

A Review on Textural Features Based Computer Aided Diagnostic System for Mammogram Mass Classification Using GLCM & RBFNN.

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Abstract—Computer Aided Diagnosis (CAD) is used as second opinion for the Radiologist and used as a solution in detection of breast cancer. It already proved its success in the reduction of human error in reading the mammogram images, and their better and reliable classification into benign and malignant masses. This paper proposed an algorithm for the detection of breast cancer in early stage, textural feature analysis proves to be one of the competent step for the detection of abnormalities. This paper estimate Gray-Level-Co-Occurrence Matrix (GLCM) method for extraction of textural feature from the segmented mammograms, and Radial Basis Function Neural Network (RBFNN) is taken as classifier and its performance evaluation is done with different textural features. The objective of this paper is to find a clear classification of breast cancer in early stage.

Keywords—Mammogram, Breast cancer, Textural Feature, GLCM, RBFNN, CAD, ANN.

I. INTRODUCTION

One of the most common type of cancer found in women is breast cancer. It ranks fifth in terms of death due to cancer. In most of the cases woman don't know about its presence, only in the later stages it gets noticed by its symptoms and this comes to be the main reason why there is number of deaths.

With the advent of CAD, diagnosis with imaging becomes more simplified and accurate.[1] In breast cancer's screening and diagnostics it provides easy tool for its detection at an early age.[2],[3]. Various studies show that with the help of developed CAD method, detection of masses in breast cancer as benign and malignant is very much improved for the diagnostic purpose by radiologist.[4]

With the objective of getting more accuracy in benign and malignant tissues we provide this article to analyze the performance of RBFNN classifier (with textural feature achieved by GLCM) for the classification of tissue. GLCM is proved to be a familiar statistical method for extracting textural feature from various images. Tissue classification is done by Radial Basis Function Neural Network (RBFNN), a type of Artificial Intelligence (AI) system, utilizing a unique type of neural network with universal function[5]. This work proposes a CAD system that combines manual segmented images with GLCM based feature extraction separately for the classification of breast cancer mammographic images as either benign or malignant.

This article is distributed into following section. In the I section introduction is given, the materials used for the work discussed under section II, methodology of the proposed CAD

system covered in section III, and the last IV section have result and conclusion of the paper.

II. MATERIALS

A mammogram is used for feature extraction and classification which is a low dose X-ray image of the breast to check the abnormal changes for the detection of breast cancer. These changes are directly recorded on an X-ray film (mammography) or into a computer known as digital mammography for radiologist to check any abnormality in breast tissues. A mammography may be checked for two purposes one for Screening and second for Diagnostic purpose. To check any lump or lesions that is not normally identified and shows no breast cancer symptoms, screening mammograms are usually done for those women. If any abnormality is found in screening or any symptoms of breast cancer is told then diagnostic mammograms are used for detailed identification.

The database which we are using here for the proposed CAD system uses digitized screening mammograms, which is taken from the Mammography Image Analysis Society (MIAS), mini mammography database. This one is created by reducing the original MIAS database mammograms to 200 micron pixel edge and clipped or padded so that every image becomes 1024 pixels * 1024 pixels.

This database consists of Medio-Lateral Oblique (MLO) views of the mammograms with ground truth of each abnormality in the form of circles. Only the architectural distorted mammograms are considered to make the feature extraction and to prove the efficiency of the algorithm.

III. METHODOLOGY

The steps we follow for the proposed CAD system have three main steps Pre-processing, Feature extraction using GLCM and then classification using RBFNN as classifier. Through pre-processing step we find out the Region of Interest (ROI) with a reliable representation of the breast anatomy in the mammograms. In pre-processing, image enhancements were done by reducing the noise or degrading factors involved in the acquisition procedure for the digital representation of the breast. Through GLCM, we extract the features of the pre-processed mammograms. Then these extracted features are given as input to the classifier for its classification into benign and malignant tissue.

A. Pre-Processing

In pre-processing step we improve the image quality by reducing the noise and also enhance the image for better and reliable results during feature extraction step and for its better interpretation. [6] Originally the affected tissue having tumour or calcified area is surrounded by breast tissues that masks or conceals the calcification and tumour area and thus prevents its accurate detection. This step proves to be a critical success factor in the CAD system and helps in suppressing distortions and neglecting those parts which are not part of breast and this ensures a better classification accuracy of CAD algorithm.[7]This also ensures that processing and analysis tasks are narrowed down to relevant image features.

