International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Mammogram Image Analysis for Breast Cancer Detection

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Abstract: ***Breast cancer is the most commonly occurring cancer in women. Early detection of breast cancer is important step in diagnosis in diagnosis of the abnormalities which may reduce the mortality rate. In this paper, we present a method for classification of medical images. It can be achieved using digital mammography. Mammography is most reliable and widespread method for early detection of breast cancer. This system includes Preprocessing on mammogram image and uses wavelet feature extraction to improve sensitivity. The proposed system has three major steps- Preprocessing, Feature Extraction and Classification. The main aim of this dissertation work is to implement a system which is used to for diagnosing the breast cancer as of mammogram pictures. In first stage preprocessing on mammogram picture is prepared which reduce the computational rate and exploit the probability of accuracy. To review the developed method, early step, found on gray stage information of picture enhancement as well as segments breast cancer.***

Keywords: Mammography image, Gabor Wavelet, Discrete Wavelet Transform, Support Vector Machine

1. Introduction

Breast cancer is the second leading cause of cancer death in women, exceeded only by lung cancer. The chance that breast cancer will be responsible for a woman's death is about 1 in 36 (about 3%). Death rates from breast cancer have been declining since about 1989, with larger decreases in women younger than 50. These decreases are believed to be the result of earlier detection through screening and increased awareness, as well as improved treatment.

The first symptom of breast cancer most women notice is a lump or an area of thickened tissue in their breast. Most lumps (90%) are not cancerous, but it is always best to have them checked by your doctor.

This cancer originates from breast tissue, mostly from the inner lining of milk ducts or the lobules that supply the ducts with milk. It has been one of the major causes of death among women since the last decades and it has become an emergency for the healthcare systems of industrialized countries. If the cancer is detected early, the options of treatment and the chances of total recovery will increase.[J.Somare,2012]

Breast is divided into the following main sections as :

1. Breast Gland:
Each breast has 15 to 20 lobes arranged similar to petals of daisy; inside each lobe are many smaller structures which are called lobules; at the end of every lobule are tiny sacs that can produce Milk.

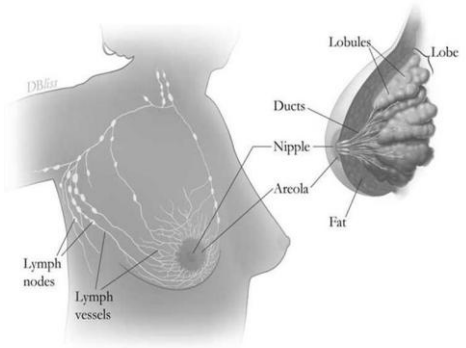

Figure 1: Structure of the female breast

2. Ducts:
Lobes, Lobules and bulbs, are connected by a network of slight tubes i.e. ducts; The Ducts hold Milk from bulbs towards the wickedness area of skin in the middle of the breast i.e. areola; Ducts link collectively into bigger ducts end at the nipple, wherever milk is delivered.

3. Lymph nodes:
Filter dangerous bacteria and take part in a key role in fighting off infection. There are no muscles inside the breast, but muscles recline under every breast and wrap the ribs. Each breast too contains blood vessels and vessels that take lymph. The lymph vessels direct to small bean shaped organs called lymph nodes, clustering of which are uncovering under the arm, over the clavicle, in the breast and in various other parts of the body.

Image manipulation is commonly used in image processing and pattern recognition field. Image manipulation may include quality enhancement, filtering, segmentation, feature selection or extraction and dimensionality reduction. Mammographic images are X-ray images of breast region displaying points with high intensities density that are suspected of being potential tumors. Automatic tumor detection is extremely challenging as the suspicious calcification or masses appear as free shape and irregular

texture, so that no precise patterns can be associated to them.The detection of tumours in mammogram is divided into three main stages. [2]

The first step involves an enhancement procedure, image enhancement techniques are used to improve an image. Then the Gabor Wavelet based features are extracted from mammogram. Then the next stage involves the classification using SVM classifier.

2. Proposed System

A simplified block diagram of proposed system is depicted in following figure 2.

