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Image Compression Using Multithresholding Technique to Enhance Huffman Technique

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Abstract-Image compression means reducing the size of graphics file, text, without degrading its quality. Two techniques are exist for compression to find out, whether the reconstructed image has to be exactly same as the original or some unidentified loss or changes may be incurred. First is lossy technique (in this some of data may be lost). Second is lossless technique (in this technique the reconstructed image is exactly same as the original) Image compression is an essential technology in multimedia and digital communication fields. Ideally, an image compression technique removes redundancy, and efficiently encodes what remains .The Process to remove the redundancy is called compression. Most of the existing image coding algorithm is based on the correlation between adjacent pixels and therefore the compression ratio is not high. Fractal coding is a potential image compression method, which is based on the ground breaking work of Barnsley and was developed to a usable state by Jacquin. The fractal-based schemes exploit the self-similarities that are inherent in many real world images for the purpose of encoding an image as a collection of transformations. Here in this hybrid model we are going to propose a Nobel technique which is the combination of multithresholding technique and huffman techniques. This paper presents Huffman compression technique which is lossless technique. To enhance the huffman technique we are using multithresholding technique which is lossy technique. We implement lossless technique so our PSNR and MSE will be better than the old algorithms and due to multithresholding we will get good level of compression.

Index Terms-CR (Compression Rate), MSE (mean square error), PSNR (peak signal to noise ratio), Huffman, Multitresholding.

1 INTRODUCTION

Image Compression addresses the problem of reducing the amount of data required to represent the digital image. Compression is achieved by the removal of one or more of three basic data redundancies: (1) Coding redundancy, which is present when less than optimal (i.e. the smallest length) code words are used; (2) Interpixel redundancy, which results from correlations between the pixels of an image & (3) psycho visual redundancy which is due to data that is ignored by the human visual system (i.e. visually nonessential information). Most of the existing image coding algorithm is based on the correlation between adjacent pixels and therefore the compression ratio is not high. Fractal coding is a potential image compression method, which is based on the ground breaking .Its essence is that correlation not only exists in adjacent pixels within a local region, but also in different regions and local regions with global region[13]. Mostly we use the fractal-based schemes because It exploit the self-similarities that are inherent in many real world images for the purpose of encoding an image as a collection of transformations. Image compression may be lossy or lossless. Lossless compression methods like [1], [2], [11] have much lower performance with respect to lossy compression [22]. Lossy compression techniques achieve very high compression ratios but the decompressed image is not exactly same as the original one. These methods take advantage of the fact that to certain extent the human eye cannot differentiate between the images although noise exists in the decompressed image. Lossless methods on the other hand, give very less compression ratios but exactly recover back the original image [11]. Most advances in the compression field are in lossy compression, [11]. Lossy compressions proposed recently use wavelet transforms. [3], [11] .But using wavelets proves to be computationally expensive and the problem of edge pixels also persists. Here we are proposed Huffman codes contain the smallest possible number of code symbols (e.g., bits) per source symbol (e.g., grey level value) subject to the constraint that the source symbols are coded one at a time. The Huffman encoding algorithm is an optimal compression algorithm when only the frequencies of individual letters are used to compress the data. The idea behind the algorithm is that if you have some letters that are more frequent than others, it makes sense to use fewer bits to encode those letters than to encode the less frequent letters. In haffman we are using "prefix property". The idea is that the encoding for any one character isn't a prefix for any other character. For instance, if A is encoded with 0, then no other character will be encoded with a zero at the front. That way, if we start reading a string of bits and the first bit is a zero, we know that we can stop reading, and we know that bit encodes an A because no other character encoding begins with a 0. So, Huffman coding when combined with technique of reducing the image redundancies using multithresholding helps in compressing the image data to a very good extent. Multithresholding is the type of segmentation. Thresholding is one of the powerful methods for image segmentation; it is useful in discriminating objects from the background in many classes of scenes. For example, an image contains an object, which is made up of pixel, which has homogeneous grey level and a background with a different level. In simple thresholding the image can be segmented into two different regions, which classifies all pixels with threshold level values greater than T as object pixels and pixels with threshold level values smaller than T as background pixels. But in the multithresholding image is segmented into no. of threshold level. Compression rate (CR) is depending on the no. of level. If the no. of levels is more then the CR is very high. When we are increasing the no. of threshold level CR is also increase, but there is one problem occurred, the image quality is degraded.JPEG is a commonly used standard method of compression for photographic images. The name JPEG stands for Joint Photographic Experts Group, the name of the committee who created the standard. JPEG provides for lossy compression of images. Image compression is the application of data compression on digital images. In effect, the objective is to reduce redundancy of the image data in order to be able to store or transmit data in an efficient form. The best image quality at a given bit-rate (or compression rate) is the main goal of image compression. The main objectives of this paper are reducing the image storage space, high compression rate, Easy maintenance and providing more security, Data loss cannot affect the image quality, Lower bandwidth required for transmission, reducing cost.

