Chapter 85
Enhanced Breast Cancer Diagnosis System Using Fuzzy Clustering Means Approach in Digital Mammography

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ABSTRACT

Breast cancer or malignant breast neoplasm is the most common type of cancer in women. Researchers are not sure of the exact cause of breast cancer. If the cancer can be detected early, the options of treatment and the chances of total recovery will increase. Computer Aided Diagnostic (CAD) systems can help the researchers and specialists in detecting the abnormalities early. The main goal of computerized breast cancer detection in digital mammography is to identify the presence of abnormalities such as mass lesions and Micro calcification Clusters (MCCs). Early detection and diagnosis of breast cancer represent the key for breast cancer control and can increase the success of treatment. This chapter investigates a new CAD system for the diagnosis process of benign and malignant breast tumors from digital mammography. X-ray mammograms are considered the most effective and reliable method in early detection of breast cancer. In this chapter, the breast tumor is segmented from medical image using Fuzzy Clustering Means (FCM) and the features for mammogram images are extracted. The results of this work showed that these features are used to train the classifier to classify tumors. The effectiveness and performance of this work is examined using classification accuracy, sensitivity and specificity and the practical part of the proposed system distinguishes tumors with high accuracy.

INTRODUCTION AND RELATED WORK

Breast cancer is one of the major causes of death among women, especially in developed countries. The early detection of this disease can reduce the rate of death in women. CAD can help the radiologist in detecting the abnormalities in an efficient way. The mammograms can be used in the detection of breast cancer according to the World Health Organization's International Agency for Research on Cancer (Gaber et al., 2015). Mammographic images are X-ray images of breast region (Verma & Zhang, 2007; Hassanien et al., 2003, Hassanien and Tai-hoon, 2012). Computer-assisted breast tumor classification which is based on the image analysis techniques provides more useful information. The conventional method for the breast tumor classification consists of three steps process. The first step involves the segmentation of breast tumor from the image. The second step is feature extraction and the third one is the classification process using a classifier. The goal of this study is to increase the diagnostic accuracy of image processing for optimum classification between benign and malignant abnormalities in digital mammograms.

Image enhancement module is a vital part as a preprocessing for any image processing technique. Image processing techniques like morphological operations and threshold techniques are applied in this study to enhance the mammogram images for the computerized detection of breast cancer.

Segmentation of medical images is an important step (Ali et al., 2015). This study employs a fuzzy segmentation algorithm for segmenting the mammogram images. Texture based features are extracted from the segmented images. These features are fed to the classifier for classification process. The binary classification accuracy of the developed system is measured using the Receiver Operating Characteristic (ROC) analysis with performance measures such as sensitivity, specificity and accuracy.

This chapter proposes a new technique based on fuzzy algorithm and ANN to diagnosis breast cancer from digital mammograms.

Research in areas of Computer-Aided Diagnostic (CAD) systems developed within a decade. In early studies investigators outlined many approaches and limitations of Computer-Aided Diagnosis (CAD) in mammography. Winsberg, Elkin, Macy, Brodaz, and Weymouth (1967) described a method that compares density between left and right breasts. An algorithm was developed by Kimme, O'Loughlin, and Sklansky (1975) to detect abnormal breast regions. They calculated seven features for breast images and compared them corresponding to regions of the left and right breasts. Smith, Wagner, Guenther, and Solmon (1977) introduced a measure to distinguish between malignant and benign cancer. Hand, Semmlow, Ackerman, and Alcorn (1979) constructed fourteen parameters of three basic textural features, intensity, roughness and directionality to detect malignant areas on xeromammograms. They achieved sensitivity of 87%. Now recent studies characterized by greater use of image processing, feature analysis and artificial intelligence methods. Varela, Tahoces, Mendez, Souto and Vidal (2007) applied iris filter and means of adaptive threshold to segment images and extract feature to train neural network classifier. System results sensitivity 88% and 94% at 1.02 false positives per image. Kumar and MONI (2010) applied Fuzzy Clustering Means (FCM) to extract tumor from Computed Tomography (CT), textural information obtained using curvelet transform. Consequently after classification 94.3% accuracy obtained. This chapter presents a new method for breast cancer early detection.

The remainder of this chapter is organized as follows. Section 2 presents the proposed model and its framework. In section 3, the research methodology and implementation of this chapter is presented and performance evaluation and analysis of the results are presented. Section 4 concludes this chapter and future work is presented.

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