Name(s)

Aileen F. Wang

Project Number

S1219

Project Title

A Novel Breast Cancer Detection Algorithm Using Point Region Growing Segmentation and Pseudo-Zernike Moments

Abstract

Objectives/Goals
Mammography has been one of the most reliable methods for early detection and diagnosis of breast cancer. However, mammography misses about 17% and up to 30% of breast cancers due to the subtle and unstable appearances of breast cancer in their early stages. The objective of this project is to design and develop a computer aided diagnosis (CADx) algorithm to automatically analyze and detect breast cancer from a mammographic image with the lowest False Negative Rate (FNR).

Methods/Materials
First, I developed an automatic and efficient image segmentation algorithm, Point Region Growing, to extract the single breast mass. Then, I developed a robust image reconstruction algorithm using the Pseudo-Zernike polynomial to analyze the segmented breast mass. Finally, I invented a new classifier, Root Mean Square (RMS), of Pseudo-Zernike moments to classify both benign and malignant breast masses. This novel CADx algorithm was implemented using MATLAB and validated on a set of randomly selected mammographic images from the Mammographic Image Analysis Society (MIAS) database.

Results
A comparative study among the various algorithms for the segmentation and reconstruction of breast masses was performed on randomly selected mammographic images. The results demonstrated that the newly developed algorithm is the best in terms of accuracy and cost effectiveness. More importantly, the new classifier RMS has the lowest FNR # 6%.

Conclusions/Discussion
This study has developed a novel CADx algorithm to automatically analyze and detect breast cancer from a mammographic image and reduced the best benchmark of FNR from 17.6% to 6%. This CADx algorithm can be easily integrated into the current breast cancer screening system and generalized to diagnose other type of cancers.

Summary Statement

This study has not only developed a novel CADx algorithm to automatically analyze and detect breast cancer from a mammographic image with the lowest FNR but also laid a foundation for diagnosing other type of cancers.

Help Received

Dr. James Li helped on the selection of the mammographic image database and provided feedback for my project.