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Medical Image Lossless Compression Using Improvised DCT

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Abstract— The era of digital technology, bulky data transmitted over the network. The main challenge is to maintain the quality of the data packet delivered at the receiving end at a very high speed, failing the image quality would fall down and also everything would turn into slow motion. To maintain the speed and quality, lossless compression of the image is required. Medical images are a bigger challenge as they have different formats, especially MRI images. The thesis proposes compression of medical images using improvised DCT algorithm. Since finer details are important in medical images a special masking technique has been used, a mathematical formulation has also been derived to achieve the goal of maintaining the quality with speed. Finally, DCT and inverse DCT is applied on the images to compress the images. To check the robustness of the proposed algorithm MSE, PSNR and compression has been computed. The proposed algorithm had been compared with standard DCT algorithm and it is found that the proposed algorithm improves MSE, PSNR and compression ratio by 8% percent on an average. It can be concluded that the proposed algorithm performs better than standard DCT algorithm for medical images.

Keywords—ImageCompression,PSNR,MSE,DCT,InverseDCT,MRI

I. INTRODUCTION

Medical imaging is an area of medical field it is an application which helps to generate images of the human body, it is also the technique and process to create ocular representation of the internal body for clinical analysis and medical intercession and visual ocular representation of the function of some tissues, medical imaging help to diagnose and treat disease, medical imaging also helps to store data set for future diagnosis and research and development of medical field, in modern technology it is necessary to prepare for future plan and provide a wealthy information that is relied upon in the clinical management of patients and conduct planning.

There are many types images used in medical field CT (computed tomography), MRI (magnetic resonance imaging), Positron emission tomography-computed tomography (better known as PET-CT or PET/CT), these all related to the health care industry. These all standard are used in medical field all these treatments based upon the images the standard of this image is digital in nature and digital images need to be compression technique, compressed image easy to store large size of data and maintain easily, image compression is a technique of data compression and it is used for reducing redundancies of image, basically compression are two types lossless and lossy compression.

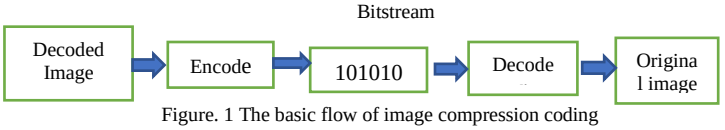

Figure. 1 The basic flow of image compression coding

Lossless image compression provides a correct reconstruction of original image, whereas lossy compression technique achieves higher compression ratio as compared to lossless compression but also achieve higher image degradation, both of technique we can select but depend on application area but in the medical image we can't bear loss of data so lossless image compression is used. In this paper, we introduced a lossless image compression algorithm for the medical field and telemedicine data storage.in this paper improvised DCT (Direct Cosine Transform) we are used which is fast transformation and also achieve higher compression ratio to take less time.

Section I introduction of paper (medical image compression using improvised DCT)
Section II Related Work previous year paper and related work describe Panos and Sanchez introduction of data compression etc
Section III Methodology (Describe algorithm DCT using masking)
Section IV Result and Discussion (describe result with help of graph and table)

Section V Conclusion (conclude paper with future scope)

II. RELATED WORK

Panos and Sanchez introduced the data compression approach. The aim of this proposed approach is provided compressed high size 3D image data for telemedicine applications using a centralized server, where all other consumers can use the data with high data quality [1].

Dr.Ghadah, Dr.Hazeem introduced an approach for medical science image compression with wavelets of polynomial prediction and bit plan slicing. In this paper, the authors give away by combing two existing approach wavelets of polynomial prediction coding and bit plan slicing [3].

Deshmukh and Satone **introduced** an approach to the study of image compression. The authors analyzed several techniques for compression of an image in medical science. This paper outlines the differentiation of compression approaches such as lossless and lossy and also describes numerous types of these techniques [7].

III.METHODOLOGY

Lossless image compression technique improvised DCT (Direct Cosine Transformation) is used some parameters are calculated based on these parameters we check the image quality, loss of image information there is no use of an image in the field of medicine. After image compression, the compressed image compares to the original image. For comparing images many parameters are used MSE, PSNR, CR, Compression size, and time is taken to compressed an image.

