Chapter 11
Adaptive Prediction Methods for Medical Image/ Video compression for Telemedicine Application

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ABSTRACT

Due to rapid development of multimedia communication and advancement of image acquisition process, there is a crucial requirement of high storage and compression techniques to mitigate high data rate with limited bandwidth scenario for telemedicine application. Lossless compression is one of the challenging tasks in applications like medical, space, and aerial imaging field. Apart from achieving high compression ratio, in these mentioned applications there is a need to maintain the original imaging quality along with fast and adequate processing. Predictive coding was introduced to remove spatial redundancy. The accuracy of predictive coding is based on the choice of effective and adaptive predictor which is responsible for removing spatial redundancy. Medical images like computed tomography (CT) and magnetic resonance imaging (MRI) consume huge storage and utilize maximum available bandwidth. To overcome these inherent challenges, the authors have reviewed various adaptive predictors and it has been compared with existing JPEG and JPEG LS-based linear prediction technique for medical images.

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INTRODUCTION

Due to advancement of wireless communication, remote diagnosis of emergency medical events is possible in real time. The medical records are required to transmit for remote assessment with effective compression techniques, so that optimum bandwidth utilization is achieved without loss of visual quality of images. For every medical images diagnostically affected part are considered to be more important than other part of the image, which is known as Region of Interest (ROI). Telemedicine system involves many health care centers which are equipped with highly efficient software platform and devices. For any telemedicine system, it is essential to use compression algorithms to improve channel utilization and to reduce storage requirement. It is also equally important to preserve diagnosis area with high resolution so that, it can be further decoded to reproduce the processed image at various resolutions for different end terminal devices. High resolution with high compression ratio is the major challenge to design efficient ROI based medical image compression for health care centers for telemedicine system.

Efficient medical image compression involves three basic processing steps.

- Suitable transform techniques for de-correlation based higher compression rate.
- Suitable prediction based entropy coding scheme for error control.
- Reproducible compressed image with compatible resolution level for end terminal.

Image compression techniques are widely classified as lossless and lossy compression techniques. Each of these techniques removes trivial and unnecessary data to decrease image size. Lossy techniques gains higher compression ratio compared to lossless techniques but degrades the image quality as there is permanent loss of information whereas lossless compression protects all details of original image. In case of medical images non-degraded images are essential for radiologists to interpret disease and to extract related diagnostic information. Also degraded images affect the efficiency of Computer Aided Diagnosis (CAD) system. Also legal reasons also require the non-degraded images that have suffered no loss of information. As a result lossless compression methods are mainly used for medical image storage. The medical and information technology community has acknowledged that the lossless compression is a really pertinent way to minimize the transmission and archive resources related to medical imaging while ensuring its ideal reconstruction. Compared to its precursor H.264/AVC, High Efficiency Video Coding has shown a remarkable enhancement in the encoding efficiency of video sequences, acquiring a decrease in bit-rate of 50% while ensuring the same perceived quality.