International Journal of Engineering Sciences & Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

IJESRT

RESEARCHERID
THOMSON REUTERS

[Suharta, *et al.*, 9(2): February, 2020]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DETECTION OF BREAST CANCER USING ADVANCE GMM SEGMENTATION AND MULTI SVM CLASSIFIER

Shiana Kocchar[*1] & Baldip Kaur[2]

[*1]M.Tech, Lala Lajpat Rai Institute of Engineering and Technology, Moga, Punjab
[2]Assistant Professor, Lala Lajpat Rai Institute of Engineering and Technology, Moga, Punjab

DOI: 10.5281/zenodo.3692931

ABSTRACT

Breast cancer is a malignant neoplasia produced by a cellular division dysfunction. Amammography is a particular form of radiography, using radiation levels between specific intervals with a purpose to acquire breast images to diagnose an eventual presence of structures that indicates a disease, especially cancer. In this proposed system we have detected cancer using GMM Segmentation along with SVM Classifier from mammographic images and to evaluate the state of cancer. We have evaluated the performance of our proposed system on various parameters. We have taken a dataset of different images and evaluated the result on this dataset. It can be seen that the proposed system, shows very good results on the various input images. The proposed system can classify the MRI image into three categories. It has concluded that the proposed system shows the accuracy of 96.67%.

KEYWORDS: Breast cancer detection and classification, SVM Classifier, GMM Segmentation.

1. INTRODUCTION

The fundamental knowledge of breast structure and some breast pathologies is essential to understand the importance of breast cancer study. Breast cancer is a malignant neoplasia produced by a cellular division dysfunction. A mammography is a particular form of radiography, using radiation levels between specific intervals with a purpose to acquire breast images to diagnose an eventual presence of structures that indicates a disease, especially cancer. In the case of mammary pathologies, their early detection is extremely important. The technological advances verified in imaging have contributed to the increase in the successful detection of breast cancer cases. In this area, mammography has an important role to detect lesions in initial stages and make a favourable prognosis.

During the fetal period is created, by the epidermis, a depression forms a mammary pit on the local of the mammary gland. The region where the mammary glands appear is located on the left and right sides of the upper ventral region of the trunk. The breasts exist in both women and men, but the mammary glands are normally most developed in females, except in some particular circumstances related to hormonal problems. The nipple is a small conical prominence surrounded by a circular area of pigmented skin, the areola, which contains large sebaceous glands that are often invisible to the naked eye. The base of the female breast, roughly circular, extends from the second rib above to the sixth rib below. Medially, it borders the lateral edge of the body of the sternum and laterally it reaches the mid auxiliary line in Fig 1.1 (Moinfar, 2007 and Moore et al, 2004).

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

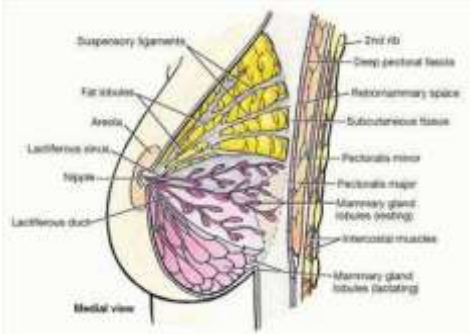

Fig 1.1: Anatomy of breast (From Moinfar, 2007 and Moore et al, 2004)

At puberty, the female breasts normally grow according to the glandular development and increase of fat deposition; furthermore, also the nipples and areolas grow. The size and shape of the breast depends on genetic, racial and dietary factors. During the pregnancy, the areola colour becomes dark, and after that keeps the pigmentation. This colour diminishes as soon as lactation is over, but is never entirely lost throughout life (Moore et al, 2004 and Gray, 2000).