Error Metrics: - Two of the error metrics used to compare the various image compression techniques are the Mean Square Error (MSE) and the probalistic Signal to Noise Ratio (PSNR). The MSE is the cumulative squared error between the compressed and the original image, whereas PSNR is a measure of the peak error. The ma

$$MES = 1/NM = \sum_{V=1}^{M} \sum_{x=1}^{N} [I(x,y) - I'(x,y)]^2$$

$$PSNR = 20 * \log10 (255 / \mathrm{sqrt}(MSE))$$

Where I(x,y) is the original image, I'(x,y) is the approximated version (which is actually the decompressed image) and M,N are the dimensions of the images. A lower value for MSE means lesser error, and as seen from the inverse relation between the MSE and PSNR, this translates to a high value of PSNR. Logically, a higher value of PSNR is good because it means that the ratio of Signal to Noise is higher. Here, the 'signal' is the original image, and the 'noise' is the error in reconstruction. So, if you find a compression scheme having a lower MSE (and a high PSNR), you can recognise that it is a better one.

2 METHODOLOGY

Hybrid model (MULTITHRESHOL, HUFFMAN) is implemented as follows:

Loading an image is our first step as shown in fig.1 and 2 that image can be in RGB or gray scale format. The two images are taken to show different results .But important is to extract the original size of the image so as to compare it with the compressed image to get the exact results

Fig.1: Lena image used as a first image

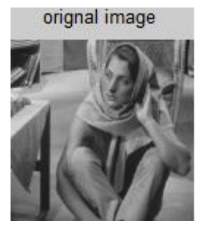

Fig.2: Barbara image used as a second image

The model we are using is hybrid model it is combination of Multithresholding and Huffman. First Multithresholding is implemented .We have to take the size of the same image and implement 3x3 matrix scanning on the same image for the extracted size to make a data set consisting of the different values for RGB. Then we define the threshold level. Then our algorithm suggest the most suitable multi threshold values to make a set of the extracted matrix to make most of the colour as closest intensity or in simple words make the set of closest one value and assign different threshold value to each set and make a table for different levels. If we set the level at 10.then it will chose a value as it should lies between the 10 values for each set. Now assign that chosen values to the sets. After all this happens now we have to build a Huffman tree for these values. Huffman tree is used for further compression of multi threshold image. In huffman tree we assign unique binary values to each set. These binary values are assigning according to the probability of occurrence of nos. The probability of occurrence will be higher for that no. which is most repeated. Table for level 10 is shown below. After applying the haffman, image is compressed.Fig.3 and fig.4 shows original and compressed image and histogram of Lena and Barbara image.