B. Feature Extraction

The mammogram we have consists of a large no of heterogeneous information that's shows different types of tissues, blood vessels,glandular ducts, breast edge, the X-ray film and its machine characteristics. So to have a better diagnostic approach for classifying normal and abnormal areas of tissue images correctly,we have to use such a system which can easily distinguish between normal and abnormal tissue.Since a lot of heterogeneous information leads to high dimensional feature vectors that degrade the accuracy of diagnostic system significantly, together with increasing the computational complexity. So to achieve a compact and robust size of mammographic descriptors, we have to select reliable feature vectors to reduce the irrelevant information.

Here we propose GLCM method for extracting the textural features of mammograms.

1) Grey Level Co-Occurrence Matrix (GLCM):

The Gray-Level-Co-occurrence Matrix (GLCM) has been proved to be a promising method for image texture analysis. It is widely used in many texture analysis applications and remained to be an important feature extraction method in the domain of texture analysis.In a statistical texture analysis, texture features were computed on the basis of statistical distribution of pixel intensity at a given position relative to others in a matrix of pixel representing image. Depending on the number of pixels or dots in each combination, here we have the second-order statistics. [8]Feature extraction based on GLCM is the second-order statistics that can be used to analyzing image as a texture.[9]In the proposed work we use only 7 features out of 14 textural features given byHaralick, namely Contrast, Correlation, Energy, Sum Entropy, Sum Variance, Info. Measure of Correlation, Inverse Difference Moment. [10]

Creation of matrix is the first step we started in executing our algorithm, this calculates how a pixel with gray-level value 'i' occurs horizontally lie adjacent to the pixel with gray scale 'j' and image of local range. These features are then normalized after extraction to simplify the feature vectors to get better performance of the classifier. This normalization can be done by dividing each vector by its maximum value,by doing so all vectors values becomes less than or equal to one.

C. Artificial neural network

In proposed CAD technique we use artificial neural network for the classification of breast cancer in benign and malignant. There is always a problem in detection of masses in digital mammography due to machine vision perception.This problem is solved to a great extent in the proposed CAD, using Artificial Neural Network. [11]Through a complex interconnected computing architecture of various simple processes in the CAD, we enhance the computational power and better perception capabilities of the human brain. ANN became a popular and widely used function approximators and pattern classifiers where efficient learning algorithm for classification of breast cancer is applied. In this algorithm for classification we have two stages one is training where characteristic properties are separated and based on this, a unique description of training class is prepared, and these feature-space partitions are used to classify the image features in the subsequent testing stage. These trained classifiers are then used to classify the benign and malignant breast cancer.

Radial Basis Function Neural Network (RBFNN): In order to discover the potential image of micro calcification,mass lesions in the breast tissue images a proper reliable method must be used.[12] In our proposed CAD technique we used RBFNN as the potential classifier. In RBFNN the value of the real valued function depends only on the origin distance.That is, if a function 'h' satisfies the property $h(x)=h(\|x\|)$, then it is known as a radial function. Its characteristic feature response increases or decreases monotonically with central point distance.

IV. RESULT AND CONCLUSION

In our proposed work an advanced CAD system is prepared by using RBFNN as classifier. The digitized mammograms were taken from the Mini-MIAS database for the development of proposed work. Pre-processing is worked for the identification of Region of Interest (ROI) which is marked by the radiologist in Mini-MIAS database. Through GLCM, Textural features are extracted. Following textural features like energy, variance, entropy, correlation, inverse difference moment, contrast are used for the classification of the mammograms. As the number of textural feature increases the performance with the classifier becomes better but it increases the computational complexity. Most of the used textural features produce good accuracy in classification of the masses.

By analysing the recall and precision the classifier's performance can be evaluated.

Through the proposed work a radiologist could better identify the abnormality in breast cancer and can categorized it into benign and malignant. The main objective of our proposed work is performance evaluation of RBFNN classifier with the outcomes of different textural features obtained from GLCM. One of the important step of the RBFNN training is to decide the proper number of hidden neurons,if it is not selected

properly the RBFNN will show poor generalisation characteristics, reduced training speed and there will be a large memory requirement.[13] So a suitable number of RBF neurons and appropriate cluster distance factor should be chosen and taken carefully during the designing of RBFNN for classification. In our proposed work using RBFNN as classifier and GLCM for feature extraction, the CAD system shows a strong evidence of increased effectiveness in early identification of breast cancer into benign and malignant in the given mammograms.

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