The breast consists of gland tissue, fibrous tissue, connecting its lobes and fatty tissue in the intervals between lobes. The breast contains 15 to 20 lobes of glandular tissue, which constitute the parenchyma of the mammary gland. These lobes give a shape characteristic to the breast due to a considerable amount of fat, and these are composed of lobules, connected together by areolar tissue, blood vessels and ducts. Each lobule is drained by a lactiferous duct, which opens independently on the nipple. Just deep to the areola, each duct has a dilated portion, the lactiferous sinus, which accumulates milk during lactation. The smallest lobules include also the alveoli, which open into the smallest branches of the lactiferous ducts (Dixon, 2006).

2. LITERATURE SURVEY

(Oad, Devi and Sajida,2018), Breast cancer has been the main cause for high mortality rate in women. To improve the survival rate, regular screening and early diagnosis of breast cancer is essential. Mammography imaging reveals the presence of calcifications if present. These calcifications can be classified as benign and malignant, out of which malignant ones need serious attention. Manual investigation of these images is time consuming and error-prone. Computer based approaches are sought for this purpose. Image processing and pattern recognition based techniques have been widely adopted in this regard. This work reviews the existing approaches owing to image processing and pattern recognition towards breast tumour identification. The approaches are divided into filtering based, morphology based, multi-scale based, model based and pattern recognition based approaches to facilitate a clear understanding. The work suggests that opportunities still exists in various aspects to improve the detection accuracy of breast cancer.

(Devakumari, 2018), Breast cancer disturbs one in eight women. It is dreadful and a life threatening disease. The causal agent of breast cancer is still under research. But there are some jeopardy factors such as age, gene, obesity, taking birth control pills and smoking. Normally breast cancer is a malignant tumor that initiates in the cells of the breast and eventually it extends to the surrounding tissues. The disease can be preserved if it is detected early. As stages increase, the chance of preserving decreases. There are numerous imaging techniques that play a vital role in detecting breast cancer. This research study analyses various breast cancer detection techniques based on image processing techniques, data mining methods, various features used and a brief comparative study of the existing breast cancer detection system.

(Mohamed, 2018), The study aimed to collect a group of breast cancer images as the first-ever special data set in Sudan. The researcher has collected 1170 breast cancer images from several hospitals in Sudan, namely, Khartoum Breast Care Center, Radiation & Isotope Hospital and Asia Hospital. The images were classified by radiology specialists at Radiation & Isotope Hospital and Amal National Hospitals using BI-RADS and given the named Samah mammography Dataset (SMDS) to help doctors in early detection and to reduce treatment cost. The researcher has Method (IDL, interactive data language) to process the images and the functions for segmentation and classification in addition to training, testing the dataset (SMDS) and reading the results which

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

were 82.5% successful and accurate. GUI in IDL (interactive data language) was also used. This technique has helped the specialists detect and diagnose tumor accurately and led to greater treatment chances and lower cost of medication.

(Abdallah, 2018),Enhancement of mammography images considers as powerful methods in categorization of breast normal tissues and pathologies. The digital image software gives chance to improve the mimeographs and increasing their illustration value. The image processing methods in this paper were using contrast improvement, noise lessening, texture scrutiny and portioning algorithm. The mammography images kept in high quality to conserve the quality. Those methods aim to augment and hone the image intensity and eliminate noise from the images. The assortment factor of augmentation depends on the backdrop tissues and type of the breast lesions; hence, some lesions gave better improvement than the rest due to their density. The computation speed examined used correspondence and matching ratio. The results were 96.3 ± 8.5 ($p>0.05$). The results showed that the breast lesions could be improved by using the proposed image improvement and segmentation methods.

Research Gap

Existing system uses baye's classifier that can be replaced with Multi SVM Classifier to get better performance. Performance of existing system is measured only on the basis of true positive rate and false positive rates, but to evaluate the actual performance of the system more parameters should be evaluated which is to be done in the proposed system.

Hence an effective image processing system is to be required so that it can detect, whether the cancer is present or not. If present, at what stage it is.

