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A Recent Approach to Analyze Performance of Medical Images by Using SPIHT Method Rooted on the Wavelet Transform

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ABSTRACT: There has been investigated numerous ways to compress the images for fast transmission with minimum redundancy over communication network and to offer more secrecy for the important data. The medicinal picture compression methods play a critical role in digital pictures compression to decrease the redundancy and encoding of data. By applying multifarious algorithms researchers have observed various results but in current scenario more sophisticated and fast compression approaches are demanded for faster transmission as the images have been produced in bulk for various purposes in the sector of the healthcare which need to compress and process in more efficient and fast way for the efficient treatment of the patients across the globe. In this paper a recent approach has been investigated for the fast image compression and transmission with minimum redundancy and to offer more secrecy from various noise attacks which is the major challenge to protect the data over communication media. This investigated method is basically rooted on principle of the faster lifting wavelet transform for compressing medical pictures in a fast and error free compression as well as to maintain the image quality with high precision which is demanded in the modern world.

KEYWORDS: Communication Media, Images, MSE, PSNR, Wavelet Transform.

INTRODUCTION

The medicinal pictures are essential in the sector of the medical science for multifarious purposes such as the patient's reference for treatment which is needed to store and process according to the demands. These types of pictures demand the compressed file size for the processing such as transmission over communication media due to various reasons such as fast and secure transmission etc. [1] The pictures data which are generated every day in the medical sector is increasing dramatically worldwide [2]. The overall bandwidth of the communication networks have been increased constantly but the transmission data is also increasing continuously for various purposes which need to compress for fast transmission [3]. There is an extensive demand of the picture storage as well as retrievals for many purposes in the sector of the healthcare for the proper treatments of the patients [4].

The wavelet examination is a novel approach for the solutions of the challenging and difficult issues in numerous applications such as in the compression of the pictures [5]. Although there has been done extensive research in the sector of healthcare to reduce the pictures size but there are still a huge challenge for the image quality maintenance and proper size reduction [6].

The picture quality is a critical challenge which is based on practicability and frequently overlooked in numerous designs of multiple systems [7]. The distribution and the storage of medicinal digital images play a critical role for the patients proper treatment and recovery across the globe and there has been invented numerous approaches but these have few limitations with the present communication models [8]. The recent invented communication models demand more compressed data as the bandwidth is limited according to the users demands which demands compressed data [9].

LITERATURE REVIEW

Oliveira et al. explored and reviewed the automated picture registration approaches that has been utilized in the medicinal sector for multifarious purposes. The primary objective of this paper was to offer an introductory level of this sector as well as to offer the information on the effort that has been done. In this paper it is explored that the medicinal sector has a pragmatic scope for more experimentation for the medicinal image compression for better utility [10]. Sophia et al. explored a novel approach for context rooted compression which play a crucial role in the sector of the digital communication arena. This investigated approach offers an improved technique for files compression of multiple pictures formats for clinical pictures by normalization as well as prediction. In present article, it has been found that this investigated approach is improved in comparison to existing methods [11]. Zhang et al. explored a recent contextual unseen Markov model as well as the enhanced pulse coupled neural network rooted fusion method for multiple medicinal picture fusion. This method is better for the flexibility as well as for the representation of the pictures e.g. the boundaries, contours as well as the textures that can overcome the disadvantages of the 2-D wavelet transformation. This experiment outcomes demonstrates that this investigated approach can further enhance fusion picture quality as well as the visual effects [12]. Veeraswamy et al. discussed about his research on the AC-coefficient forecast for picture compression as well as the blind watermarking. In this paper, authors investigated a novel picture compression algorithm rooted on the AC coefficients in DCT blocks. The linear programming is utilized to measure the weights with respect to the picture contents. In addition to this, a picture watermarking algorithm is also investigated by applying the DCT AC coefficients [13].

