Breast Cancer Detection Using LBP and DWT Features

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ABSTRACT: In this Paper a novel automatic technique to detect early breast cancer by analyzing breast thermogram. The system comprises mainly of three steps: 1)Image Enhancement 2) feature extraction 3) finally classification and performance analysis In the segmentation phase, we have first removed the background region by applying the Otsu's thresholding method followed by a reconstruction technique. In this paper Features are extracted based on both LBP (Local binary Pattern) and DWT Feature matching is done by forming combined single feature vector using minimum distance search. Finally, feed-forward artificial neural network with gradient decent training rule is employed here as a classifier

KEYWORDS: Breast Cancer , LBP, DWT, Image Enhancement.

I.INTRODUCTION

Breast cancer is cancer that develops from breast tissue.[8] Signs of breast cancer may include a lump in the breast, a change in breast shape, dimpling of the skin, fluid coming from the nipple, or a red scaly patch of skin.[1] In those with distant spread of the disease, there may be bone pain, swollen lymph nodes, shortness of breath, or yellow skin.[9] Risk factors for developing breast cancer include being female, obesity, lack of physical exercise, drinking alcohol, hormone replacement therapy during menopause, ionizing radiation, early age at first menstruation, having children late or not at all, older age, and family history.[1][2] About 5–10% of cases are due to genes inherited from a person's parents, including BRCA1and BRCA2 among others. Breast cancer most commonly develops in cells from the lining of milk ducts and the lobules that supply the ducts with milk. Cancers developing from the ducts are known as ductal carcinomas, while those developing from lobules are known as lobular carcinomas.[1] In addition, there are more than 18 other sub-types of breast cancer. Some cancers, such as ductal carcinoma in situ, develop from pre-invasive lesions.[2] The diagnosis of breast cancer is confirmed by taking a biopsy of the concerning lump. Once the diagnosis is made, further tests are done to determine if the cancer has spread beyond the breast and which treatments it may respond to.[1]

The balance of benefits versus harms of breast cancer screening is controversial. A 2013 Cochrane review stated that it is unclear if mammographic screening does more good or harm.[10] A 2009 review for the US Preventive Services Task Force found evidence of benefit in those 40 to 70 years of age,[11] and the organization recommends screening every two years in women 50 to 74 years old.[12] The medications tamoxifen or raloxifene may be used in an effort to prevent breast cancer in those who are at high risk of developing it.[2] Surgical removal of both breasts is another preventative measure in some high risk women.[2] In those who have been diagnosed with cancer, a number of treatments may be used, including surgery, radiation, chemotherapy, hormonal therapy and targeted therapy.[1] Types of surgery vary from breast-conserving surgery to mastectomy.[13][14] Breast reconstruction may take place at the time of surgery or at a later date. In those in whom the cancer has spread to other parts of the body, treatments are mostly aimed at improving quality of life and comfort.[14]

Outcomes for breast cancer vary depending on the cancer type, extent of disease, and person's age.[14] Survival rates in the developed are high,[15] with between 80% and 90% of those in England and the United States alive for at least 5 years.[5][4] In developing countries survival rates are poorer.[2] Worldwide, breast cancer is the leading type of cancer in women, accounting for 25% of all cases.[16] In 2012 it resulted in 1.68 million new cases and 522,000 deaths.[16] It is more common in developed countries[2] and is more than 100 times more common in women than in men.[15][17].

- Breast cancer is one of the most widespread cancers in the world. A digital mammogram is an X-ray picture of the breast, which used for early detection of breast cancer and other abnormalities.
- The early detection of the cancer can reduce mortality. Mammograms help radiologists to detect the malignant masses precisely at their early stage.
- But, the mammograms are usually characterized by low contrast therefore it is not easy to read by the radiologist to detect small masses and micro-calcifications, which are indirect signs of malignancy, precisely and in their early stage.
- So we need a Computer aided diagnosis (CAD) system for mammography, which simulates the process of the radiologist and used to interpret mammography image and check for the presence of breast cancer and distinguish between malignant and benign tumors of breast cancer.

