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Prioritized Coding of Multiple ROIs on Medical Image

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Abstract*:* A medical image coding method is to transmit multiple ROIs of medical image by giving priority from one rural place to another rural place without any loss at any stage by using a coding algorithm named EBCOT. EBCOT with context modeling is one type of coding algorithm for Integer Wavelet Transformed data, which is based on context adaptive binary arithmetic coding and BPC. The strength of the proposed method is evaluated for transmission of medical images over noisy channels with *a* priori knowledge of the channel condition. The proposed method is the combination of the random access and scalability features**.**

Key words: Bit planecoding (BPC) , Embedded block coding with optimized truncation (EBCOT) , Region of interest (ROI).

INTRODUCTION

Medical images applications have required a good quality on image compression algorithms mainly lossless compression [1]. With the use of medical images in healthcare services and the increased interest in telemedicine technologies [2],[3]. It has become essential thing is to reduce both storage and transmission bandwidth requirements for communication of related data, by employing lossless compression methods. Telesurgery, Teleradiology, and Teleconsultation comes under healthcare services.Transmission of medical images to mobile devices, from one rural place having two important problems: 1) successfully dealing with low channel capacities, which is regularly found in wireless technologies; and 2) Reducing the harmful effect of transmission errors due to vanishing effects on the signal. In order to successfully compact with low channel capacities, source coding methods with scalability and random access features are usually in use[4]-[6]. Scalability is the capability to decode the data gradually at various qualities, whereas random access is the capability to randomly access and decode any Region of interest (RoI). In order to decrease the harmful effect of transmission errors, channel coding is usually developed to add controlled redundancy to the data, so that a less number of errors can be detected and corrected [7],[8].

A 2-D medical image transmission over noisy channels, significant source coding methods were presented [9], [10]. In [9] the authors report a JSCC method for transmission of a 2-d medical image over the Internet protocol. This method is based on locally adaptive resolution (LAR) compression and Mojette transform, and having features RoI coding. In [10] the authors report a wavelet transformed data used in JSCC method. The main aim of this paper is to develop previous work in [9]–[10] and propose a PRIORITIZED CODING OF MULTIPLE ROIS ON MEDICAL IMAGE. This method is useful in the environment of telemedicine, where remote clients may browse medical images through a wireless channel using mobile devices, and they may request the transmission of different RoIs within a single medical image. In this particular scenario, the multiple RoIs are first prioritized, and then the entire image and RoIs are coded for wireless transmission.

The proposed method is the combination of random access and scalability features of embedded block coding with optimized truncation (EBCOT) specifically, the method encodes deferent ROIs differently. Multiple RoIs are encoded by prioritizing the wavelet-transformed data. This method is minimizing the overall image distortion depending on a target bit-stream length, and generates scalable bit streams with RoI decoding capabilities. This proposing method is different from the method in [9][10], where only one RoI may be encoded. But this method is employed for coding of multiple ROIs on a single image by giving Priority according the particular Region requirement.The proposed method is twofold. First, prioritizing the wavelet coefficient data which allow prioritized transmission of multiple RoIs within a single medical image. Second, prioritized wavelet-coefficients data guarantee the decoding of multiple RoIs at any bit rate at the highest quality resolution is possible even in the presence of transmission errors. The strength of the proposed method is tested on medical image with transmission over noisy channels. Peak signal-to-noise ratio (PSNR), of prioritized ROIs and Background information has been compared. The rest of this paper is ordered as follows. Review the random access and scalability features of EBCOT. The proposed method for coding of multiple ROIs. The experimental results and finally the conclusion.

EBCOT

EBCOT with context modeling is a entropy coding algorithm for wavelet-transformed data, which is dependent on context adaptive binary arithmetic coding and bit-plane coding. The result of this coding process is in the form of bit stream with scalability and random access features. After integer wavelet transformation, all wavelet coefficients are quantized uniformly by employing a fixed dead-zone about the origin. One quantization step size is allowed per subband. When the integer wavelet transform is employed, the

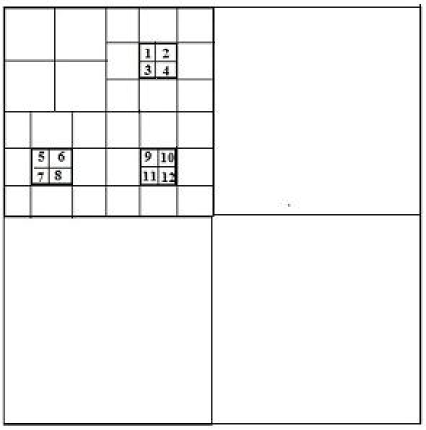

Fig 1: The twelve code blocks of one packet partition

quantization step size is fundamentally set to 1. EBCOT divides each subband into a "packet partition." This packet partition divides each subband into typical non-overlapping rectangles. Three spatially reliable rectangles comprise a packet partition location. After that dividing each packet partition location into typical non-overlapping rectangles code blocks are obtained. The code-blocks are then the primary entities for the purpose of entropy coding. Fig.1 shows the twelve code blocks of one packet partition location at resolution level 2 of a 3-lavel wavelet transformation.

