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# Region of Interest Based Image Compression

**PratikChavada[1], Narendra Patel[2], KanuPatel[3]**

P.G.Student, Department of Computer Engineering, B.V.M. Engineering College, V. V. Nagar, India[1]

Associate Professor, Department of Computer Engineering, B.V.M. Engineering College, V. V. Nagar, India[2]

Assistant Professor, Department of Information Technology, B.V.M. Engineering College, V. V. Nagar, India[3]

**ABSTRACT**:The basic goal of region of interest (ROI) based compression for medical image is to enhance the compression efficiency for transmission and storage.Main goal of Region of interest(ROI) compression is to compressROI with supreme quality as compared to other region called Background. For an example, while compressing medical image the diagnostically important region should be compressed with better quality than background. Thus, the ROI area is compressed with less compression ratio and the background with the highest possible compression ratio in order to get overall better compression performance.

As a part of ROI compression technique algorithm is developed using discrete cosine transform and Wavelet transform. A detailed analysis is carried out on the basis of parameters like compression ratio(CR),mean square error(MSE) and peak signal to noise ratio(PSNR). Advantage of ROI compression over conventional compression scheme is to improve quality of ROI with less value of MSE and PSNR.

**Keywords**:Region of interest,Image compression, DWT, JPEG, PSNR, MSE,Compression ratio.

## I. INTRODUCTION

The aim of this paper is to propose an algorithm which compressesmedical images.It requires some specific portion as region of interest called ROI in which we have to maintain the image quality and other than ROI portion is called Background.The US medical images are used for diagnosis purpose so here good quality of ROI is required. Image compression is the application of data compression on digital images. The objective is to reduce redundancies of image data in order to able to store or transmit the data in an efficient form.The reduction in file size allows more images to be stored in a given amount of disk or memory.It is also reduction the time required for images to be sent over the Internet. It also reduction the time for downloaded from Web pages. The purpose of image compression is to achieve a very low bit rate representation [10].

In case of conventional compression schemes the equal loss of information will occur for whole image, as they are compressed with equal CR but in contextual compression schemes, the visual quality of important area (ROI) will be quite better due to less information loss of ROI as compared to back ground.

## II.RELATED WORK

In [1] an efficient, region-of-interest (ROI) coding scheme achieved by modifying the implicit ROI encoding method is proposed. This new method reduces the priority of background coefficients in the ROI code-block without compromising algorithm complexity. ). The main strength of maxshift is its fast ROI reconstruction.It also lifts the restriction on ROI shape [2]many classes of images contain spatial regions which are more important than other regions. Compression methods capable of delivering higher reconstruction quality for important parts are attractive in this situation. For medical images, only a small portion of the image might be diagnostically useful, but the cost of a wrong interpretation is high. Hence, Region Based Coding (RBC) technique is significant for medical image compression and transmission. Lossless compression schemes with secure transmission play a key role in telemedicine applications that help in accurate diagnosis and research. New method for region of interest (ROI) coding based on the embedded block coding with optimized truncation (EBCOT) paradigm [3]. In [4]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. The introduction of the wavelets gave different dimensions to the compression. This paper aims at the

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analysis of compression using DCT and Wavelet transform by selecting different parameters.In [5] examine a set of wavelet functions (wavelets) for implementation in a still image compression system and to highlight the benefit of this transform relating to today's methods. CT or MRI Medical imaging produce human body pictures in digital form. Since these imaging techniques produce prohibitive amounts of data, compression is necessary for storage and communication purposes [7].In [8] the analysis of compression using DCT and Wavelet transform by selecting proper threshold method, better result for PSNR have been obtained.

## III. PROPOSED TECHNIQUE

(A) JPEG algorithm step [8]:

- The first step in JPEG compression process is to subdivide the input image into non-overlapping pixel blocks of size 8*8.
- Pixel values of a black and white image range from 0-255 but DCT is design to work on pixel values ranging from -128 to 127.Therefore each block is modified to work in the range.
- DCT equation used to calculate DCT matrix. DCT is applied to each block by multiplying the modified block with DCT matrix on left and transpose of DCT matrix on its right.
- Each block is then compressed through quantization.
- Quantized matrix is then zigzags scan then entropy encoded.
- Compressed image is reconstructed through reverse process.Inverse DCT is used for decompression.

