SCANNING METHODS FOR IMAGE COMPRESSION: A SURVEY

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ABSTRACT

All the multimedia services confront issue of bandwidth availability. Image compression can resolve this issue by cutting down storage space required to store the data. However before compression an important area of concern is scanning of images. This paper will focus on distinct sort of scanning techniques which are employed in image compression. Hence a survey has been created for different scanning techniques which describe the importance of the same. Comparison has been made within the finish of this paper.

Keywords: Scanning Techniques, Space Filled Curve (SFC), Zigzag scan, Raster Scan and Image Compression.

I. INTRODUCTION

Exponential growth of technology has made human life totally dependent on it. In today's world, web became a necessity instead of a requirement .Sharing of data could be a common example of its services. One can share any information from anywhere at any time from around this world. Modernization of web technologies increment in their users day by day. People share a huge amount of data among themselves across the world. Hence the main issue faced by these technologies is space required to store the large amount of data. Indeed there is demand of efficient data compression technique to provide uninterrupted service to the users. A major and vital field of data compression is image compression [1].A number of techniques have been formulated for the compression of images as titled in [2][3][4] .Image compression can be further divided up into two main categories i.e. lossy and lossless Image compression [5] [6]. Within the latter one information compression results into less compression ratio than the primary one has. The most important advantage of lossless data compression techniques isn't any information is lost throughout the total process whereas within the lossy algorithms one have to be compelled to compromise between high compression ratio and also the data as some information may be lost. Image compression comprises of two major steps i.e. encoding and decoding process. Further encoding process is sub divided into source coder and channel coder and reverses for the decoding. Before learning the techniques of image compression one must acquire knowledge of scanning methods for

images. As before employing any transformation to image for compression the 2-Dimionesional signal of an image is converted into a 1-D signal. This is accomplished by various scan methodologies.Multiple scan methods has been arose to convert 2-D signal into 1-D signal and studies shows

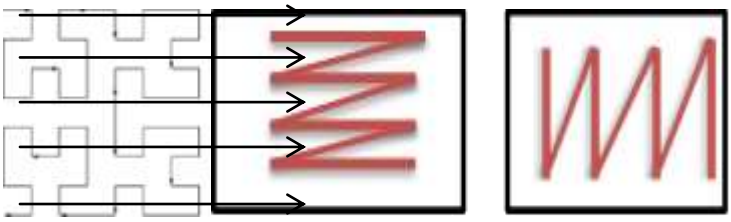
that these scan techniques can affect the rate of compression of an image irrespective of transform applied [2] . Thus one must aware about the different scanning techniques which can be utilized in image compression process. The scanning techniques a classified as Peano scan ,Hilbert scan, Raster scan, Fractional scan, Raster horizontal and vertical scan, Peano- Hilbert scan [7], Snake horizontal and vertical scan , Zigzag Scan. This paper is a comparative survey all the techniques employed for scanning purposes.

II. IMPORTANCE OF SCANNING TECHNIQUES

Image processing is a vast field. One of its major applications is compression .Compression is composed of two sub method named as source and encoding method severally. These two sub method additionally depends upon among different parameters. One of the most important parameter is nature of scanning techniques to compress the data. It may be scanned horizontally or vertically.Fig.1 shows structure of Hilbert and Raster scan [8-10]. Subject of matter received from vertical scan may be completely different from that obtained by horizontal scan differs from. Since there are numerous directions to scan an image, therefore individual possibility of representations of its content. Fig.2. and Fig.3. shows structure of basic raster scan and snake (horizontal and vertical) respectively detecting the balance scan that brings more effective, much useful and applicable content of the image, could be useful for image processing. For compression, effective scan should exploit redundancy of the image.

III. LITERATURE SURVEY

K.S. Thyagarajan and Shankar. Chatterjee in [2] proposed a novel scanning technique for images known as fractal scanning which is used to increase pixel correlation. The previously existing techniques for image compression generally reduce the correlation among the images or simply feat the correlation. The video images are acquired and kept by employing raster scan .However, according to them fractional scan can be achieved by using 1-D and 2-D adaptive Differential pulse code modulation (predictive techniques).



a.) b.)

