RESEARCH ARTICLE

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A Review on Methods Utilized for Classification of Mammographic Image

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ABSTRACT

Cancer is the uncontrollable, abnormal, continuous replication of the cells which will surely lead to forming tumor. In the breast tissues Cancer flourish, it is second leading source of cancer mortality among the women, effect is reduced by prior detection. Diagnosis based on Mammography is treated as most effectual to observe breast cancer. Matching two mammographic views of same patient may cause upgrade in the precision of CAD system and it can guide the radiologists to identify Breast Cancer in initial stages, bring about to a devaluation of mortality rate. The image processing techniques are used for the automatic detection of tumor and classification algorithm categorized tumor as cancerous or non-cancerous from mammographic image. This paper details the distinct methods used for cyst detection and classification.

Keywords: Breast Cancer; Mammography; CAD System; Cyst.

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INTRODUCTION

For Breast Cancer, United States stated Statistics in 2017, an approximately 252,710 recent invasive and 63,410 non-invasive BC case will be pronounced in women. BC diagnose chances in a Malaysian lady is 1 in 20. Highest risk (6.25%) is to identify BC in Chinese women [2], as shown in Fig.1. Then after that Indian women have 5.88% and Malay women with a 3.57% lifetime risk. The survival rate of BC is incredibly influenced by malignancy's stage in the course of diagnosis. To give proper treatment to patients, early diagnosis needed and thus reduce mortality and morbidity rate. For different kinds of cancer, a High-performance diagnosis will be helpful for a medical expert to support them to diagnose and adopt appropriate treatment. Normally, BC is treated by surgery, which is pursued by chemotherapy, hormone therapies, and radiations. At any time disease may recur if cancer patients treated initially. Yet maximum recurrences cases tend to appear in the first Five after the treatment. The detection of BC is done by adopting imaging techniques. Digital imaging, Magnetic Resonance Imaging and ultrasound imaging are some extensively used imaging methods. In the MRI method reaction of the tumor tissue is monitored by inserting dye material in the body of the patient. The MRI has some limitations that its cost, which is more than X-ray mammographic technique, a detector absorbs X-ray that forms an image. Mammography is an estimable and most effective utensil for abnormalities detection inside the breast. Mammographic screening is effective for BC mortality reduction by 30-70% [11]. Mammography used for detecting information breast masses. However,

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only just one mammogram is not sufficient to find an unnatural area.

Multiple views mammographic screening helps doctors in BC diagnosis. However diagnosis accuracy depends on individual skills and perception of medical expert. Therefore, an automated matching method between the different perspectives of multiple mammographic is required. In the previous two decades, CAD techniques have been conferred for the disclosure of breast masses through mammographic images. The CAD system having two types; first is unilateral and the second is bilateral. A single screening aspect is used in unilateral. CC and MLO are typical mammographic views [1]. In the second bilateral CAD system, the integration between MLO and CC view has been demonstrated to upgrade the accuracy of BC detection. Cranio-caudal mammographic view is captured from top horizontally compressed breast using compression plates. From lateral sides, MLO views are captured and by an angle of the crosswise compressed breast. In the previous 10 years, various procedures have been suggested for automated breast mass detection using machine learning with Computer Vision techniques. Unfortunately, a high count of False Positive detection is present in the supervised method. In CAD number of factor influence the rate of False Positive mass detection, which analyzed carefully to produce a low rate of error. The Radiologists identify irregular lumps in breast by using mammography. Having low contrast property of mammogram images, hence chances of False Positive as well as False negative results. If the result is "False positive" this should be more investigated. In these cases, diagnostic ultrasound, mammogram, and MRI or Biopsy recommended for further investigation to analyze the existence of cancer. To CAD system will be helpful to overcome these different limitations. The masses can be detected and classified just as benign either malignant by radiologists with the help of Computer-aided diagnosis. CAD can reduce variable interpretation of masses by a medical expert.