Grandhe et al. explored a new method for the 3D medicinal picture retrieval system by applying the dual tree M-bands wavelet transformation. In this paper, authors discussed that the medicinal picture diagnosis is a critical and the challenging task due to multifarious reasons which are not in a condition of recognition in the early phase. This article offers a detailed study on clinical picture processing and compression approaches [14]. Bruylants et al. investigated another approach for data handling which are being generated each day for clinical purposes. The proper handling of the produced medicinal image is critical and demands more research to explore pragmatic compression approaches. In this paper, authors investigated medicinal image compression approach to handle bulk image data [2].

METHODOLOGY

1. *Design:*

The image compression play a crucial role in the modern digital image transmission due to various reason such as to reduce the redundancy and fast transmission over communication media and to provide more sophistication in medical image transmission for the fast and better treatment of the patients. There has been explored numerous approaches for better image compression and transmission over communication media in last many years but these investigated approaches are not as much sophisticated in modern world to minimize the quality degradation of the pictures due to the bulk production of the medical images for the patients treatment. The approach design model is depicted in the below Figure 1.

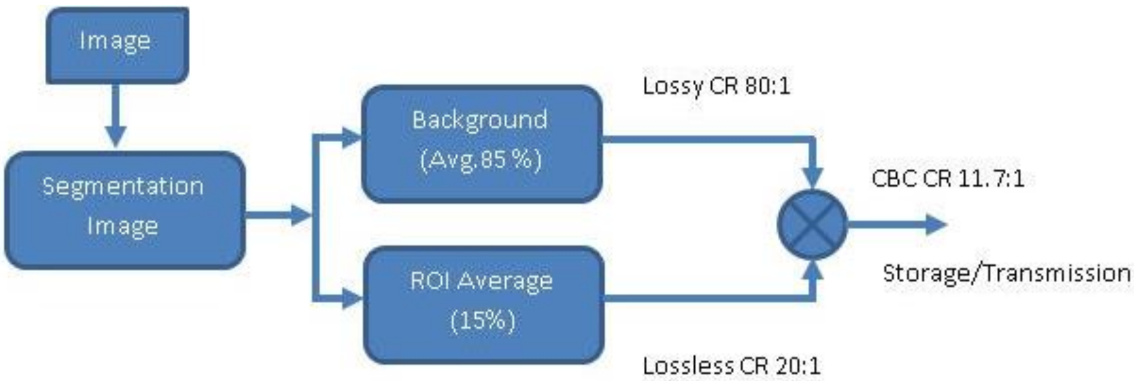


Figure 1: Content rooted compression calculated compression ratio

2. *Instrument:*

The compressions of the images play a crucial role in various arena across the globe such as the medicinal applications, multimedia as well as in the sensors. The compression of the pictures demands to reduce the total amount of the sequence of the digital data for proper storage and communication perspectives. The medicinal image compression methods are being investigated for better and fast transmission of the medicinal images. In this research paper a new image compression approach has been verified and tested with the help of the MATLAB software. For this method testing the MATLAB R2018a was utilized with a personal computer configuration of 64-bit with 6GB RAM. The MATLAB tool offers numerous tools for multifarious purposes which are not limited to image processing, signal processing etc. This software has numerous advantages such as user friendly interface and easy to handle by the individuals.

3. *Data Collection:*

The set partitioning in hierarchical trees (SPIHT) is a significant technique to compress images but in this approach numerous image formats have been tested and verified such as JPEG, PNG and TIFF etc. for actual verification of this approach to compress the data for better and fast transmission without low redundancy for fast image decoding and transmission for patients treatments worldwide. The SPIHT algorithm was investigated for the transmission of the pictures progressively with the help of the SNR scalability. A tree rooted assembly which is called spatial orientation tree (SOT), generally describes the spatial connection on the hierarchal pyramid. Figure 2 below depicts the way how the SOT is described in the pyramid assembled with iterative four-subband piercing.

