International Journal of Computer Trends and Technology- volume4Issue2- 2013

A Color Image Compression Using Pixel Correlation and Its Comparison with Existing Algorithms

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***Abstract* - Image compression is a widely addressed researched area. Many compression standards are in place. But still here there is a scope for high compression with quality reconstruction. The JPEG standard makes use of Discrete Cosine Transform (DCT) for compression. In this paper, it presents the new method use of DCT that is image compression using pixel correlation and its comparison with existing algorithms. Image reconstruction without any loss with high compression ratio has to be defined in this context. This algorithm is used only JPEG color images. In this R, G and B component of color image are converted to YCbCr before DCT transform is applied. Y is luminance component; Cb and Cr are chrominance components of the image. It takes three different images in different size for comparison with the Huffman coding and Arithmetic Coding. Results are analyzed on the basis of compression ratio.**

Keywords - Discrete Cosine Transform (DCT), JPEG, Compression Ratio, Huffman Coding, Arithmetic Coding.

I. INTRODUCTION

In color images, each color component that is R, G, B components, each contains 8 bit data. Also color image contains lots of redundancy which will make it difficult to store and transmit. However, RGB model is not suited for image processing purpose. For compression, a luminance-chrominance representation is considered due to superior to the RGB representation. Therefore, RGB images are transformed to one of the luminance-chrominance models, performing the compression process before apply the DCT, and then transform back to RGB model because displays are most often provided output image with direct RGB model. The luminance component represents the intensity of the image and looks like a gray scale version. The chrominance components represent the color

3. Psycho visual Redundancy

Coding redundancy is present when less than optimal code words are used. Inter pixel redundancy results from correlations between the pixels of an image. Psycho visual redundancy is due to data that is ignored by the human visual system. An inverse process called decompression (decoding) is applied to the compressed data to get the reconstructed image. Image compression systems are composed of two distinct structural blocks: an encoder and a decoder.

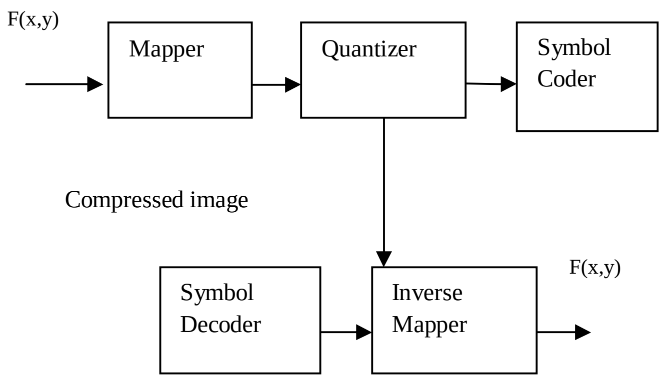

Fig. 1: Encoding and Decoding Process Model

F(x, y) Encoder Compressed image F(x, y) Decoder Image f(x, y) is fed into the encoder, which creates a set of symbols form the input data and uses them to represent the image. If we let n1 and n2 denote the number of information carrying units(usually bits) in the original and encoded images respectively, the compression that is achieved can be quantified numerically via the compression ratio,

CR = n1 /n2

II. IMAGE COMPRESSION TECHNIQUES

The image compression techniques are broadly classified into two categories depending whether or not an exact replica of the original image could be reconstructed using the compressed image. These are:

1. Lossless technique
2. Lossy technique

A. Lossless Compression

In lossless compression techniques, the original image can be perfectly recovered from the compressed (encoded) image. These are also called noiseless since they do not add noise to the signal (image).It is also known as entropy coding since it use statistics/decomposition techniques to eliminate/minimize redundancy. Lossless compression is used only for a few applications with stringent requirements such as medical imaging.

B. Lossy Compression

Lossy schemes provide much higher compression ratios than lossless schemes. Lossy schemes are widely used since the quality of the reconstructed images is adequate for most applications .By this scheme, the decompressed image is not identical to the original image, but reasonably close to it.

In this prediction – transformation – decomposition process is completely reversible .The quantization process results in loss of information. The entropy coding after the quantization step, however, is lossless. The decoding is a reverse process. Firstly, entropy decoding is applied to compressed data to get the quantized data. Secondly, dequantization is applied to it & finally the inverse transformation to get the reconstructed image.

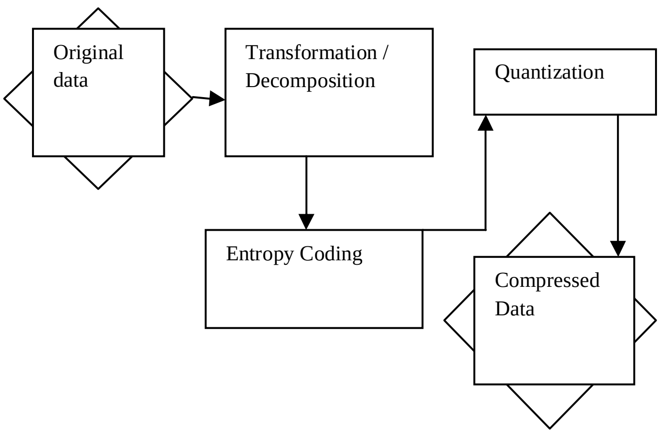

Fig. 2: Outline of lossy image compression

As shown above the outline of lossy compression techniques .In this prediction – transformation – decomposition process is completely reversible .The quantization process results in loss of information. The entropy coding after the quantization step, however, is lossless. The decoding is a reverse process. Firstly, entropy decoding is applied to compressed data to get the quantized data. Secondly, dequantization is applied to it & finally the inverse transformation to get the reconstructed image.