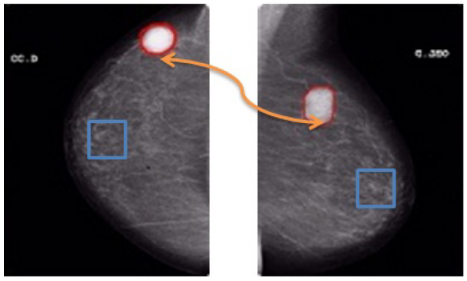

Figure 1: CC (left) and MLO (right) View of Breast Mammogram [2]

LITERATURE SURVE

When the mammographic image is captured the every image has different value of various parameters like brightness, contrast, etc. this happens due to the varying conditions during image capture. Noise gets added in the image which leads to the challenge in the automatic segmentation and detection of the objects and abnormalities from the mammographic image. Preprocessing is necessary for normalizing uniformity and eliminates the undesirable artifacts such that the all mammographic images are comparable with each other.

Mohamed Abdel-Nasser et al [1] the matching approach is presented to detect the relation between candidate points in multiple mammographic views SIFT is adopted to find candidate points, texture feature used to analyzed the irregularity of region surrounding each point. Segmentation is used for choosing initial candidate points in both MLO and CC views. The local site around candidate points can be categorized by classifier combination. The trained classifier feature sets adopted to categorize, SIFT used for detection of landmark, feature descriptor, and matching. They have used different numbers of texture methods that are Local Binary Pattern, Local Directional Number Pattern, Histogram of Oriented Gradients, Gray Level Co-occurrence matrix, Gabor Filter. For classification Support Vector Machine classifier is used. In this study 60% matching rate achieved for cancerous points.

F. F. Ting et al [2] to BC classification the algorithm self-regulated multilayer perceptron neural network (MLNN) is invented. ML-NN employs a multilayer perceptron neural network upon breast cancer division to assist medical specialists in the examination of BC. Through implementing the algorithm, breast pathological images can categorized into a normal patient and cancer patient outwardly earlier information about the appearance of cancer tumors. ML-NN can classify the medical data images as a normal patient, malignant or benign patient with specificity, AUC, sensitivity, and accuracy of 90.67 %, 0.906±0.0227, 90.53% and 90.59% respectively.

M. A. Berbar [3] suggests wavelet based contour let approach to extract peculiarities of mammographic images. Ere removing features reverse extending function 'stretch limo' practiced for pre-processing. Seven characteristics obtained from GLCM are contrast, inverse diversity moment, energy, entropy, sum average, and homogeneity. SVM classifier was employed to categorized a mammogram in effected rather normal. Mini MIAS dataset was utilized during evaluation of system. The review of the system was estimated in terms of accuracy, specificity, and sensitivity. The accuracy and sensitivity comprise 97.89% and 97% sequentially.

Nadeem Tariq [4] the recommended method, texture characteristics of mammogram were estimated applying Gray Level Co-occurrence Matrix with 0°, from the estimate characteristics most effective characteristics having huge participation to accomplish the wanted output were collected and implemented to Artificial Neural Network for training and analysis, as ANN is popularly practiced in several areas such as, pattern recognition, medical diagnosis, machine learning. For this work, mini-MIAS dataset is utilized and the overall specificity, accuracy, and sensitivity obtained through adopting the recommended method is 100%, 99.4%, and 99.3% sequentially.

M. Abdel-Nasser et al [5] the effects of factors like Integration Scale, pixel resolution, feature normalization and preprocessing on performance of texture method and tumor classification. For classification non-linear and linear SVM classifier is used. To find out the perfect combination among studied factors for those three approaches: Sequential Forward Selection, greedy and exhaustive search. The mini-MIAS dataset is used. Texture analysis techniques like LBP, LDN, HOG, HAR and Gabor Filter are used. For preprocessing three algorithms used the median filter, CLAHE, and Sharpening. The decision is taken by the SVM classifiers by varying threshold over decision value ROC curve is generated.