II. LBP BASED CANCER DETECTION

2.1 PREPROCESSING
The objective of preprocessing [3] is remove an irrelevant noisy and improve the quality of an image, eliminate an unwanted parts in mammogram background and make it ready for further processing. Preprocessing is very important step in mammogram image analysis and enhances the image quality and influence the result, improve the accuracy of result and play the major role to identify abnormality. Morphological operations [6] are used to remove the noisy data, enhance and contrast the input image. Morphological operators are those applied on the binary image, before convert the gray image into binary image. Four morphological operations are used to improve the image for further process; they are Erosion, Dilation, Top-Hat and Bottom-Hat. Dilation operator can gradually enlarge the boundaries of regions of foreground pixels (i.e. white pixels) of binary image. Erosion operator can erode away the boundaries of regions of foreground pixels (i.e. white pixels,), thus areas of foreground pixels shrink in size, and holes within those areas become larger. Detailed information of image can achieve by using Top-Hat operator, the brightest part of an image become highlight. Bottom-Hat operator can used of highlight the black spot in a white background. Erosion and Dilation operators can used for reduce the noisy, Top-Hat and Bottom-Hat operators can used for enhance and contrast the image. Contrast image can achieves by subtracting the Bottom-Hat image from Top-Hat and initial image. Eliminate the muscle part by using the k-means.

2.2. LOCAL BINARY PATTERN
Local Binary Patterns (LBP) is a method for texture feature extraction mostly used for recognition techniques. The extracted features are useful for classifying breast cancer abnormality in mammograms. Given a pixel in the image, an LBP code is computed by comparing it with its neighbours. There are two user defined parameter for input to LBP, they are P (number of neighbours) and R (radius of comparisons).

2.3. GABOR FEATURES
A set of Gabor filters with different frequencies and orientations may be helpful for extracting useful features from an image.[7] 2-D Gabor filters have rich applications in image processing, especially in feature extraction for texture analysis and segmentation.[8] f defines the frequency being looked for in the texture. By varying , theta we can look for texture oriented in a particular direction. By varying sigma , we change the support of the basis or the size of the image region being analyzed. Existing cancer detection system is shown in fig.1
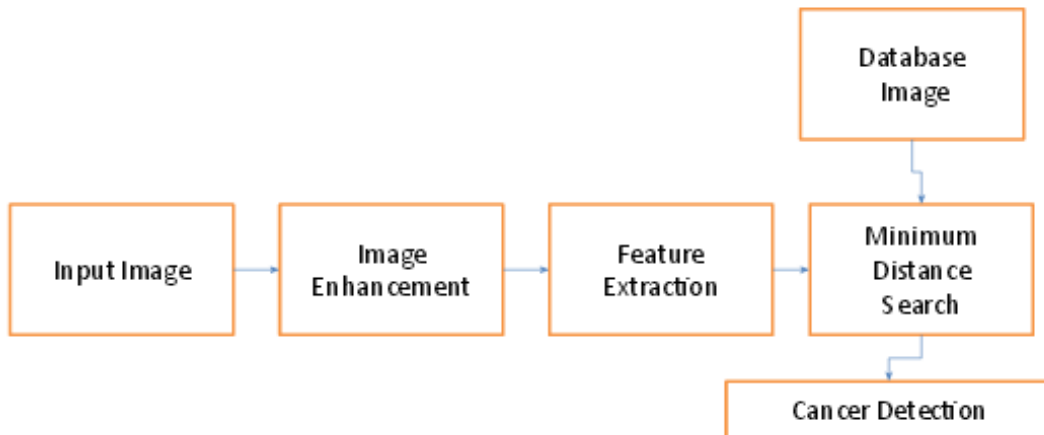
Figure.1. Conventional breast cancer detection system