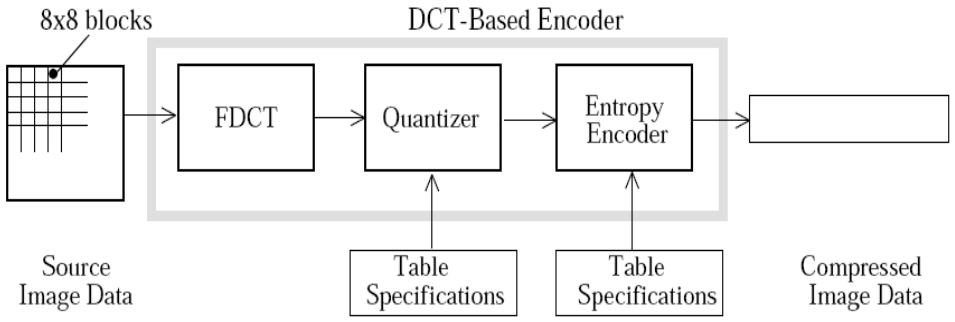


Fig 1:DCT Encoding [8]

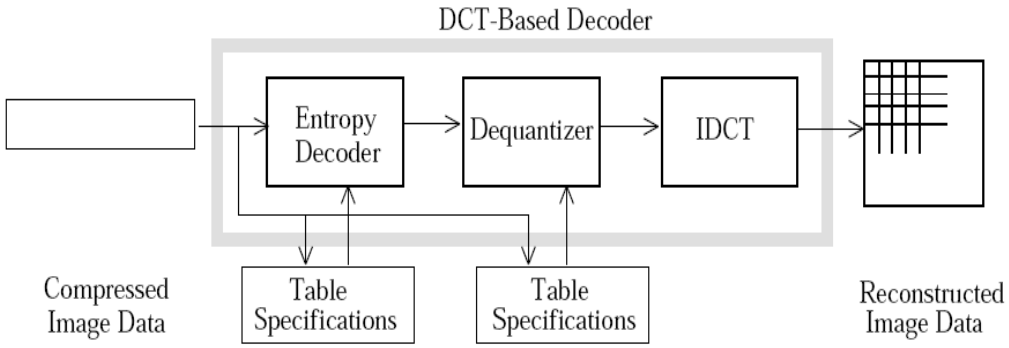


Fig 2:DCT Decoding [8]

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(B)ROI based JPEG Algorithm steps:

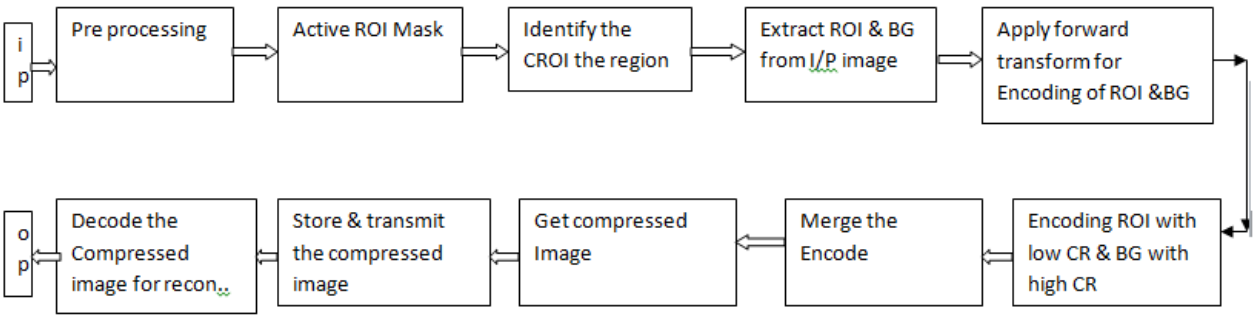


Fig 3: ROI based JPEG Algorithm steps

Algorithm Steps:

- Initialize the parameters of an image and load the original image to be compressed.
- Select ROI by FREEHAND command.
- Select ROI and extract in another image.
- BG in another image.
- Encoding of ROI region is performed selectively with JPEG with low CR.
- Encoding of BG region is performed selectively with JPEG with low CR.
- Merge the ROI and BG.
- After reconstruction, the image is correlated with original image.
- Evaluate the result using parameters like PSNR and MSE.

