achieve a given reproduction quality. Initially, the YCbCr color space was considered for use as a standard color space, but this idea was abandoned. However, the YCbCr color space was used as the default color space for much of the experimental research carried out by the JPEG committee. There has been a limited amount of research on how the use of other color spaces affects the compressibility of color images. Although, given the drastic differences among the various ways of representing color, it seems unlikely that there would be no differences among the color spaces. In fact, the XYZ and YCbCr color spaces have been shown to be better than the RGB color space for image compression. The various color spaces currently available can be divided into three different categories. These divisions are device color spaces, linear transforms of device color spaces, and non-linear transforms of device color spaces.

Techniques of Image Compression

a) Predictive Coding

In predictive coding the image data is not compressed in the manner described in Fig. 1. Instead, one predicts the image pixels and computes a prediction error. The prediction error is actually the information that is quantized and encoded. In general, predictive coding is similar to DPCM systems, which were commonly used before computer technology made transform coding affordable. The actual pixel is predicted somehow from information conveyed through the past (already processed) pixels and only the prediction error is quantized and encoded. The decoder applies the same prediction step as the encoder. Given the predicted value, the decoder simply integrates the error to the predicted value in order to produce the reconstructed pixel. A feedback loop is required at the encoder side to synchronize encoder and decoder. However, predictive systems are often used for "lossless" compression, i.e. the data is not quantized and, hence, there is no need for the feedback loop. There are several methods for adaptive or non-adaptive prediction.

b) Discrete Wavelet Transformation (DWT)

Wavelet functions have a finite interval of spread and their respective average value is zero for all cases. Any function can be transform to wavelet function using the wavelet transformation (t). The essential capacity otherwise called infant wavelets are gotten from single model wavelet called the mother wavelet. In the image compression process, first the image is ordered into squares of 32*32. After categorization the blocks are passed through filters such as scaling filter and wavelet filter. Scaling filter is a low pass filter and wavelet filter is high pass filter.

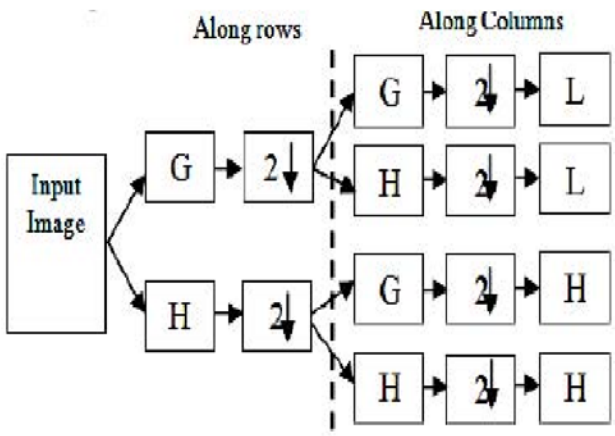

Figure 2.1 Block Diagram for Forward DWT.

c) Discrete Cosine Transform (DCT)

DCT is commonly used compression and transformation technique for images. This is an orthogonal algorithm with basic features which makes it special. These features are: algorithm for computation, good energy compaction, correlation reduction properties and image independent basic functions. DCT is very closely related to DFT because both are real valued transformations.

The remarkable development in the field of information technology and the diversity of multimedia applications in recent years imply the development of more efficient image compression techniques to enhance the capacity of data transmission and storage. Based on the fact that Curvelets transform provide a sparse decomposition of images, which means representing the most relevant information (geometric structures in this case) with coefficients of large amplitudes. We propose to use a non-uniform logarithmic quantization, able to quantify the high amplitudes coefficients more accurately in order to promote, in this step, the coefficients which carry the directional information of the image.