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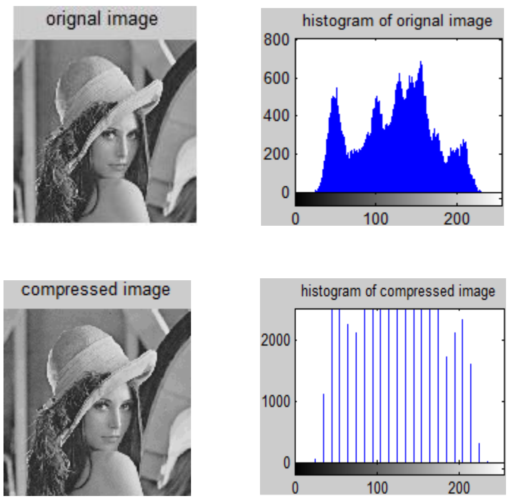

Fig.3: Original and Compressed Lena image with its histogram at threshold level 10.

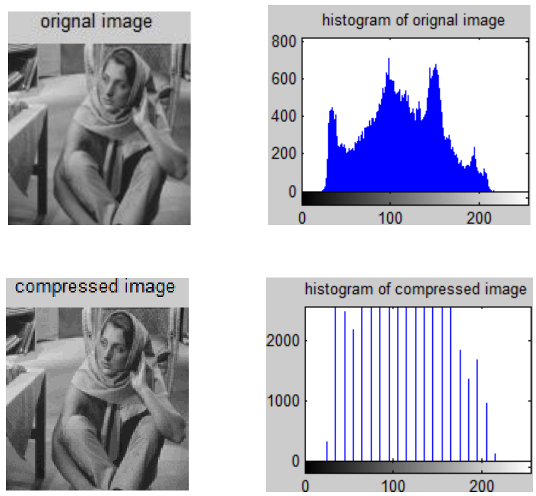

Fig.4: Original and compressed Barbara image with its histogram at threshold level 10.

Then after compression we transfer the image from one place to place or store the image. At the receiving side there is need to be decompress the image. With the help of Huffman tree we have to compress image and this is lossless technique so after doing decompression we will get the same image which we are encoding now. Fig.5 and fig.6 shows decompressed image of Lena and Barbara. Quality is good after decompression. After the whole process we have to check the PSNR and MSE. It is almost same as PSNR and MSE of original image.

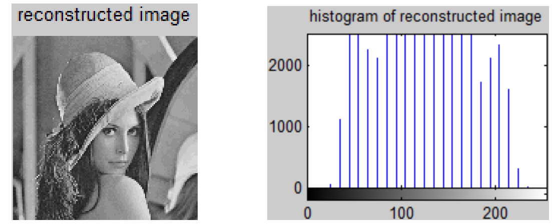

Fig.5: Decompressed Lena image with its histogram.

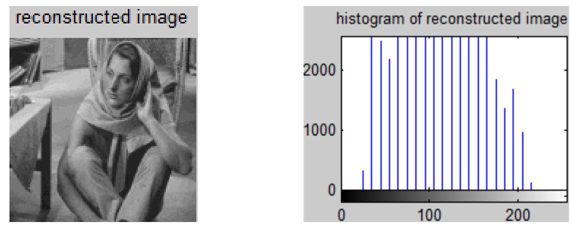

Fig.6: Decompressed Barbara image with its histogram

At the last we have to calculate PSNR and MSE of the decompressed image and compare it to the original image. PSNR (Probabilistic signal to noise ratio) and MSE (mean square error) are the two factors to which depicts the quality of picture.

3.Graphs

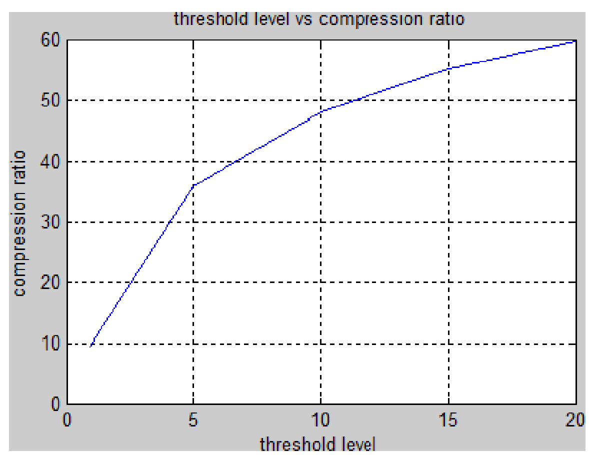

Fig.7:Graphs showing the varying values of Threshold Level and Compression for Lena image as a input.

