EARLY STAGE DETECTION OF MICROCALCIFICATIONS IN MAMMOGRAMS: A SURVEY

NEHA SHAHARE, D.M.YADAV

1Department of E&TC, SITS, Narhe, Pune, India
2Department of E & TC,JSPM, Narhe, Pune, India.
E-mail: 1nnganvir_sits@sinhgad.edu, 2dineshyadav8@yahoo.com

Abstract— Breast cancer is one of the most deadly diseases for women. Mammography is the most effective method for the early stage detection of breast diseases. Survival rate of breast cancer is approaches 100 percent, if cancer is detected early by using breast self examination (BSE) and clinical breast examination (CBE) at the aged of 40–49 years. Mammography continues to be regarded as a very useful diagnostic tool for detection & diagnosis of breast lesions, it uses lower levels of radiation than ordinary chest x-rays. But, a meta analysis is showed that the sensitivity of screening mammography ranged from 83% to 95 % with a false positive rate of 0.9% to 6.5 % respectively. The appropriate method used for early detection of pre-cancerous symptoms is screening mammography, which has to be conducted as a regular test for women. Calcification clusters are said to be an early sign of breast cancer. Microcalcifications are very small bits of calcium deposits present inside the breast tissue. Many researchers have proposed the algorithm for Micro calcification detection based on wavelet transform, mathematical morphology and neural networks.CAD system is also used for automatic detection of clustered micro calcifications in digitized mammograms. This paper is review of detection of micro calcification in mammograms using wavelet.

Keywords— Mammograms, Microcalcification, BSE, CBE, CAD.

I. INTRODUCTION
Breast cancer is the leading cause of death among women. According to the National Cancer Institute estimates that one out of eight women in the United States will develop breast cancer at some point during her lifetime. Primary anticipation seems impossible because the causes of this disease still remain unknown. Early detection is the only key to improving breast cancer prognosis. X-ray mammography is the most common technique used by radiologists in the screening and diagnosis of breast cancer. Although it is seen as the most reliable method for early uncovering of breast carcinomas, reducing death rates by up to 25%, its interpretation is very difficult, i.e., 10%-30% of breast lesions are missed during routine screening. Currently, mammography remains the most effectual diagnostic technique for early breast cancer detection; however, not all breast cancers can be detected by mammograms. For micro calcifications, the interpretation of their presence is very difficult because they are very tiny, typically in the range of 0.1 mm–1.0 mm and the average is about 0.3 mm. So, they can be overlooked easily by a radiologist. To provide verification for the radiologists in detecting the apprehensive regions in mammogram images and to get better accuracy and sensitivity of interpretation, a variety of Computer Aided Diagnostic (CAD) systems have been proposed. But, designing an effective diagnosis system to detect the presence of micro calcification still remains as a challenge due to the fuzzy nature and low contrast of the mammogram. Micro calcification is a tiny bit, which may not be clearly visible because of low contrast in the image. Density of micro calcifications may be high, low, or variable. And if in a cluster, the homogeneous or non-homogeneous nature of the density is noted. Distribution refers to the overall placements of the micro calcifications within the breast image. Micro calcifications can be in single clusters or multifocal, one-sided or two-sided, diffuse, segmental, linear, or regional. As clusters of micro calcifications in digital mammograms are important and early sign of breast cancer, this proposed CAD system is for detection of micro calcifications in digital mammograms. Because, micro calcifications are tiny deposits of calcium in breast tissue and due to dense nature of breast tissue and poor contrast of mammograms, it prohibits effectiveness in detecting micro calcifications.

II. LITERATURE SURVEY
Breast cancer is the increasing common disease in American women; it continues to be significant public health problem in united States. To deal with this problem many methods for automated digital mammography processing have been studied in the literature survey. In this survey, we discuss the breast cancer and related literature of the research.In literature, various techniques are described to detect and classify microcalcifications digital mammograms as benign or malignant. Many researchers developed different CAD systems for detection of microcalcification in digital mammograms using wavelets and using neural network also.

Sami Dhahabi invented, “Breast cancer diagnosis in digitized mammograms using curvelet moments” [2]. He deals with this problem and proposes a feature extraction method based on curvelet transform and moment theory for mammogram description. A k-nearest neighbor classifier was used to distinguish...
between normal and abnormal breast tissues and to classify tumors as malignant or benign. Table 1 shows literature survey by different researchers. Its has been observed for filtering and feature extractions wavelet transform and SVM is used.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Author's Name &amp; Year of Publication</th>
<th>Title of the Paper</th>
<th>Methodologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chisako Nakamura, Takanoue Futakoshi, Hidaka Ishi, Hiroshi Fujita</td>
<td>Breast mass classification on mammograms using radial local ternary patterns.</td>
<td>Inverted an ROI-based feature, namely, radial local ternary pattern (RLTP), by using artificial neural network (ANN), support vector machine (SVM) and random forest (RF) classifier. Performance was evaluated with 376 ROIs including 161 malignant and 195 benign masses.</td>
</tr>
<tr>
<td>4</td>
<td>C. C. Diaz-Huerta, E. M. Felipe-Rico, I. M. Montano-Zetino</td>
<td>Quantitative analysis of morphological techniques: an automatic classification of microcalcifications in digitized mammograms.</td>
<td>Four different algorithms based on Mathematical Morphology is proposed. A set of features in the spatial, texture and spectral domain is extracted and used as input in a support vector machine (SVM).</td>
</tr>
<tr>
<td>5</td>
<td>Baljit Singh, Kshetri, Amar Parpat Singh Phagwaha</td>
<td>Classification of clustered microcalcifications using MIIEFP-ANN and SVM.</td>
<td>Classification of clustered microcalcifications using MIIEFP-ANN and SVM.</td>
</tr>
<tr>
<td>8</td>
<td>Ha Kyung Kang, Yeong Jo, Soo Min Kim, IEEE</td>
<td>A Microcalcification detection using adaptive contrast enhancement on wavelet transform and neural NW.</td>
<td>This paper includes the detection algorithm which has two parts. One is adaptive contrast and second is multi-stage microcalcification detection. The results show that the proposed microcalcification detection algorithm is much more robust against fluctuating noisy.</td>
</tr>
<tr>
<td>9</td>
<td>J Balakrishnan, Dr. IA Venkata, C Gourishankar, IROSIS, Vol 7 No 1, 2010 [23]</td>
<td>Detection of microcalcification in mammograms using wavelet transform and fuzzy shell clustering</td>
<td>The proposed microcalcification detection algorithm involves mammograms quality enhancement using multi-resolution analysis which based on the wavelet transform/wavelet transform and microcalcification detection can be achieved by fuzzy shell clustering.</td>
</tr>
</tbody>
</table>