III. LITERATURE SURVEY

Sr. no.	Title	Author	Year	Approach
1	Cross-Space Distortion Directed Color Image Compression	S. Zhu, M. Li, C. Chen, S. Liu and B. Zeng	2018	we propose a novel compression scheme for color images through defining a cross-space distortion so as to reduce as much as possible the distortion in the RGB space.
2	Task-Based JPEG 2000 Image Compression: An Information-Theoretic Approach	Y. Lin, A. Amit, M. Marcellin and A. Bilgin	2018	which are ideally suited for human observers but are not necessarily optimal for machine observers, i.e., automated image exploitation algorithms.
3	Rate-distortion based sparse coding for image set compression	X. Zhang, W. Lin, S. Ma, S. Wang and W. Gao	2015	In this paper, we propose a novel image set compression approach based on sparse coding with an ordered dictionary learned from perceptually informative signals.
4	Image compression based on the transform domain downward conversion	S. Zhu, Z. Miao, B. Zeng, G. Liu and L. Zeng,	2015	In this paper, we focus on the design of a new block-based image compression by using our proposed transform domain downward conversion (TDDC).
5	Efficient VLSI architecture of visual distortion sensitivity based spatially adaptive quantization for image compression	H. Cao, Y. Zhang and H. Jiang	2013	This paper presents a new and efficient very large scale integration (VLSI) architecture for the implementation of VDSSAQ.
6	JPEG image compression using quantization table optimization based on perceptual image quality assessment	Y. Jiang and M. S. Pattichis	2011	We consider the use of perceptual image quality assessment for quantization table (QT) optimization for JPEG compression. For evaluating performance, we consider the use of the Structural Similarity Index (SSIM) for evaluating distortion in the compressed images.

S. Zhu, M. Li, C. Chen, S. Liu and B. Zeng [1] Traditional color image compression is usually conducted in the YCbCr space but many color displayers only accept RGB signals as inputs. Due to the use of a non-unitary matrix in the YCbCr-RGB conversion, low distortion achieved in the YCbCr space cannot guarantee low distortion for the RGB signals. To solve this problem, we propose a novel compression scheme for color images through defining a cross-space distortion so as to reduce as much as possible the distortion in the RGB space. To this end, we first derive the relationship between the distortions in the YCbCr space and RGB space. Then, we develop two solutions to implement color image compression for the most popular 4:2:0 chroma format. The first solution focuses on the design of a new spatial down sampling method to generate the 4:2:0 YCbCr image for a high-efficiency compression. The second one provides a novel way to reduce the distortion of the compressed color image by controlling the quantization error of the 4:2:0 YCbCr image, especially the one generated by using the traditional spatial downsampling. Experimental results show that both proposed solutions offer a remarkable quality gain over some state-of-the-art approaches when tested on various textured color images.

Y. Lin, A. Amit, M. Marcellin and A. Bilgin [2]Traditional image compression methods primarily focus on maximizing the fidelity of the compressed image using image quality driven distortion metrics, which are ideally suited for human observers but are not necessarily optimal for machine observers, i.e., automated image exploitation algorithms. For machine observers, task-based distortion metrics, such as probability of error, have been shown to be more effective for tasks such as object detection and classification. This motivates an approach to a task-based image compression, within the JPEG 2000 framework, which preserves the information that is most relevant for the given task. Our proposed method produces a JPEG 2000 compliant compressed codestream, which can be decoded by any JPEG 2000 compliant decoder. We demonstrate the feasibility and the effectiveness of our task-based image compression approach on a simple object classification and detection problem and quantify its performance relative to a conventional MSE encoder.

X. Zhang, W. Lin, S. Ma, S. Wang and W. Gao [3] In this paper, we propose a novel image set compression approach based on sparse coding with an ordered dictionary learned from perceptually informative signals. For a group of similar images, one representative image is first selected and transformed into wavelet domain, and then its AC components are utilized as samples to train an over-complete dictionary. In order to improve compression efficiency, the dictionary atoms are reordered according to their frequency used in sparse approximation of the representative image. In addition, a rate-distortion based sparse coding method is proposed to distribute atoms among different image patches adaptively. Experimental results show that the proposed method outperforms JPEG and JPEG2000 up to 6+ dB and 2+ dB, respectively.