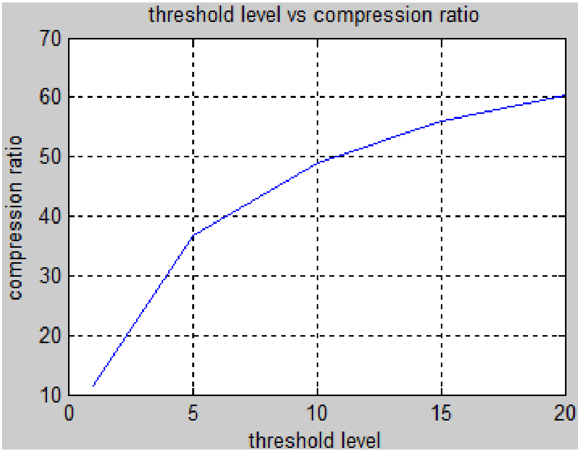

Fig.8: Graph showing the varying values of Threshold Level Land Compression for Barbara image as a input.

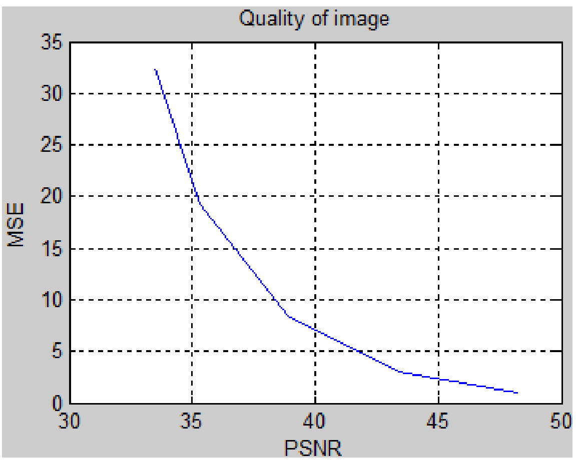

Fig.9: Graph showing the varying values of MSE and PSNR for Huffman at different Threshold Level for Lena image as a input.

4.RESULTS

TABLE I
RESULTS SHOWING FOR DIFFERENT THRESHOLD LEVEL FOR LENA IMAGE

LENA IMAGE				
THRESHOLD LEVEL	TIME TAKEN (sec.)	CR (%)	PSNR	MSE
1	20.51	9.51%	48.2	1
5	14.7	35.73%	43.4	2.99
10	12	47.86%	38.87	8.5
15	10.85	55.2%	35.31	19.3
20	10.12	59.62%	33.5	32.42

TABLE II
RESULTS SHOWING FOR DIFFERENT THRESHOLD LEVEL FOR BARBARA IMAGE

BARBARA IMAGE				
THRE-SHOLD LEVEL	TIME TAKEN	CR (%)	PSNR	MSE
5	14.92	36.8%	43.4	3.012
10	11.3	48.9%	38.9	8.5
15	11.11	55.9%	35.2	19.96
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

5.CONCLUSION AND FUTURE WORK

We have proposed a new compression technique which is focus on lossless and lossy mechanism. This technique is suited for both lossy and lossless compressions. The proposed method is a combination of both. In addition, we have calculated the time taken to compress the image. Here we are implement the Huffman and multithresholding method. We implement lossless technique so our PSNR and MSE will go better than the old algorithms and due to multithresholding we will get good level of compression. The proposed method can be used for any type of image. If we need less CR (compression Ratio) then set threshold level at low level, if we need high CR then set threshold level high. Therefore, based on the type of image and where it has been used, we can decide on what quality of compression we require. Results show that it gives better quality images and high CR than a simple Huffman technique and JPEG2000.We have working toward reduces the losses caused due to multithresholding technique

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