(C)Image compression using Wavelet

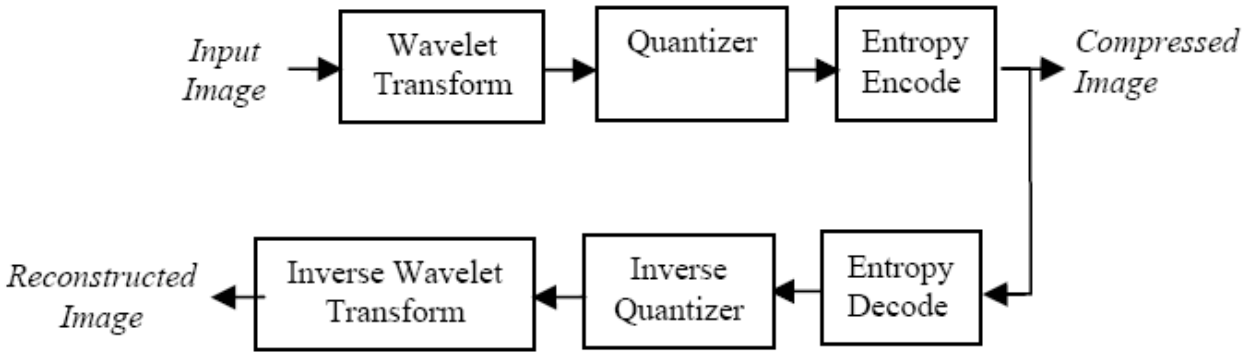


Fig 4: Wavelet Encoder & Decoder[10]

The steps of the proposed compression algorithm based on DWT are described below [10]:

**I. Decomposition:**

Choose a wavelet and a level N. Compute the wavelet and decompose the signals at level N.

**II. Threshold detail coefficients:**

A threshold is selected and hard threshold is applied to the detail coefficients (HL, LH, HH) for each level from 1 to N.The value of wavelet coefficient is smaller than threshold it become zero.

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**III. Reconstruct:**
For each level from 1 to N, compute wavelet reconstruction using the original approximation coefficients and the modified detail coefficients (in which high frequency coefficients are present) of levels from 1 to N.

(D)ROIbased Wavelet algorithm

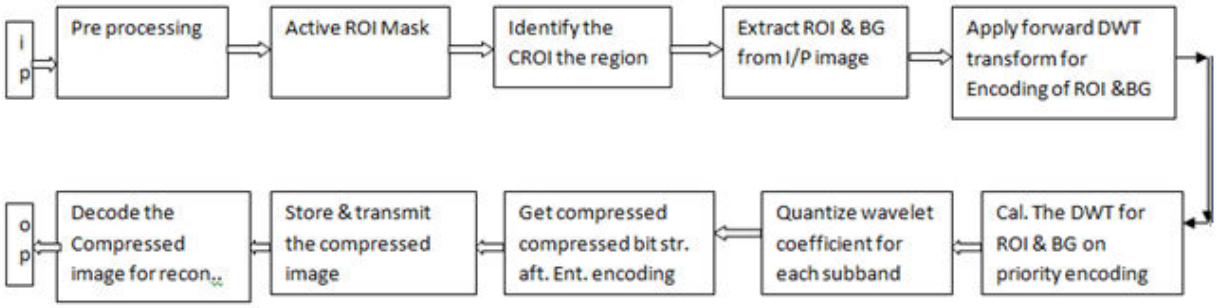


Fig 5: ROI wavelet algorithm steps

Algorithm Steps:

- Identify the region of interest (ROI)from original image.
- Select ROI using FREEHAND command using mouse.
- Generate the ROI mask and extract it in to another image.
- Extract background in another image.
- Select the method of compression for ROI and BG respectively.
- For priority encoding of image, calculate the wavelet coefficient of ROI & BG separately.
- Quantize the wavelet coefficient for each sub band of each region.
- Compress the ROI and BG with very low and high CR respectively.
- Get the compressed bit stream of input image for ROI & BG separately.
- Decode the image.
- Merge the ROI and BG region to get reconstructed image.
- Calculate performance parameters of ROI, BG& reconstructed image.
- After calculating parameters, original image compressed with same CR and get full compressed image.
- Compare and analysis of ROI part of reconstructed image and full compressed image.
- Repeat the process by changing threshold till the desired quality and the required compression performance parameters are achieved.