Fig.1a.) Hilbert Scan b.) Raster Scan. **Fig.2 Raster scan, horizontal (left,) vertical (right)**

After scanning for the image compression it have vector quantization has to be utilized. Vector quantization is generally used for compression of image as well as speech signals with very low bit rate. Further it is claimed to have better correlation for rescanned images with reduced bandwidth requirement. As a result rescanned image achieved much better Pixel to noise ratio (PSNR) in comparison with the original images with a better image quality. It is suggested that result can be improved by using subband coding for image compression.

Revital Dafner *et.al* in [9] provides an alternative to classic scanning techniques by introducing a new context based scanning technique. Peano-Hilbert techniques are used to convert a 2-D image signal into 1-D signal. This technique employs space filling curve (SFC) to covert a 2-D spatial coherence into 1-D autocorrelation by continuously scanning every pixel of an image only once. Context based space filling curve scan an image on the bases of context. It exploitsimages or group of images. The presented technique diminishes the number of edge crossing during image scanning in comparison to the Peano-Hilbert scan. Also the entire algorithm aims and did provides a better spatial correlation. On conclude, claiming having such a scan technique which avoid edge crossing, achieves a better spatial correlation and same can be used in pattern recognition and texture analysis. This technique overcomes the issues of Peano-Hilbert Scan.Richard Pracko *et.al* in [10] proposed a novel scanning technique which is built on the bases of segmentation of an image. More specifically rather than utilizing traditional scanning methods,scanning of an image is done in an alternate manner such that scanning provides a greater extent of similarity in among neighboring pixels. Original image is segmented into sub segments and each segment is scanned individually. Two mode scan is applied i.e. firstly image is scanned by standard raster scan method and then a non-recursive 2-D continual scanning is employed which scan pixels as well as difference between them. Analysis has been made from entropy point of view. As a result it enhances adjacent pixel similarity without using SFC and Peano-Hilbert scan .Hence the asserted result having less correlation, reduced bit rate and less entropy of original image on the basis of histogram .

Fig.3. Snake Scan (a.) Horizontal b.)Vertical

result (as segmented image contain less gray levels). Authors also proposed that in future more complex and sophisticated prediction error algorithms can be designed utilizing segment base scanning.Tang Haijiang et.alin [11] analyzed the effect of scanning techniques on gray scale image compression by introducing a multi scan strategy. Earlier all the literature studied above does provides a theoretical compression and briefly explains the different scanning techniques. Hilbert scan gives the better and promising results. In this paper multi scan strategy includes four scan named as raster scan, vertical scan and two diagonal scans respectively. The whole scenario is set to minimize the compression ratio for gray scale images. Further it is proposed a novel adaptive linear predictor. It is concluded and achieved compression ratio of 2-10 % by using JPEG-LS algorithm by fist

utilizing first two scans. However results are not satisfactory for the two diagonal scans. Xiaopeng Fan et.al in [13] presented a novel scheme

for image compression based on spatial prediction. More former techniques used discrete cosine transform based image coding which is based on zigzag scanning. This paper introduced a novel efficient scanning technique of scanning which employ a tree structure. After scanning entropy coding is designed for the image compression. This algorithm improves the performance of AVC/H.264 intra frame coding and hence increases the coding efficiency.Particularly for the prediction based image compression. Though zigzag can be effective scan method than tree structure from a different point of view.Dawei and Shizhong Yang in [14] demonstrated a modern algorithm for compression of remote sensing images. Remote sensing images are compressed by using a novel zerotree[15] technique rather than orthodox Embedded Zerotree Wavelet (EZW) technique. EZW basically employ 2D wavelet. This technique is effective for compression but become more complex algorithm for large images. This algorithm employ RMEZW algorithm which utilize 2D wavelet transform with Differential phase code modulation. Moreover it employzigzag scan which is better than Embedded Zerotree Wavelet (EZW) in the sense that it have multi tree root and it restore original image value more accurately. Zigzag scans the image in a one goes hence reduce the time cost. Further this algorithm receives higher compression ratio and better quality of reconstructed image. M. F. Fahmy and G. Fahmy in [17] presented a novel algorithm for signal processing and apply same for the image compression. Images are scanned in a similar in kind as in [14] that is in zigzag scan order. The only parameter it differs is that it utilized EZW algorithm after scanning. As we are concerned only about scanning method hence whole algorithm archives small signal reconstruction and hence reduced compression ratio.Torsten Palfner and Thomas Wedi in [18] suggested an alternative algorithm to [13] in terms of scanning. It is termed it as adaptive scanning which focus on the missing reference pixels and hence amend the intra prediction .Basic methodology employ transforms before quantization of an image.H.64/AVC utilized intra prediction before transformation. Hence instead of scanning images from left to right as done by zigzag image is scanned in a reverse order of 90,180 and 270 degree respectively. Further after this reversible scanning process image filliping is enforced to improve spatial correlation of edges. This algorithm accomplishes lower PSNR value than [16] of 1dB just by changing the scan format. Shams MImam et.al in [20] intended an algorithm for lossless image compression utilizing Generic Peano Pattern Mask Tree. This technique reduces unwanted data by employing Peano counter tree (P-tree), peano scan and Peano mask tree. P-tree results into compressed (lossless) data mining0One can who want detail of this tree can refer [21]. This novel algorithm uses mask rather than bits for compression. Hence performance of peano scans and hence of data mining can be mended by using Generic Peano Pattern Mask Tree.Tarek Ouni et.al in [22] proposed a potent approach for scanning of images by employing gradient based Space Filling Curves. This particular approach overcomes the issues of universal techniques which utilizes entropy coding (line by line scanning) for scanning process. One of the main advantages of this technique that it looks into correlation of pixel on the basis of context scanning curves. Context based SFC is computed by combining four different scans a) horizontal snake scan b) vertical snake scan c) first zigzag and d) second zigzag scan. The whole script leads to improved auto-correlation and better compression efficiency. Chien-Pen Chuang et.al in [23] , intended a novel image compression (lossless). The algorithm is disunited into two sub parts. Firstly snake scan is used to convert a 2-d signal into 1-d signal and then arithmetic coding is applied. Snake results into