Every node of the tree architecture illustrated in figure 2 has been recognized with the help of the pixel coordinates. This tree diagram is directly descendants corresponding to pixels of the similar spatial orientation in the subsequent greater level of the represented pyramid. This depicted tree diagram is described in such a way that every knob has either no offspring of 4 offspring that forever makes a collection of the 2 * 2 neighboring pixels. The subsequent groups of coordinates are utilized to show the recent coding approach:

P (i, j): group of coordinates of each offspring nodes (i, j);

B (i, j): group of diverse coordinates of each child of the nodes (i, j);

I: group of coordinates of each spatial orientation for hierarchy origins (knots in the maximum pyramid level); M (i, j) = B (i, j) - P (i, j).

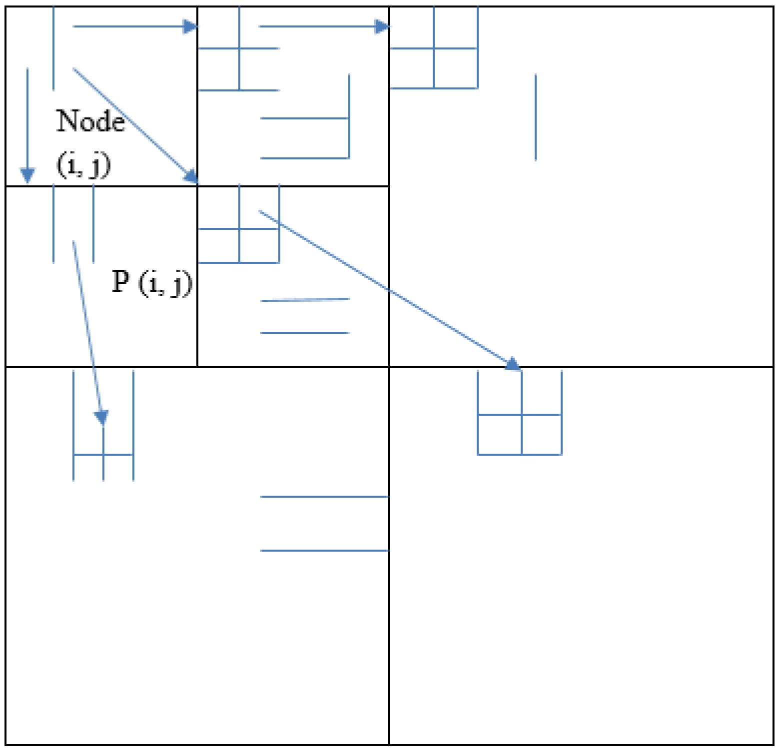


Figure 2: Illustrates the SOT tree (Wavelet Pyramid)

Group dividing guidelines are just the following:

- The original segregation is molded with the groups {(i, j)} as well as B (i, j), for each of the (i, j) ∈ I.
- If B (i, j) is important, in that case it is braked into L (i, j) and the 4 single component groups with (k, l) ∈ p (i, j).
- If L (i, j) is noteworthy, in that case it is divided in 4 groups B (i, j), with the help of (k, l) ∈ P (i, j).

4. *Data Analysis:*

The pictures quality can be degraded after the compression, blurring or multifarious factors such as the noise or sensors inadequacy. To maintain the quality of the pictures various performance parameters are needed to take care for the validation of the medicinal images such as pixels based measures as well as the correlation based measures. The pixel based parameters are utilized to investigate the MSE which is rooted on the pixels differences like the real picture and the reconstructed picture. The lower mean square error (MSE) represents acceptable degradation. The MSE and normalized cross-correlation (NCCR) equations are given below.

$$MSE = \frac{1}{N^2} \sum_{p,q=0}^{N-1} \{C\ (p,q) - c'(p,q)\}^2$$

$$NCCR = \frac{\sum_{i,j=0}^{N-1} C\ (i,j)\ c'(i,j)}{\sum_{i,j=0}^{N-1} C\ (i,j)\ ^2}$$

4.1 Algorithm:

Step 1: Input the real picture g(x).