R. R. Janghel et al [6] four models implementation is done and that is Radial Basis Function Networks, Learning Vector Quantization, Competitive Learning Network, and Block Propagation Algorithm. Higher accuracy of LVQ than other models shows its better ability in the classification. neural networks are optimal classifier identified as the best parameter. BC database is based upon FNA test. Confusion Matrix is used; it has all info about predicted and actual classification. The best configuration of the classifier shows 95.82% tested the accuracy of LVQ from 74.88 % for CL and MLP having 51.88%. LVQ is a supervised learning mechanism that has shown higher performance then CL unsupervised learning mechanism.

Leonardo de et al [7] a methodology is presented by employing Growing Neural Gas Algorithm for detection of the lesion. To describe the texture of the segmented structure Ripley's K-Function is used for this Support Vector Machine as a classifier by considering two elements: Texture and Shape. The clustering algorithm is used while pre-processing operation which is intentionally used to process only on the ROI. To break the image in two groups thresholding operation is used which also proposed to give more attention to the breast part. By applying GNG Algorithm mass candidate found a set of structures. The result shows that the adoption of these two methods in diagnosis of tumour is encouraging and 89% accuracy is achieved.

Arnau Oliver et al [8] presented a method which purposes to reduce false positive rate in mass which is done with the basis of texture features. Several local records of ROI is built by the LBP texture descriptor. After that, several local descriptors are combined to get a global record. For reduction of false positive thus global LBP descriptor is used. For the computation of the local descriptor, the ROI picture is separated into small areas. A final descriptor is provided by combining local descriptor by using spatial enhanced Histogram. Descriptors obtain utilized to categorized ROI between real tumours and normal parenchyma.

JuCheng Yang et al [9] micro calcification is sparkling spots in mammographic views, which are tiny in size so challenging to detect. For detection of the micro calcification morphological bandpass filter (MBF). For detection task string of MBFs are connected. In the Binary image region of interest of micro calcification is obtained. Morphological Bandpass Filter has a basic operation that is dilation and erosion. MBF is a good means for getting peaks of image. MBF approach for identification of micro calcification is more accurate than DWT in size and position of micro calcification. Using MBF can ROI with False Positive Rate and True Positive Rate of 4.31% and 93.07% respectively.

SUMMARIZED WORK DONE

Table 1: Summary of Methods Used

Ref No.	Methodology	Result
1	SIFT find candidate points LBP, LDN, HOG methods used for texture feature analysis, SVM classifier used for classification	60% matching rate achieved for cancerous points
2	Multilayer perceptron neural network used for classification	Sensitivity 90.53% and accuracy 90.59% achieved
3	Seven features obtained from GLCM, MIAS dataset was utilized	Accuracy 97.89% and sensitivity 97% achieved
4	GLCM with 0° to estimate texture feature, ANN used for classification	Specificity 100%, accuracy 99.4%, and sensitivity 99.3% achieved
5	For classification non-linear and linear SVM classifier is used Median filter, CLAHE, and Sharpening used for preprocessing	Found best combination of texture analysis technique
6	LVQ, RBF, CVQ, CL, BPA methods used for texture analysis. ANN used as classifier	95.82% accuracy of LVQ
7	GNG Algorithm to detect lesion, Ripley's K-Function for segmentation, SVM classifier for classification are employed	89% accuracy is achieved for tumour detection
8	LBP to reduce false positive rate SVM for classification	LBP+SVM found ROIs 512 for FP reduction
9	For detection MBF method used	93.07% TPR and 4.31% FPR is achieved by MFB

CONCLUSION

The various methods and techniques used for the identification and segmentation of ROI and abnormalities present in the mammographic image were described in this review. These techniques plays vital role while mammographic image processing operations like segmentation, filtering, feature extraction along with classification because the classification is done through the algorithm. The classification algorithm decides wither the tumor is cancerous or noncancerous and helps the patient and prevents the chances of death. The methods and techniques described in this paper have shown better result in terms of precision. But there is need to improve precision of classification tumor for correct diagnosis of breast cancer patient.

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