Chapter XXXIX
Region of Interest Coding in Medical Images

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ABSTRACT

To provide efficient compression of medical images, identifying and extracting the region of interest from the entire image and coding the specific region to accuracy is important. This chapter introduces the basics of region of interest coding, an overview of the coding methods available and their main features for the benefit of learners and researchers. The special focus is on JPEG-2000-based algorithms.

INTRODUCTION

One of the main aims in medical image processing is to extract important features from radiological image data, called the region of interest (ROI), for accurate diagnostic analysis, interpretation, and better patient treatment. Coding the region of interest is significant for easy, rapid transmission, and also for efficient storage. This is useful in the application areas of teleradiology, picture archiving and communication systems (PACSs), and hospital information systems (HISs; http://www.dclunie.com).

What is the Region of Interest?

ROI is the region of image that is of clinical or diagnostic interest to the doctor, radiologist, or image analyst. Its shape may be regular, as shown in Figure 1, or arbitrary and irregular, as in Figure 2.

Multiple ROIs

There could be more than one region of interest within a given image, leading to multiple ROIs as shown in Figure 3.

Figure 1. UltraSound image ROI is fetus zone—regular shape

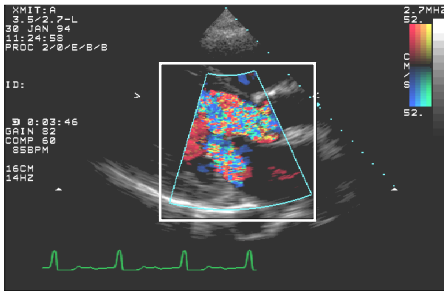
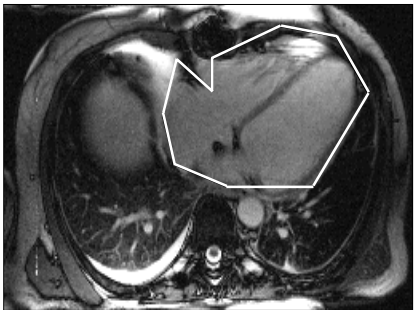


Figure 2. CT image—ROI is heart—arbitrary shape



Identifying and Extracting

Identifying and extracting the region of interest is required before compressing and coding the image that includes the region of interest. Identifying a region is done by manual and/or automatic segmentation methods. The segmentation procedure used is based on the input image data, the nature of the information sought by the end user from the segmented image, and the application (Grimes, 2004).

ROI Compression and Coding

With the growing interest in the areas of telemedicine and health informatics, compressing and coding ROI is a necessity. The following are some of the compression schemes employed in this area of image coding.

Image compression usually can be lossy or lossless. Lossless compression methods are preferred for high-value content, such as medical imagery or image scans made for archival purposes. Lossy methods are especially suitable for natural images in applications where minor (sometimes imperceptible) loss of fidelity is acceptable to achieve a substantial reduction in bit rate.

Lossy Compression Schemes

Totally lossy schemes result in image alteration, which might entail a loss of diagnostic or scientific utility. Sometimes lossy compression may deliver exquisite quality and yet can introduce medically unacceptable artifacts into the image. These are less popular in medical situations.

Lossless Compression Schemes

The following are categorized as lossless compression schemes in different contexts based on the end user or observer:

- **Visually Lossless:** Nonclinical human observer

Figure 3. Lesions are the ROIs in brain MRI slice