A. Block coding

Entropy coding is performed on each code-block individually . This coding is a combination of context-dependent, binary arithmetic coding of bit planes. Consider a quantized code-block to be an collection of integers in sign-magnitude representation, then consider a sequence of binary collection with one bit from each coefficient. The first such collection contains the most significant bit (MSB) of all the magnitudes. The second collection contains the next MSB of all the magnitudes, continuing in this fashion until the final collection which consists of the least significant bits of all the magnitudes. These binary collections are referred to as bit planes. Each bit plane is encoded in three passes . The scan pattern followed for the coding of bit planes, within each code-block (in all subbands), is shown in Figure 2. This scan pattern is essentially a column-wise raster within stripes. At the end of each stripe, scanning continues at the beginning (top-left) of the next stripe, until an entire bitplane (of a code block) has been scanned EBCOT algorithm employs three coding passes to encode each code block. Which are Significance Propagation Pass, Magnitude Refinement Pass and Cleanup Pass these coding passes encodes the magnitude, significance, and sign information of the wavelet coefficients with respect to bit plane of the integer wavelet-transformed data. The resulting code streams may then be independently truncated into different lengths, and thus, independently decoded.

Scalability: In order to get scalability, EBCOT collects number of layers, where the initial layer approximately comprises the most significant bit planes, and the last layer approximately comprises to the least significant bit planes.

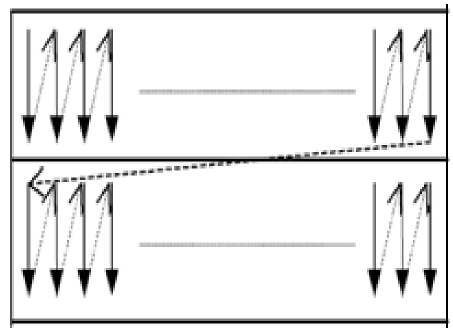

Fig 2 :.Scan pattern

This set of layers constitutes the bit stream which is representing the entire image in an optimal rate distortion sense.

*Random access***.** Following integer wavelet transformation, EBCOT partitions each frequency subband into equal sized small regions, which are called as code blocks and EBCOT generates an independent code stream, for each code block . Code blocks are encoded independently; the resulting code streams then can be decoded separately, which allows for random access to any region at any resolution

PROPOSED METHOD

Prioritized Coding of Multiple ROIs: In this method we are coding different ROIs on a single medical image with different qualities in order decode highest priority region first than the remaining regions. A low resolution and a low bit rate receiver can also receive that highest priority region which is the most important region for further application slike diagnosis purpose. Fallowing figures shows the block diagram of proposed method and detailed block diagram proposed method respectively.

As per the proposed method depicted in Fig. (3). We first apply a IWT with dyadic decomposition to an input medical image. This wavelet transform maps integers to integers and it allows for perfect predictability with finite precision arithmetic, which is necessary for perfect reconstruction of a signal [11].

In this work, we use the biorthogonal Le Gall 5/3 wavelet filter, implemented using the lifting step scheme [12]. Each level of decomposition, r , of the transform decomposes the medical image input into four frequency sub-bands denoted as LL_r, LH_r , HL_r and HH_r The estimate low-pass sub-band, LL, is a coarser version of the original medical image, whereas the other sub-bands represent the details of the image. The decomposition is iterated on the estimated low-pass sub-band.

Prioritizing Multiple ROIs

Consider a medical image and assign different transmission priorities to different regions. In the fallowing figure(5) we can observe that a image has got portions by assigning different transmission priorities .where the highest transmission priority region has indicated as ROI 1 and reaming less priority regions has indicated as ROI 2,ROI 3 and ROI 4 respectively .Here ROI 1 has the highest Priority than ROI 2,ROI 3,ROI 4.In the same way ROI 2 has highest priority than ROI 3 ,ROI 4 but not ROI 1.Like wise ROI 3has less Priority than ROI 1,ROI 2. Finally ROI 4 has lowest priority than reaming regions.