residual data by vanishing the correlation between pixels. Since our main concern is on scan pattern we will not investigate coding method. However this algorithm achieves better results than conventional coding methods which does not use snake scan at first step.Ziya Arnavut et.al in [24], describes various scan method employed on pseudo color images. The fact why paper focus on pseudo color images because these images require less storage and increase the buffer space which ultimately leads to speeding of the data during transmission This novel algorithm utilizes four scans namely horizontal and vertical scan and snake or combination of both . Further it exploits Burrows-Wheeler transformation for compression. On conclusion it is claimed having compression ratio of 1.55 by employing raster horizontal scan.Vascan O.Orest and Weingart Mircea in [25] just intended an approach which is inspired from the work of [2] .Basically improved the quality of reconstructed image by utilizing Hilbert scan and further improving vector quantization. Restricting on Hilbert scan those follow Hilbert curve order blocks rather than employing raster scan results. On further analysis and got results in the form of improved PSNR and diminished the processing time of Hilbert scan. . Nasir D. Memon et.al in [26] presented a prediction scheme for lossless image compression in which it is divided image into block and each block is scanned simultaneously hence it named there algorithm as lossless image compression with a codebook of block scan. Hence they developed a codebook from where a scan method can used freely while previously existing techniques work on the assumption that scan of image is done on regular pattern. This prediction scheme also reduced the prediction error rate. After removing the spatial redundancy (block by block) of an image by prediction tree hence performed residual image encoding which results into an effective error modeling scheme .The more focus this paper is on decoration process that is removal of spatial redundancy. Nasir Memon et.al in [27] planed a survey and analysis for the various scan techniques used in image compression. It is interpreted about effect of order of the pixel scan for predictive and context based lossless image compression . Authors analyzed the results among scans like raster scan progressive scan and Hilbert scan. Though it is well recognized that Hilbert scan commits better result than other methods yet they deduced their result in terms of predictive gain and discovered that random scan is lowest in the list .In the very next step authors computed optimal predicators which are used to test the average entropy of the prediction errors. Hence it is concluded and asserted having results in terms of entropy (prediction error) of 3.75, 3.78,398 for progressive, raster and Hilbert scan respectively. Overall this paper provides a deep understanding of scanning methods.Seyun Kim and Seyun Kim in [28] proposed a hierarchical prediction scheme which scans the image than raster scan. It predicts upper, lower pixels and done by the same, left pixel.

IV.CONCLUSION

Scanning technique has an important role in image processing and itindeed affects the performance of the compression algorithm. A survey has been compiled on distinct scanning approaches. We conclude that various scanning techniques are used to convert 2-D signal into 1–D signal and it results a better efficient compression ratio. Also these techniques provide more complexity to the entire compression algorithms. An alternate technique can be employed which can substitute the conventional scan techniques with less complex algorithm.

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