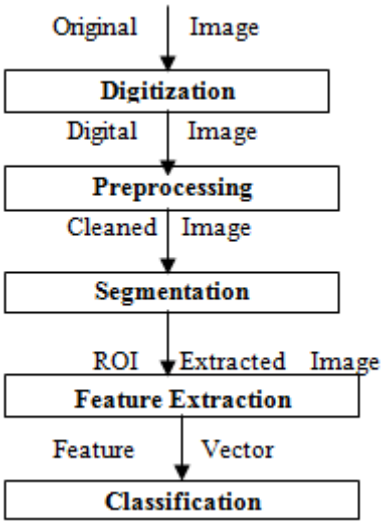

Figure 2: Proposed System

1) **Digitization:** Digitization produces the digital image, which is fed to the pre-processing phase.
2) **Preprocessing:** After digitization image may carry some unwanted noise. The preprocessing stage reduces noise and distortion, removes skewness and performs skeltonizing of the image. After preprocessing phase, a cleaned image goes to the segmentation phase.
3) **Segmentation:** The segmentation stage takes in the image and separates the different logical parts. Segmentation is the process of partitioning an image into semantically interpretable regions.
4) **Feature Extraction:** After segmentation, set of features are required for each image. In feature extraction stage every image is assigned a feature vector to identify it. This vector is used to distinguish the image. Gabor Wavelet is used for Feature Extraction.
5) **Classification:** Classification is the main decision making stage of image recognition and finding whether the image is cancerous or not. It uses the features extracted in the previous stage to identify the image segment according to preset rules. Advanced classifiers such as Support Vector Machines (SVM) applied to image patches extracted around image.

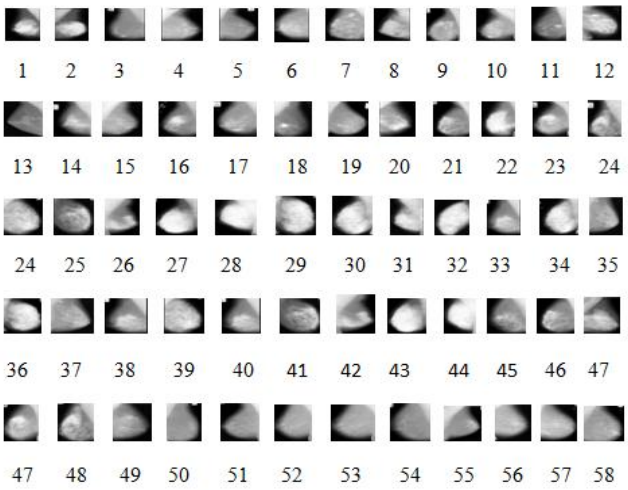

Figure 3: Input image

In mammography image the spatial resolution of x-ray which is in the order of few microns permits to visualize masses. But the conventional mammograms are highly textured and complex. This makes the interpretation difficult. For this reason, it is necessary to extract features from the mammogram to improve performances of the diagnosis in terms of precision and reliability. The feature extraction and selection from an image plays a critical role in the performance of any classifier. Higher accuracy of the classifier can be achieved by the selection of optimum feature set.

2D Gabor wavelets have been widely used in computer vision applications and modelling biological vision, since recent studies have shown that Gabor elementary functions are suitable for modelling simple cells in visual cortex. Other nice property is provided by their optimal joint resolution in both space and frequency, suggesting simultaneously analysis in both domains [6].

3. Image Preprocessing

A preprocessing phase of the images is necessary to improve the quality of the images and make the feature extraction phase more reliable.

Wiener filter is an optimum filter. Objective of a wiener filter is to minimize mean square error. Wiener filter has capability of handling both degradation function and also noise. From degradation model, error between input signal f (m, n) and estimated signal f (m, n) is given by

$$E(M,N) = F(M,N) - F(M,N) \quad (1)$$

Square error is given by

$$[F(M,N) - F(M,N)]^2 \quad (2)$$

Mean square error is given by

$$E\{[F(M,N) - F(M,N)]^2\} \quad (3)$$

Wiener filters are class of optimum linear filters which occupy linear estimation of preferred signal sequence from another related sequence.

Figure 3: Wiener filter image

4. Experimental Results

The proposed system has been developed for diagnosing of breast cancer from mammogram pictures. In first stage, the preprocessing on mammogram picture is done which minimize the computational cost and maximize the probability of accuracy. To summarize the developed method, the initial step, based on gray level information of image enrichment and segments the chest cancer.

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