Step 2: Read the picture g'(x).

Step 3: Calculate the diverse factors (namely the MSE, CR including the value of the PSNR) of picture preliminary after i = 0 to the n = 10.

Step 4: Weigh various parameter digits with the approaches SPIHT with Haar.

Step 5: Weigh the various parameter digits through the methods SPIHT with the help of bior4.4

Step 6: Revise step 3 while (i≤n)

Step 7: End.

RESULTS AND DISCUSSION

A comparative analysis by applying the progressive approach for SPIHT algorithm with haar through various parameters such as the MSE as well as CR, including the PSNR as well as CoC has been described underneath. Compression outcomes of the SPIHT using the Haar wavelet 16×16 picture are considered for the results validations with applied algorithm. For the testing and validation of the proposed algorithm 16x16 picture format is considered. In this section, various iterations are presented with respect to the various parameters such as CR, PSNR, MSE as well as the CoC. Figure 3 shown below depicts the real picture with its compressed picture for the testing and to measure the performance parameters.


(a) Real Picture (b) Compressed Picture

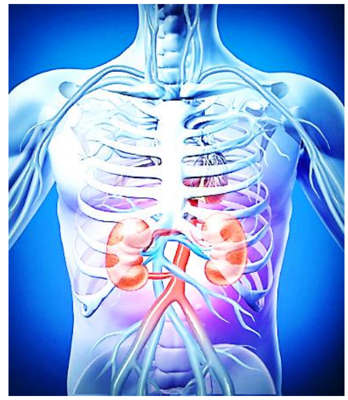
At Iterations 5 (CR: 5.29, PSNR 44.9)


(a) Real Picture (b) Compressed Picture

At Iterations 6 (CR: 10.6, PSNR 38.99)

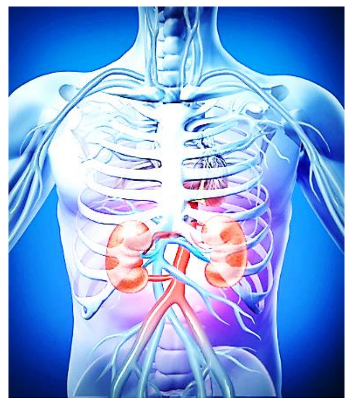

(a) Real Picture (b) Compressed Picture

At Iterations 7 (CR: 18.42, PSNR 36.6)

(a) Real Picture (b) Compressed Picture

At Iterations 8 (CR: 28.39, PSNR 31.31)

(a) Real Picture (b) Compressed Picture

At Iterations 9 (CR: 40.31, PSNR 30.10)

Figure 3: Depicts various iterations for real picture with compressed picture from iteration 5 to 9 with CR as well as the measured PSNR.

Table 1: Depicts kidney picture measured parameters with SPIHT as well as Haar.

S. No.	No. of iterations	CR (%)	PSNR	MSE	CoC
1	5	5.29	44.9	1.50	0.779
2	6	10.6	38.99	2.05	0.769
3	7	18.42	36.3	3.80	0.755
4	8	28.39	31.31	11.08	0.729
5	9	40.31	30.10	30.64	0.714