S. Zhu, Z. Miao, B. Zeng, G. Liu and L. Zeng, [4] In this paper, we focus on the design of a new block-based image compression by using our proposed transform domain downward conversion (TDDC). Applied directly on each 16×16 macro-block of pixels, this downward conversion is implemented through our proposed advanced padding technique such that a non-zero 8×8 coefficient block (thus down-sized) is generated only at the top-left corner in the transform domain, accompanied by zeros in other 75% positions. Consequently, a considerable bit-count saving can be achieved for the whole macro-block. In the meantime, 25% pixels reserved during the TDDC may be directly reconstructed from the down-sized coefficient block while the other 75% pixels that are not reserved during the TDDC will be reconstructed via the interpolation. Finally, this TDDC-based compression is used in conjunction with the JPEG baseline coding method (i.e., 1-out-of-2 selection) according to a rate-distortion optimization (RDO) based criterion. Experimental results show that our proposed compression scheme provides a significant quality gain as compared with the original JPEG baseline coding method and another super-resolution directed down-sampling (SRDDS) based compression scheme.

H. Cao, Y. Zhang and H. Jiang [5] As the visual distortion sensitivity based spatially adaptive quantization (VDSSAQ) algorithm considers human visual system (HVS) and tunes the quantizer's steps in a finer manner to improve the perceptual quality, it usually causes considerable computing complexity and memory access overhead. To address this problem, this paper presents a new and efficient very large scale integration (VLSI) architecture for the implementation of VDSSAQ. The proposed architecture exploits the parallelism between wavelet transform and quantization as well as quantization algorithm itself to speed up the computing process. Besides, a delaying quantization operation scheme is designed to work with the bitplane coder (BPC) to further reduce the time consumption and memory accesses significantly. Experimental results show that the proposed VLSI architecture outperforms the state-of-the-art architectures with the least memory accesses and highest overall throughput, which makes it desirable in real time image compression applications.

Y. Jiang and M. S. Pattichis [6] We consider the use of perceptual image quality assessment for quantization table (QT) optimization for JPEG compression. For evaluating performance, we consider the use of the Structural Similarity Index (SSIM) for evaluating distortion in the compressed images. This leads to the study of rate-SSIM curves that replace the traditional use of rate-distortion curves based on the PSNR.We introduce a multi-objective optimization framework for estimating the best rate-SSIM curves. To estimate globally optimal quantization tables, A stochastic-optimization algorithm based on Simulated Annealing is proposed and its variations are studied. We report results on all methods on the Lena image and results from selected methods on the LIVE image quality assessment database. For the LIVE database, compared to the use of the standard JPEG quantization table at quality factor QF=95, QTs based on the training set give average bitrate reductions of 11.68%, 7.7% and an increase of 2.4%, while the SSIM quality changes from -0.11%,+0.05% and 0.12% respectively. In all cases, the results indicate that all considered methods improved over the use of standard JPEG tables.

IV. PROBLEM IDENTIFICATION

Generally, the future of the compression algorithms seems to be foggy. Although numerous of techniques are represented in annual meetings and conferences each one of which seem to perform better or to be more efficient or to improve each of the quality, bit rate, complexity, encoding or decoding time of image compression, finally the total gain is not adequate to replace image compression . People think that the combination of all these new techniques could probably result in a new standard. To our point of view, while the encoding architecture remains the same it would be really tough to enhance the coding performance. The significant differences in the various color spaces suggest that the color space selected for use with the JPEG algorithm will affect the resulting compression. The differences in the perceptual uniformity, channel redundancy, and compatibility with the algorithm are just a few of the variables that could affect the efficiency of the resulting compression.

V. CONCLUSION

In this review recent work on image compression has been studied and reviewed based on their performance. For various image compression applications every algorithm has its own advantages and drawbacks bi-directional prediction enhanced the first compression. A specific compression organization can be acknowledged by different compression algorithm. In any case, there are as yet a huge number of issues and issues to be tended to. Most importantly, the JPEG calculation is intended for any three segment color space. Be that as it may, as this exploration has appeared, some shading spaces are preferable for compression over others. In any case, there are different manners by which the JPEG algorithm could be improved to be more helpful for compression in a given color space.

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