III. PROPOSED BREAST CANCER DETECTION SYSTEM
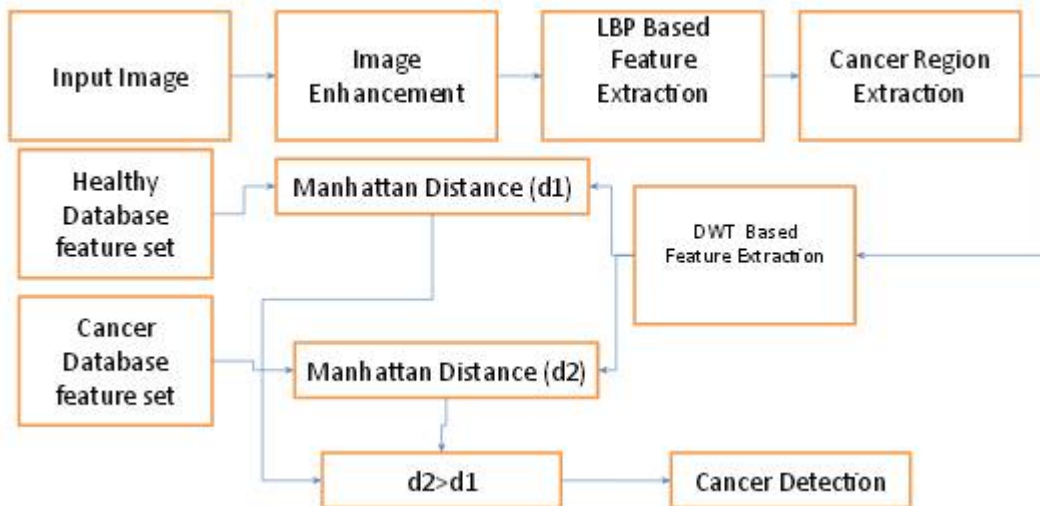
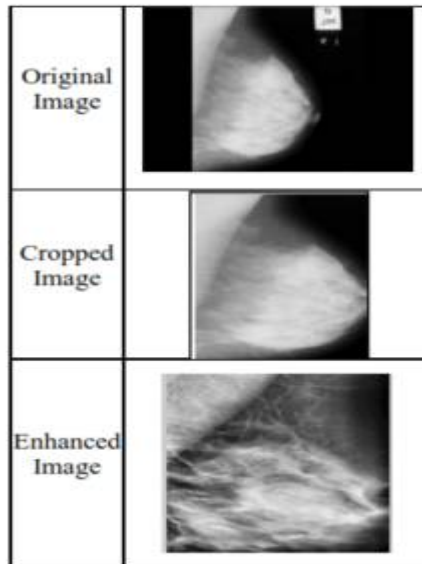**Figure.2.** Proposed breast cancer detection system

Figure.3. Image Enhancement

3.1 IMAGE ENHANCEMENT
- Mammogram images contain different kind of information which is unwanted for the algorithm and may cause to misguide the algorithm of classification.
- In addition, mammograms are unclear images and low contrast. Therefore, preprocessing phase is necessary to improve the quality of the image and make the feature extraction phase more reliable.
- Preprocessing may compose of the two steps: - Background removal, and image enhancement by CLAHE. Contrast-limited adaptive histogram equalization

3.2. BASIC LBP OPERATOR
The LBP operator was originally designed for texture description. The operator assigns a label to every pixel of an image by thresholding the 3x3-neighborhood of each pixel with the center pixel value and considering the result as a binary number.
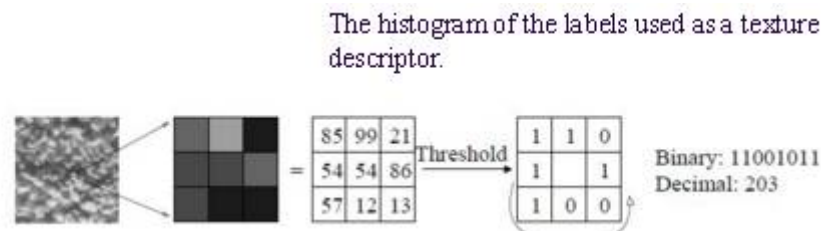

Figure.4. Basic LBP operator

We assume that by setting an optimal LBP cell size it is possible to cover by this cell almost all breast tumors. We thus consider a binary classifier which decides whether one breast region is healthy or cancerous. These regions correspond to the optimal LBP cells which size will be set experimentally. The input of the classifier is the uniform LBP histogram. The classifier then assigns values for all square cells of the whole image. The final decision is based on the thresholding: an image with higher number of positive regions than a given threshold is classified as cancerous. Because of very good accuracy in many computer vision tasks which also includes breast cancer detection [24], support vector machines are used as a classifier.

Four bands obtained after DWT

Figure.5. Basic Image feature extraction using DWT

1. Input Image I
2. Include Non cancer data feature set F1
3. Include cancer data set F2
4. Image Enhancement by CLAHE
       F=CLAHE(I)
 3. Apply LBP to F
 4. By thresholding identify cancer region and non cancer region
   I1= Cancer region image
   I2= Non cancer region image
 5. Apply DWT to I1
   F11=[LL HL LH HH]
 6. Find minimum distance
 D1= F11-F1
 D2=F11-F2
 7. If D2 > D1
 Then cancer identified
 Else
 Non cancer identified
 End.