III. PURPOSED METHOD

A color image is used RGB model. It converts into no. of pixels. Therefore, RGB images are transformed to one of the luminance-chrominance models, performing the compression process before apply the DCT, and then transform back to RGB model because displays are most often provided output image with direct RGB model. After that applied the DCT algorithm, array of integers is converted into byte [] stream and match the values of color by using binary tree to sort the values of color and mark the reference of the location of stream index. This index will fill the color of the reference location. This helps to no reduction of value to achieve the lossless image. There is no neighbour color correlation by which more efficient image compression will achieve. The main steps of this algorithm:

Step 1: Take a jpeg image.

Step 2: Image convert it into pixels.

Step 3: Apply the DCT conversion.

Step 4: Fetch value of the Red(R) mode of image.

Step 5: Replace the value of same color with array references.

Step 6: Repeat same process for Green (G) and Blue (B).

Step 7: Write image to the hard disk.

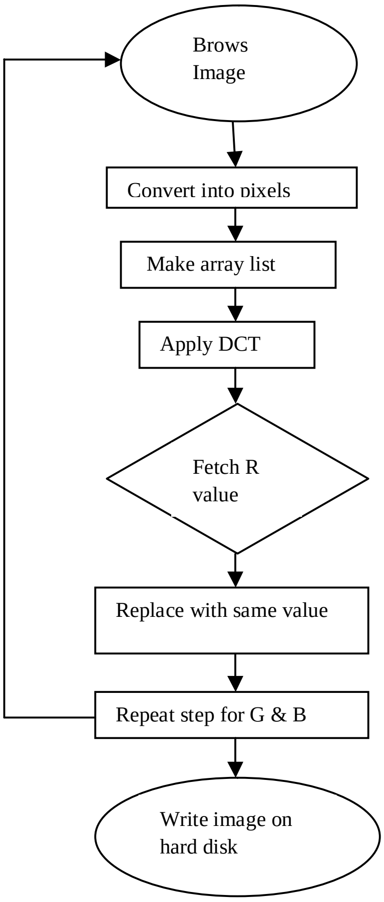

Fig. 3: - Flow Chart of Purposed Work

IV. COMPARISON WITH EXISTING ALGORITHMS

The comparison of the new method with the existing work that is Huffman Coding and Arithmetic Coding which is present by Asadollah Shahbahrami, Ramin Bahrampour et al; in their paper. They compare the Huffman and arithmetic coding on the basis of compression ratio and time ratio. For this process they take different images of different dimensions and compare it. But in this comparison mainly the compression ratio of the new work and existing work is compared.

TABLE I

COMPARISON BETWEEN NEW WORK AND EXISTING WORK

Dimension Size	New CR	Huffman CR	Arithmetic CR
128*128	6.91	4.38	4.65
256*256	6.36	4.78	5.4
512*512	7.47	5.27	6.55

Table shows the compression ratio of the new work and existing work that is Huffman coding and Arithmetic coding using different images of different dimensions. It clearly shows that the compression ratio of new work is better than the existing work.

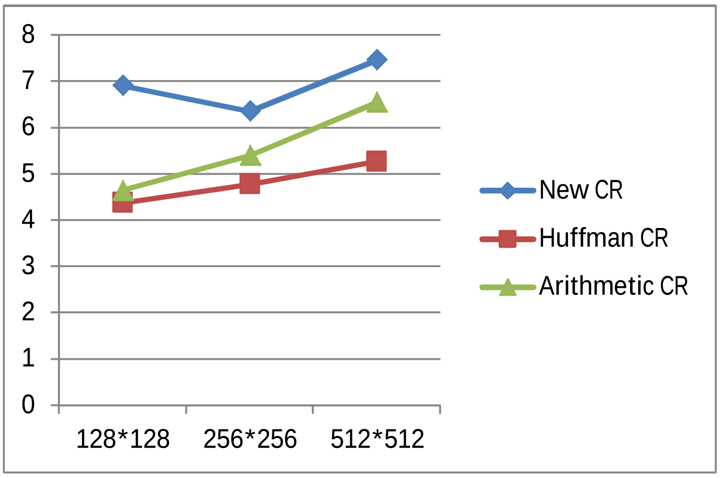

Fig. 4 : Compression Ratio Comparison Graph

The comparison graph of the compression ratio is shows by the red, green and blue color lines. Blue color line represents new CR, Green color line represents Huffman CR and Red color line represents Arithmetic CR. It shows that the new compression ratio is greater than the Huffman and Arithmetic compression ratio.

V. CONCLUSION

In this paper, we have considered a new method of pixel correlation used DCT algorithm and its comparison with existing algorithms that are Huffman Coding and Arithmetic Coding on the basis of compression ratio. As we see the compression ratio of the new method, Huffman Coding and Arithmetic coding as shown in table. The graph clearly shows that new method achieves high compression ratio as compare to both Huffman Coding and Arithmetic Coding. So, it proof that the new method has been presents a much better performance than existing work.

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