A. MSE

The MSE is the measure of the quality, The MSE of a guessed (of a process for evaluating an unrecognized volume) amplitude the mean of the two times of the bugs or deviations-that is, the changes between the guess and what is guessed. MSE is a critical function, reciprocal to the desired amount of the squared error damage or quadratic damage.

$$\frac{1}{MN}\sum_{y=1}^{M}\sum_{x=1}^{N}[I(x,y)-I'(x,y)]^2$$

B. Peak signal-to-noise ratio

It is often abbreviated PSNR, is a technical term for the ratio in max probable strength of a signal and the energy of damaged noised that affect the constancy of its characterization. Because several signals have a heavy wide dynamic scale, it is normally characterized in the log range

$$\mathbf{PSNR} = 20 * \log_{10}(255 / \sqrt{(\mathbf{MSE})})$$

C. Compression Ratio

If data within an image is providing no information or restate the information which is already known, then data is nonsense, it is called data redundancy. Data repetition is a critical problem in image compression.

$$RD = 1 - 1/CR$$

Where C_R, is commonly called the compression ratio.

$$CR = I1/ I2$$

D. PROPOSED ALGORITHM

This algorithm based upon improvised DCT

Initialize all required variables and quality required.
Step1. I ← read an image
Step2. r,c← get number of rows and columns of the image
Step3. Ones ←Generate a ones matrix and multiply by 128.
Step4. Subtract I from Ones generated in 3.
Step5. Formulate a Matrix for masking mask=

16 11 10 16 24 40 51 61
12 12 14 19 26 58 60 55
14 13 16 24 40 57 69 56
14 17 22 29 51 87 80 62
18 22 37 56 68 109 103 77
24 35 55 64 81 104 113 92
49 64 78 87 103 121 120 101
72 92 95 98 112 100 103 99]

Step6. If quality required is greater than 50 then
Ones ← Generate 8X8 ones matrix
Formulated_quality_matrix←mask*(ones)*((100-quality)/50)
else if quality required is less than 50 then
Formulated_quality_matrix←mask*(ones)*((50/quality))
else if quality required is equal to 50 then
Formulated_quality_matrix←mask
Step8. Generate 8X8 identity matrix
Step9. Perform DCT on the matrix
Step10. Perform inverse DCT on the generated matrix
Step11. Initialize a matrix to restore DCT.
Step12. Perform forward DCT transform.
Step13. Perform forward DCT cosine transform
loop through a number of rows with a step of 8
loop through a number of columns with a step of 8
read 8 blocks of the image
multiple blocks read with matrix generated in 9 and 10
store the generated matrixed loop
end loop
Step14. Quantize DCT coefficient
loop through a number of rows with a step of 8

loop through a number of columns with a step of 8
read 8 blocks of the matrix generated in 13
divide the matrix by mask
store the generated matrix end loop
end loop
Step15. Dequantize DCT coefficients
loop through a number of rows with a step of 8
loop through a number of columns with a step of 8
read 8 blocks of the matrix generated in 14
multiply the matrix by mask
store the generated matrix end loop
end loop
Step16. Perform Inverse Discrete cosine transform
loop through a number of rows with a step of 8
loop through a number of columns with a step of 8
read 8 blocks of the matrix generated in 15
multiple blocks read with matrix generated in 9 and 10
store the generated matrix end loop
end loop
Step17. Convert the matrix into intensity image using mat2gray
Step18. Perform calculations for the size of the generated image and compression ratio.
Step19. Calculate MSE and PSNR for the quality of the image.

IV. Results and Discussion

In the proposed work, there are various parameters in image compression techniques that are used to find a better compression technique. Result of base paper techniques are:

TABLE I. **Block Algorithm Results**

Sr.	Original Image Size	Compressed Image Size	PSNR	MSE	CR	Time (sec)
1	149	11.3824	65.87	0.019982	92.1494	15.12
2	140.382	12.4043	65.9835	0.016396	89.6881	14.89
3	135.231	10.6426	56.202	0.01559	91.2952	14
4	126.151	17.0137	66.3673	0.015009	87.5045	12
5	106.855	16.1406	67.1178	0.012627	86.1995	10
6	514.105	47.1484	68.5844	0.024082	90.7301	58.12
7	60.746	8.03906	68.0597	0.010165	86.2516	9
8	132.568	14.5254	66.6174	0.014169	88.4412	14.12
9	138.765	10.8711	65.7028	0.01749	91.9498	15

Result of proposed paper are: Study to compressed image using improvised DCT algorithm

TABLE II. **Improvised DCT Algorithm Results**

Sr.	Original Image Size	Compressed Image Size	PSNR	MSE	CR	Time (sec)
1	149	6.48902	68.5356	0.00911	95.2988	10.12
2	140.38	7.82616	68.08	0.00801	93.942	10.89
3	135.23	6.46133	68.6528	0.00886	94.888	9
4	126.15	8.76758	68.26	0.00970	92.6237	8.9
5	106.85	10.0771	68.781	0.00861	91.4971	9
6	514.10	34.7358	69.5852	0.00916	92.6212	38.11
7	60.746	6.808	70.20599	0.00620	87.5969	8
8	132.56	9.63103	68.3595	0.00948	92.7686	11.12
9	138.76	7.25254	68.6841	0.00880	95.3995	10

Graphical representation to show comparison of Compression size, PSNR, MSE, Compression Ratio.
Green line show base paper result and Red line show proposed paper result

