Chapter 13

Algorithms for Detection and Classification of Abnormality in Mammograms: An Overview

Anuradha Chetan Phadke
Maharashtra Institute of Technology, India

Priti P. Rege
College of Engineering Pune, India

ABSTRACT

Mammography is a popular imaging modality currently in use for routine screening of breast. Radiologists look for some of the significant signs of breast cancer while examining the mammogram visually. These signs are bounded masses, clusters of micro-calcifications, spiculations, and architectural distortions. Developing computer-aided algorithms for the detection and classification of abnormalities in mammograms is an extremely challenging task because of significant variableness in the type, size, shape, texture variation of abnormal region, and variability in the structure of surrounding tissues of the breast. The main objective of this chapter is to introduce dominant features of various signs of abnormalities and to discuss techniques to detect various abnormalities in mammograms. This knowledge will help to develop a system that is useful for the early detection and classification of breast cancer.

INTRODUCTION

Breast Cancer is women’s foremost health issue in developed as well as developing countries. According to American Cancer Society statistics, 252,710 invasive breast cancer cases in women are estimated to be diagnosed in 2017 and 40,610 breast cancer deaths of women are estimated in 2017. There are 89% of breast cancer deaths in women with ages 50 years or above (American Cancer Society, 2017). Breast cancer incidence and mortality rates vary considerably by race or ethnicity. There is requirement of
Algorithms for Detection and Classification of Abnormality in Mammograms

taking effective actions in order to control this deadly disease in future. Cancer is extremely dangerous and potentially challenging issue.

It is possible to reduce death rate due to breast cancer, by using mammographic screening to detect it at early stage. Mammography is a noninvasive test where a low dose X-ray image of breast is captured in the form of digital or digitized mammogram. Mammography is a promising technique which aids medical doctors to examine breast for the early detection and diagnosis of breast cancer. It captures two projections of each breast, a top-to-bottom view named Cranio-Caudal (CC) view and a side view taken at an angle named Mediolateral Oblique (MLO) view. If detected, proper treatment can be given at the initial stages and a patient’s life can be saved.

Some of the significant signs of breast cancer such as masses, clusters of micro-calcifications, spiculated masses and architectural distortions are checked by radiologists and breast surgeons during visual examination of mammogram. Examples of mammograms for each type of abnormality are shown in Figure 1. The breast imaging reporting and data system (BI-RADS), is a standard for reporting and classification of mammogram studies. BI-RADS is defined by the American College of Radiology, (American College of Radiology [ACR], 1998).

As the number of mammograms to be analyzed by the radiologists and breast surgeons is enormous, there is possibility that they may miss some subtle abnormalities. Computer based system which is designed using the expert knowledge of radiologists and oncologists to detect abnormalities can act as second opinion and assists the radiologists to increase performance of diagnosis.

The main goal of the proposed chapter is to introduce dominant features of various signs of abnormalities in breast and to discuss existing algorithms for detection and classification of abnormalities in mammograms. The chapter also presents recent progress in the field of development of algorithms for computer assisted detection of breast cancer. This knowledge will help to develop a system which is useful for the early detection and classification of abnormalities in breast using mammogram image analysis. Some of the techniques implemented by authors to detect various types of abnormalities in mammograms are explained in detail.

Figure 1. Examples of Mammograms with (a) circumscribed mass (b) micro-calcifications (c) architectural distortion (d) speculated lesions Source: MIAS Database