

Abstract

Computer aided detection (CAD) or diagnosis (CADx) is rapidly entering the radiology mainstream due to the conversion from film-based to digital radiographic systems and the advances in computerized image analysis techniques over the past decades. However, little CAD work in chest radiology has been done beyond lung nodules. Our research focuses on developing an intelligent CAD system for automated detection of infectious tuberculosis (TB), which has typical radiographic features such as cavity and acinar shadows.

In this thesis, I first present a general conceptual framework of the CAD system consisting of several steps, such as image preprocessing, feature extraction and classification, and final decision analysis. I then propose an efficient technique for automatic lung field segmentation using edge-region force guided active shape model (ERF-ASM) which is an important preprocessing step in the CAD system. A coarse-to-fine dual scale (CFDS) feature classification technique is then proposed for TB cavity detection. In this technique, Gaussian-model-based template matching (GTM), local binary pattern (LBP) and histogram of oriented gradients (HOG) based features are applied at the coarse scale; while circularity, gradient inverse coefficient of variation (GICOV) and Kullback-Leibler divergence (KLD) measures are applied at the fine scale. Finally, a hybrid system using combined LBP, HOG and grey level co-occurrence matrix (GLCM) based features is proposed for acinar shadows detection. Experiments over 300 chest radiographs show promising results of the proposed techniques.