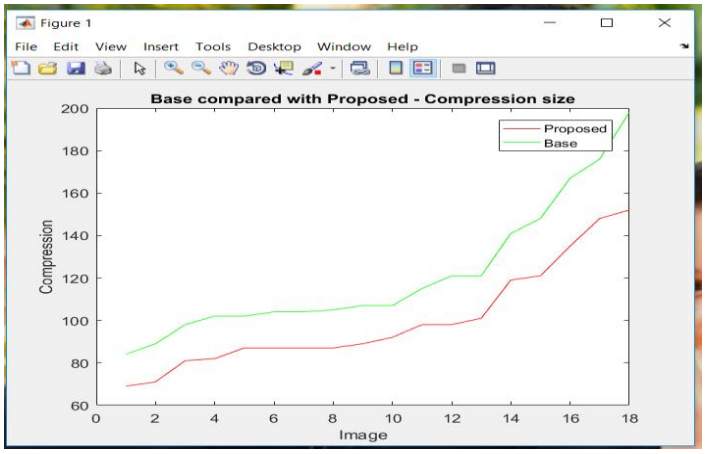

Figure 2 compression size line graph

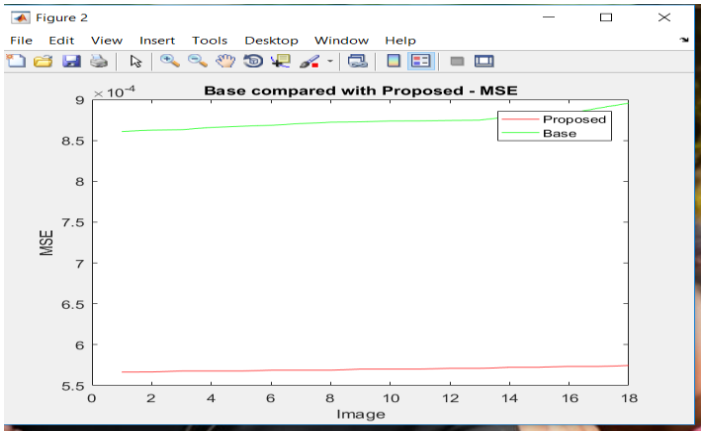

Figure 3 MSE line graph

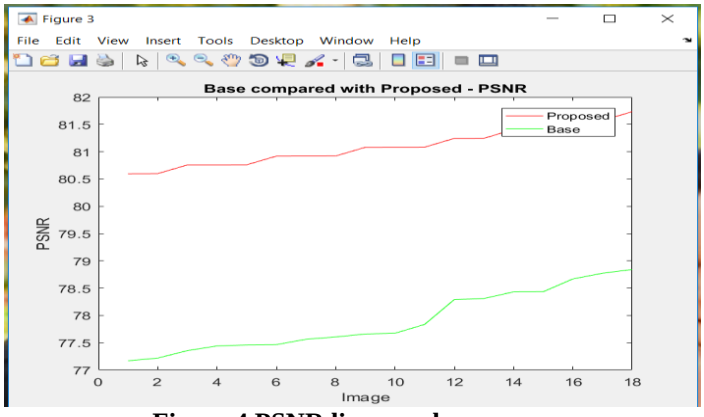

Figure 4 PSNR line graph

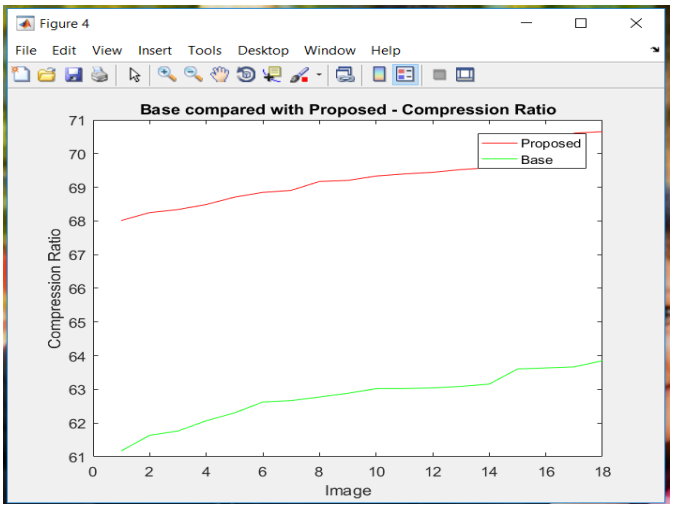

Figure 5 Compression Ratio line graph

V. Conclusion and Future Scope

The approach implemented used in this thesis on real medical images, where lossless improvised DCT compression is needed. In medical science lossless compression is espoused because the loss of data can make diagnosis results incorrect and the doctor can feel difficulty during treatment. The proposed technique automatically reduced the compression size, and time of compressions, maximize the PSNR 8% and improve CR and it is general and it will be applied to any kind of medical images. In the future, this method can be implemented in the field of telemedicine. The field of medical image compression is tender for vigorous growth. In future work, the study can be enhanced by combining other techniques with this proposed algorithm. Also, the work can be moved out with other advanced techniques to get a better result.

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