## VI. EXPERIMENTS RESULT AND ANALYSIS

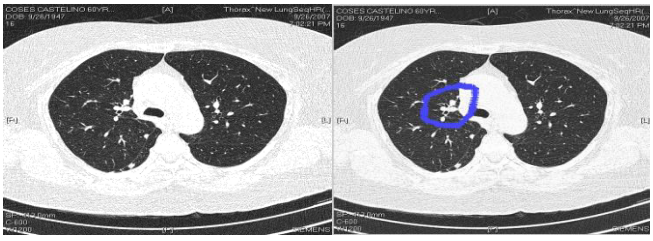

Fig 6:Original image of Lung  Fig 7: Select ROI using mouse

Here, we take Fig 6an Original image of lung, select Region of interest (ROI) using freehand command (Mouse) as indicate in Fig 7.

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Fig 8:ROI of image



Fig 9: Background of image

After selecting region of interest (ROI),we Extracted ROI and other part called Background (BG) in separate image as shown in Fig 8and Fig 9 respectively.

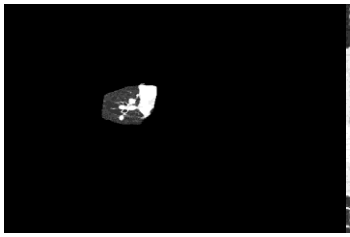

Fig 10:ROI Compress with low CR.

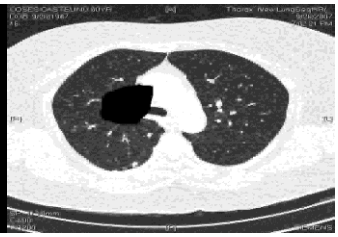

Fig 11: Background Compress with high CR

Next we compress ROI with low compression ratio and BG compress with high compression ratio using different technique DCT and DWT, which shown in Fig 10 and Fig 11 respectively.

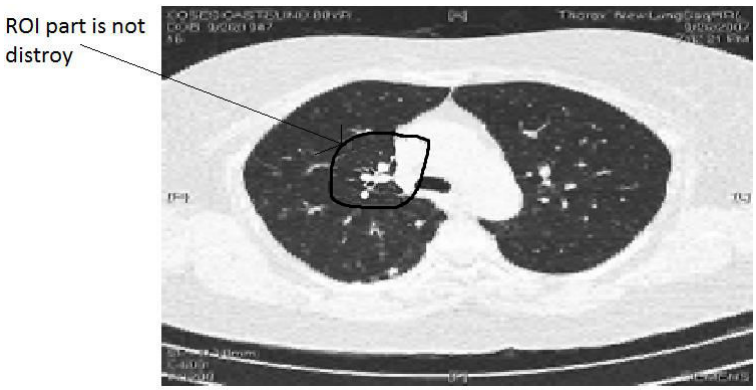


Fig 12:Reconstructed image

At the last we merged both compressed ROI and background in single image. So, we get reconstructed image as shown in Fig 12. So from Fig 12 we can see that ROI compress with less compression ratio therefore ROI part is not destroy in reconstructed image.

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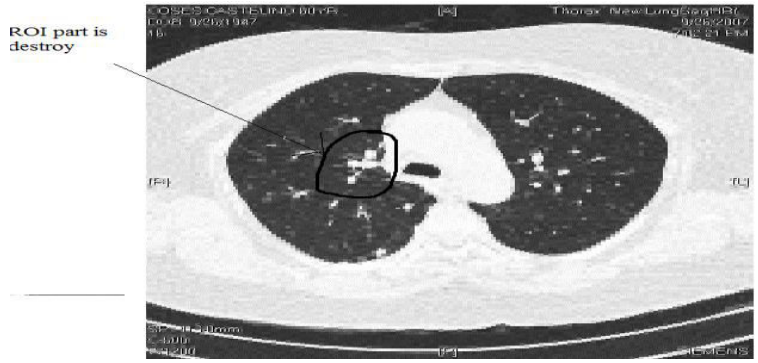


Fig 13: Fully compress image

In Fig 13, we indicate whole image compressed with same compression ratio. Therefore ROI part is destroy in Full compressed image.

Analysis is done based on different parameter like CR, PSNR,and MSEas described in below tables.

