Chapter 8
Development of Algorithms for Medical Image Compression:
Compression Algorithms

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ABSTRACT

Image compression algorithms are developed mainly for reduction of storage space, easier transmission, and reception. In this chapter, many image compression algorithms have been developed based on various combinations of transforms and encoding techniques. This research work mainly deals with the selection of optimum compression algorithms, suitable for medical images, based on the performance indices like PSNR and compression ratio. In order to find the effectiveness of the developed algorithms, characterization of the CT lung images are performed, before and after compression. The diagnosis of lung cancer is an important application for various medical imaging techniques. In this work, optimal texture features are identified for classification of lung cancer have also been incorporated as a case study. The texture features are extracted from the in CT lung images. BPN is trained to classify the features into normal and cancer.

INTRODUCTION

Image compression finds an extensive application in the field of medical image processing. Image storage problem is always encountering many practical applications. Image files contain considerable amount of redundant and irrelevant data and it is essential to propose suitable image compression algorithms which can be used to eliminate this. In this work, wavelet Transform based compression algorithms are developed for computer tomography image. Symlet based transformations have been proposed to transform the images and are encoded using the various encoding. The developed compression algorithms are evaluated in terms of Peak signal to noise Ration (PSNR), Compression ratio (CR), Means square error (MSE) and bits per pixel (BPP). The optimum compression algorithm is also found based, on the

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results obtained. so as to characterize the computed tomography (CT) image the features are extracted and it is proven that after compression, the CT images show its ability for identifying types of defects. The results are an indicator to the promising application of this for medical image compression schemes.

BASIC COMPRESSION TECHNIQUES

Image compression can be accomplished by the use of coding methods, spatial domain techniques and transform domain techniques (Vemuri et al. 2007). Coding methods are directly applied to images. General coding methods comprise of entropy coding techniques which include Huffman coding and arithmetic coding, run length coding and dictionary-based coding. Spatial domain methods which operate directly on the pixels of the image combine spatial domain algorithms and coding methods. Transform domain methods transform the image from its spatial domain representation to a different type of representation using well-known transforms.

REVIEW OF LITERATURE

Many researches applied various approaches in the field of medical image compression, in both lossless and lossy methods. Lossless compression is able to produce maximum compression ratio of 3:1 with a minimum loss of information. Since the digital images require more amount of space to store, the lossy compression is opted in order to remove insignificant information preserving every part of the relevant and important image information. More research works have been performed in teleradiology applications, to determine the degree of compression which maintains the diagnostic image quality (Ishigaki et al. 1990). MacMahon et al. (1991) proved that a ratio of 10:1 is sufficient for compressing the medical images. Cosman et al. (1994) proved that there is no significant loss of information for compression ratios up to 9:1. Lee et al. (1993), Goldberg (1994) and Perlmutter et al. (1997) pointed out that lossy compression techniques can be employed for medical images without much affecting the diagnostic content of images. The decompression results show no significant variation with the original for compression ratios up to 10:1 in case of medical images in the proposed work of Ando et al. (1999). Many researches (Slone et al. 2000, Skodras et al. 2001, Chen 2007 and Choong et al. 2007) proved that since, digital medical images occupy large amount of storage space, at least 10:1 compression ratio must be achieved. Kalyanpur et al. (2000) have proven the effect of Joint Photographic Experts Group (JPEG) and wavelet compression algorithms for medical images and satisfied without much loss of diagnostic ability upto10:1 compression. Persons et al. (2000) described the diagnostic accuracy and evaluated that compressed medical images with a compression ratio of 9:1, which will not result in image degradation. Saffor et al. (2001) evaluated the performance of JPEG and wavelet and found that the wavelet gave higher compression efficiency than JPEG without a compromise in image quality. Li et al. (2001) analyzed the effect of JPEG and wavelet compression and concluded that compression ratio up to 10:1 is satisfactory. Hui and Besar (2002) found the performance of JPEG2000 on medical images and showed that JPEG2000 is more effective, compared to JPEG when JPEG2000 images could retain more detail than a JPEG image. Both the types of compression (lossy and lossless), have been performed by Smutek (2005) and Seeram (2006). The lossless compression techniques produce best results with a high compression ratio of 3:1 and the lossy compression techniques with high compression ratios leads

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