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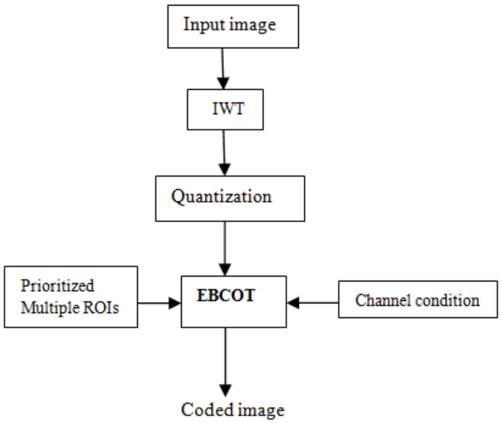

Fig 3: Block Diagram

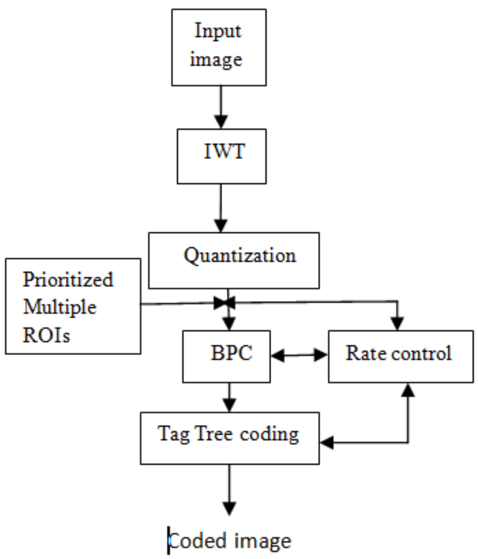

Fig 4: Detailed Block diagram

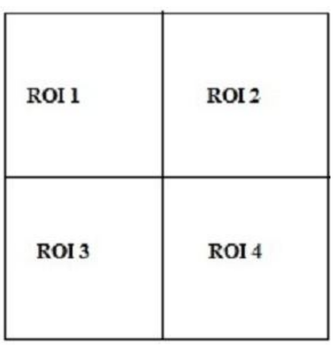

Fig 5: Prioritizing Multiple ROIs

EXPERIMENTAL RESULTS

This section represents two sets of experimental results. The first set evaluates the performance of the proposed prioritization scheme for coding of multiple RoIs. The second set evaluates the performance of the proposed method for coding and transmission of multiple RoIs over a wireless channel, Reconstruction quality (in PSNR) of the test medical image and RoIs at different bit rates, in bits-per-pixel (bpp)

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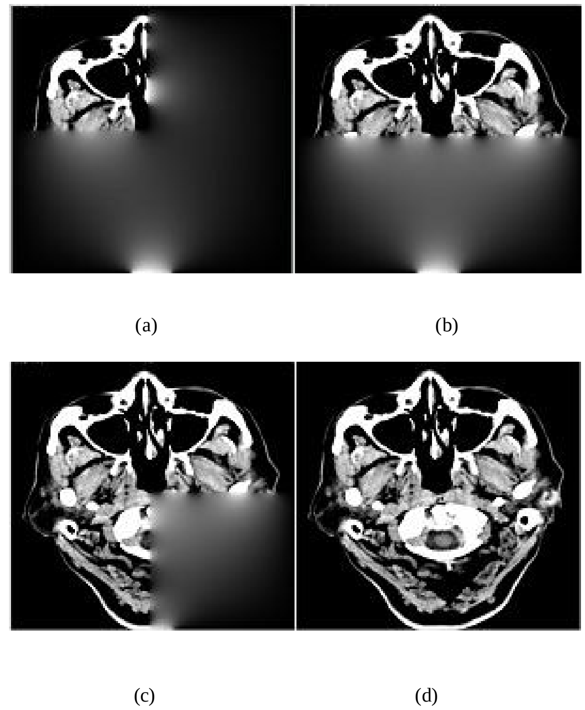

Fig 6: The test medical image reconstructed at: (a) 0.05 bpp,(b)0.25bpp, (c)0.45 bpp, and (d) 0.65 bpp.

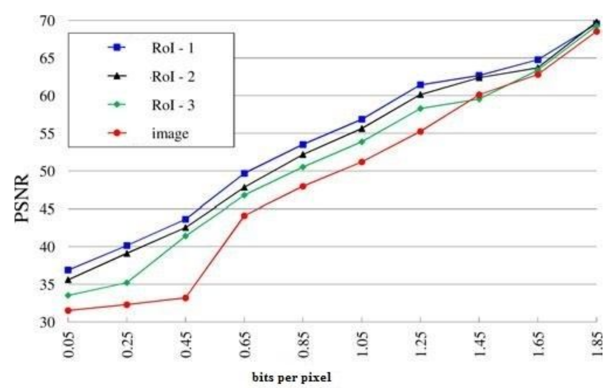

Fig 7: Reconstruction quality (in PSNR) of the test medical image and ROIs at different bit rates, in bits-per-pixel (bpp).

CONCLUSION

This paper represents main improvements to previous work on RoI coding in medical images for telemedicine applications. Specifically, the paper presents Coding of multiple ROIs on medical image for wireless transmission. The proposed method, which is based on the IWT and EBCOT with context modeling, minimizes the overall image distortion subject to a target bit-stream length, and generates scalable and error-resilient bit streams with RoIs decoding capabilities. Results show important improvements on reconstruction quality in terms of the PSNR. These improvements are clinically applicable as they allow healthcare providers, e.g., radiologists or doctors, accessing and transmitting multiple specific regions of a medical image over error-prone wireless channels, at higher qualities.

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