III. MOTIVATION

Breast cancer is the second leading cause of cancer death in women. Accurate early detection can effectively reduce the mortality rate caused by breast cancer. Masses and micro calcification clusters are an important early signs of breast cancer. An automatic classification system to discriminate and detect clustered micro calcifications from the normal breast tissue based on textural features with reduced human bias is always in demands. However, it is often tricky to distinguish abnormalities from normal breast tissues because of their subtle appearance and unclear margins. The main problem of developing an acceptable CAD system is inconsistent and near to the ground classification accuracy. In order to
improve the training process and accuracy, novel intelligent classifiers that needs to introduce which use texture information as input to classify the normal and abnormal tissues in mammograms. Development of effective diagnostic system to detect the occurrence of micro calcification still remains as a challenge due to the fuzzy nature of breast tissues and low contrast of mammographic images.

IV. AIM AND OBJECTIVES

The Aim of this research is to propose, model and apply the image processing technique to enhance the image and subsequently extract the features from the suspicious region with great accuracy to detect whether micro calcification is malignant or not. The main objectives of proposed research work are:

a) To study and compare different methods for detecting micro calcification and masses in mammograms.
b) To collect mammogram images from the database of cancer specialist hospital and enhance the contrast of the mammogram image.
c) To pre-process the image and construct the sub-images from skin lined image i.e. segmentation.
d) To do texture analysis of mammograms intends to identify specific region of interest.
e) To extract suitable features capable of distinguishing between different classes and give as an input to classifier.
f) To identify and detect of cancer cells from the image.
g) To analyze the image and proceed it further for the better treatment.

V. METHODOLOGY

It has been observed that an abnormality, specifically micro calcification area, occurs as a tiny blob in mammograms having more brightness, hence intensity, compared to its neighboring pixels. Fig 1 shows the methodology for the thesis. It shows different blocks used for work.

![Proposed Block Diagram for Microcalcification Detection](image)

To detect the suspicious area containing an abnormality is key challenge and to achieve this following are the steps involved for the proposed work.

A. Data Base Collection: Data base is collected from MIAS. Mammographic Image Analysis Society (MIAS), who released a public database comprising 322 digitally scanned films, based mammograms. More databases can collect from local cancer specialist hospitals.

B. Preprocessing: Mammograms are medical images that are difficult to understand, thus a pre-processing phase is needed in order to improve the image superiority and make the segmentation results more accurate. The first step involves the removal of noise and unnecessary parts in the background of the mammograms. Then, Image enhancement operations can be used to improve the appearance of images, to eliminate noise or error, or to accentuate certain features in an image. Contrast Limited Adaptive Histogram Equalization (CLAHE), wiener filtering can be introduced for image sharpening. Other methods can be used to remove the noise and for the contrast enhancement like Median filter, unsharp masking or morphological operation, histogram stretching, adaptive histogram equalization, Gaussian filter.

C. Segmentation: After preprocessing, the region of interest (region where mass is expected) is to be segmented. The anatomy of breast is a complex structure due to the presence of pectoral muscles as well as the varied density of breast parenchyma. It is difficult to differentiate between pectoral muscles and mass. The suspicious region or micro calcifications can be segmented using bilateral subtraction for a pair of images and Markov Random Field (MRF) hybrid with Ant Colony Optimization algorithm for a single mammogram image can be included. As per requirement different methods can be included for region of interest(ROI) and segmentation are wavelet transform, grid based sampling, region growing based method, fuzzy c means clustering.

D. Texture Analysis: Texture analysis is a potential method for studying lesions such as microcalcifications. Intensity Based Features and Gray Level Co-occurrence Matrix (GLCM) based features can be measured to analyze the performance. The texture features can be calculated like mean value, standard deviation, energy, contrast, correlation, homogeneity by any of these methods Surrounding Region Dependence Method (SRDM), Gauss-Markov random field (GRMF) and the spatial grey level difference method (SGLDM).

E. Feature Extraction: Extraction of features is the key process in the development of CAD. The classifier is used to classify the tumor as either normal or abnormal by detection of microcalcifications clusters of mammography images. Pattern recognition techniques are tightly coupled with the feature selection strategies in order to eliminate irrelevant and trivial information. Feature selection techniques help in enhancing classifier performance. ANN Classification is the process of learning to separate samples into different classes by finding common features between samples of known classes. As per the need of the system different methods can be used to get best feature extraction.
like Discriminant classifier, SVM, ELM, AdaBoost classifier, Probabilistic Neural Network (PNN) classifier.

VI. EXPECTED OUTCOMES

After successive completion of the above proposed work we will be getting an automated computer aid micro calcification and masses for affected breast tissue detection technique with high accuracy and sensitivity. This would help to diagnose breast cancer in early stages, which will save the patients from this deadly disease.

REFERENCES