TABLE 1:CR, PSNR,MSE of ROI, BG and Reconstructed image.

| ROI image | | | | BG image | | | | Reconstructed image | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Threshold | CR | PSNR | MSE | Threshold | CR | PSNR | MSE | CR | PSNR | MSE |
| Th(30) | 5.74 | 41.8480 | 4.2823 | Th(50) | 38.4 | 23.5686 | 288.1539 | 37.74 | 23.5071 | 292.2610 |
| Th(50) | 16.93 | 38.2752 | 9.7490 | Th(90) | 48.4 | 21.9428 | 418.9906 | 47.85 | 21.8518 | 427.8539 |
| Th(90) | 24.03 | 35.6622 | 17.793 | Th(150 | 50.4 | 20.4831 | 586.3616 | 50.19 | 20.3813 | 600.2794 |

Here, Table 1, indicate that, if ROI compressed with low threshold valuethen we get high PSNR and low MSE. BG compresses with high threshold value then we get low PSNR and high MSE. PSNR and MSE of reconstructed image is shown in Table 1.

TABLE 2: CR,PSNR,and MSEof Full compressed image

| Full image compressed | | | |
|---|---|---|---|
| Threshold | CR | PSNR | MSE |
| Th(50) | 38.52 | 23.4327 | 297.3085 |
| Th(90) | 48.24 | 21.7902 | 433.9689 |
| Th(170) | 50.97 | 20.0731 | 644.4267 |

PSNR and MSE of full compress image is shown in Table 2.We can say from Table 1 and Table 2 that PSNR of reconstructed image in case of ROI based compression is higher than fully compressed image and MSE of reconstructed image in case of ROI based compression is lower than fully compressed image.

TABLE3: PSNR and MSE of ROI reconstructed image

| ROI of reconstructed image | |
|---|---|
| PSNR | MSE |
| 41.8480 | 4.2823 |
| 38.2752 | 9.7490 |
| 35.6622 | 17.793 |

TABLE4: PSNR and MSE of ROI of full compress image

| ROI of full compress image | |
|---|---|
| PSNR | MSE |
| 38.2752 | 9.7490 |
| 35.6622 | 17.7936 |
| 33.3369 | 30.3938 |

Table 3 indicates PSNR and MSE of ROI part of reconstructed image and Table-4 indicates PSNR and MSE of ROI part of full compressed image. We can say from Table 3 and Table 4 that PSNR of ROI part of reconstructed image is higher than PSNR of ROI part of full compress image and MSE of ROI part of reconstructed image is lower than PSNR of ROI part of full compress image. Therefore, ROI part is more destroy in full compress image.

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## V. CONCLUSION

In medical images the region of interest should not be distorted after compression. In case of conventional compression schemes the equal loss of information will occur for whole image, as they are compressed with equal CR.But in ROI based compression schemes, the visual quality of important area (ROI) will be quite better due to less information loss of ROI as compared to back ground.

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## BIOGRAPHY

Pratik C. Chavadagraduated in May 2011 fromDharmsinh Desai University at Nadiad, Gujarat in Information Technology. He is currently working on his M.E inComputer Engineering atBirlaVishvakarmaMahavidyalaya(BVM) under Gujarat technical University(GTU). His current research interest area is in Digital Image Processing.

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Narendra M. Patel graduated from Maharaja SaiyajiRao University in Electronics. He had done Master of Engineering from Maharaja SaiyajiRao University in Microprocessor&its application. He has completed his Ph.D. from SVNIT.He had published four national and five international paper.He had presented seven national and ten internationpaper. Currently he is working asAssociate Professor at Birla VishvakarmaMahavidhyalaya (vvnagar).His area of specialization are Microprocessor Application, Operating System, computer graphics and Digital image processing.

Prof. Kanubhai G. Patel is working as Assistant professor in Information Technology Department of Birla vishvakaramamahavidyala Engineering College which is run under the CharutarVidyMandal, VallabhVidyanagar. He has completed his Bachelor of Information technology from Birla vishvakaramamahavidyala Engineering college and Master of Computer science and Engineering from Government Engineering College, Modasa with the specialized subject of Data mining and Algorithms. He has published 1 national and 5 international research paper in well reputed journals. He is a writer of Data structure book in Atul publication.