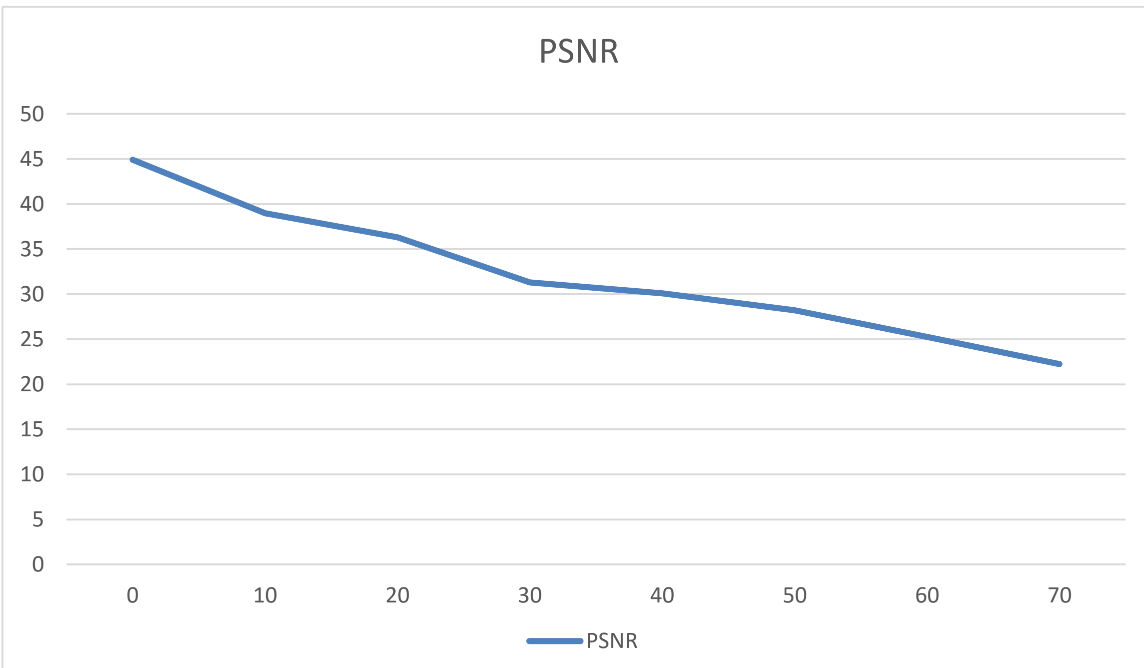


Figure 4: Illustrates the graph between the CR and the corresponding PSNR.

Table 1 depicts the kidney picture measured parameters with SPIHT as well as Haar for the iteration number 5, 6, 7, 8, and 9 and all the measure parameters like CR, PSNR, MSE and the CoC are measured and validated through the MATLAB software version R2018a. The corresponding PSNR and the MSE values in Figure 4 are 44.9, 38.99, 36.3, 31.31, 30.10 and 1.50, 2.05, 3.80, 11.08, 30.64 respectively which are optimal with 16x16 JPEG format. For the proper validation multifarious iterations results are measured and validated with high degree of precision and it is found that the present method is more sophisticated and effective in terms of quality maintenance of the pictures during the decompression of images. In this paper, compression ratio (CR) is calculated and measured properly for the real and the compressed picture with high precision for the actual validation of the proposed method for medical image compression for multifarious purposes such as the patient's treatments and proper recovery in a fast way across the globe. The actual CR for iteration 5, 6, 7, 8, and 9 are 5.29, 10.6, 18.42, 28.39 and 40.31 respectively which is pragmatic in comparison to the existing approaches.

CONCLUSION AND IMPLICATION

The image compression play a crucial role in data transmission over communication media as the channels bandwidths are limited as per the users and therefore reduced data files are demanded for the fast transmission over communication networks. There has been found various picture compression approaches for decrease of pictures sizes as per demands of communication systems. In this paper, a recent method is investigated which is more sophisticated and reliable for image size reduction and offer high quality images as compared to earlier methods of image compression. This method was investigated primarily form the image quality maintenance perspectives as in many methods the quality of recovered pictures are not as per the demand. In this approach the medicinal kidney images are tested of 16×16 pixel for the quality maintenance and to offer ease for the treatment and recovery of the patients across the globe. This method offers lower redundancy and higher correctness for compression of diverse images which is demanded in modern world. The measured performance parameters such as PSNR, MSE, CR and the CoC are pragmatic and optimal as per the image compression requirement and image quality maintenance. There is a pragmatic scope in this sector for more testing on medicinal pictures for multiple image formats to enhance the quality of the images for various purposes such as the patient's treatments etc.

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