Figure.6. Algorithm for breast cancer detection using LBP & DWT
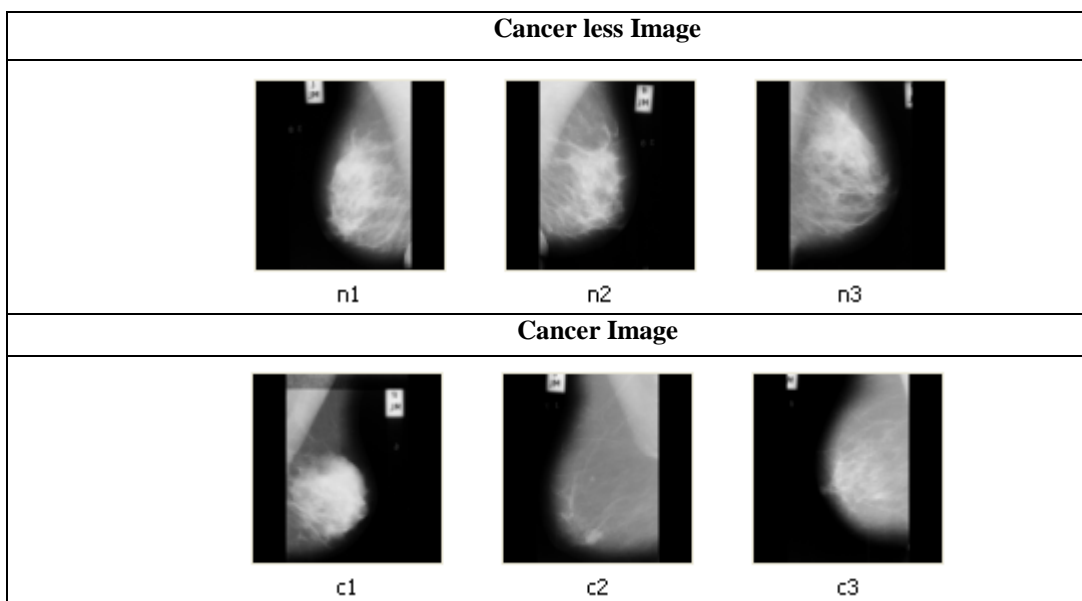
V.SIMULATION RESULTS

Figure.7. Image Database

Table.1. Performance analysis of proposed breast cancer detection method

Number of images tested	Conventional		Proposed	
	Accuracy	Precision	Accuracy	Precision
5	75	79	90	91
10	72	76	91	92
15	73	76	92	91
20	71	73	94	91
25	73	71	94	91
30	71	71	94	91

VI.CONCLUSION

The completed Local Binary Pattern is an effective tool for extracting large number of texture features so it plays an important role in false positive reduction at different ROI image sizes. The most important property of the CLBP operator in real world applications is its tolerance against illumination changes and computational simplicity. This work will be extended further for the classification of mammograms as normal or abnormal based on the texture features. There are so many techniques available for the classification such as artificial neural network, DWT. In that DWT is the better tool for discriminating the real masses and non real masses.

REFERENCES

[1] L. Tabar and P. Dean, Teaching atlas of mammography. New York: Thime 3rd ed., 2001.
[2] American Cancer Society Breast cancer: facts and figures.
[3] ACS; 2003-2004 of breast: Categorical course in diagnostic radiology physics. Physical Aspects of Breast Considerations, pages 295-309, 1999.
[4] Robert M. Haralick,K Shanmugam ,Itsak Dinstein "Textural features for image classification."IEEE Transaction On system man and cyberneticsvolume3-No.6, pp.-610- 621,November 1973.
[5] A Mohd. Khuzil,R Besar, Zaki, NN Ahmad, "Identification of masses in digital mammogram using gray level cooccurrence matrices", Biomedical Imaging and Intervention Journal,2009
[6] Jia-Lin Chen and Amlan Kundu" Rotation and Gray Scale Transform Invariant Texture Identification Using Wavelet Decomposition and Hidden Markov Model" IEEE transactions on pattern analysis and machine intelligence, vol. 16, no. 2, february 1994
[7] T. Ojala, M. Pietikäinen, and T. T. Mäenpää, "Multiresolution gray-scale and rotation invariant texture classification with Local Binary Pattern," IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 24, no. 7, pp. 971-987, 2002.
[8] S. Liao, Max W. K. Law, and Albert C. S. Chung "Dominant Local Binary Patterns for Texture Classification" IEEE Transaction on Image Processing, VOL. 18, NO. 5, MAY 2009.
[9] Marko Heikkila, Matti Pietikainen, Cordelia Schmid, "Description of interest regions with local binary patterns", Pattern Recognition 42, pp.425 -436, 2009.
[10] Materka, M. Strzelecki. Texture Analysis Methods – A Review. Technical University of Lodz, Institute of Electronics, COST B11 report, Brussels 1998.