Proposed Methodology

For instance, the conceptualisation of a construct entails close examination of meanings, awareness of peoples' everyday understanding of the concept, and analysis of the literature and relevant knowledge bases to determine the dimensions to be included in the construct. The operationalisation and empirical validation involve assessing validity and reliability through techniques such as exploratory factor analysis and reliability analysis. Keeping in view the objectives and the nature of the research problem, this research methodology draws on the positivist research paradigm and uses techniques involving both qualitative (substantive) and quantitative (structural) aspects.

a. Image Preprocessing
b. Image Segmentation
c. Feature Extraction
d. Feature Classification

These steps are explained as below:

a. Image Preprocessing

This is mainly performed to remove the noise in the image. This can be achieved by following steps:

i. Noise is removed in the proposed system by using wiener filter along with the 2-D median filter.
ii. Then the contrast in the resultant image should be increased by setting a certain threshold value. The threshold can be determined using histogram. This can be achieved by histogram modified contrast limited adaptive histogram equalisation (HM-CLAHE) method.
iii. Then the contrast of microcalcification cells canbe further enhanced using dilation which is a morphological operator.

b. Image Segmentation

The segmentation of the image is performed to segment the microcalcification cells. This is achieved by using morphological operator and applying Otsu's thresholding algorithm. This can be done as follows:

i. The image can be filtered with morphological whitetop hat for detecting microcalcification cells which are small bright particles in a slow varying background. The top hat will remove the background without reducing the microcalcification cells

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Top hat transformation = image - Open(image).

ii. Fixing an optimal threshold to segment the filtered image separating microcalcification cells from the background using Otsu's thresholding algorithm.

c. Feature Extraction

Many features such as Area, no. Of pixel intensity, brightness, contrast, size,shape, and texture can be extracted from microcalcification clusters by using the following methods:

i. Obtaining statistical moments of the gray level histogram of the region.

ii. Constructing a gray level co-occurrence matrix. The co-occurrence matrix describes the texture by finding the occurrence of certain gray levels. Various descriptors can be obtained from the co-occurrence matrixincluding the maximum probability, entropy, and uniformity.

d. Feature Classification

The extracted features can be used to classify the microcalcification clusters into either benign or malignantcancer cells using Multi SVM Classifier (which is a very robust classifier).

3. RESULTS AND DISCUSSION

The proposed system is evaluated to the following parameters: Energy, Entropy, Standard Deviation, Mean Deviation, Arithmetic Mean, Total Mean, Variance, Median, Geometric Mean, Harmonic Mean, Trimmed Mean, Co-Variance, Cross Co-Relation, Skewness, Kurtosis, and Cross Co Variance.

Screenshot of the proposed system

Table: Statistics of the proposed system

Parameter	Value
No. of Data Set Images	60
Images Tested	60
Overall System Accuracy	96.67%
Categories Tested	Beningn, Malign, Normal

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

The proposed work is evaluated and implemented using MatLab and Multiple SVM Classifier's before that Weiner Filter is being used. In this proposed system MRI image is classified into three categories. It has concluded that the proposed system shows the accuracy of 96.67% as per the 15 images on the calculated is conducted.

4. CONCLUSION AND FUTURE SCOPE

Conclusion

Breast cancer is a malignant neoplasia produced by a cellular division dysfunction. A mammography is a particular form of radiography, using radiation levels between specific intervals with a purpose to acquire breast images to diagnose an eventual presence of structures that indicates a disease, especially cancer. In this proposed system we have detected cancer using GMM Segmentation along with SVM Classifier from mammographic images and to evaluate the state of cancer. We have evaluated the performance of our proposed system on various parameters. We have taken a dataset of different images and evaluated the result on this dataset. It can be seen that the proposed system, shows very good results on the various input images. The proposed system can classify the MRI image into three categories. It has concluded that the proposed system shows the accuracy of 96.67%.

Future Scope

In the future, the GMM segmentation technique can be improved by using canny edge detection for better segmentation and to decrease the time for segmentation. The proposed system can also be extended by adding an Artificial Neural Network to the existing SVM classifier to improve the performance of the proposed system.

REFERENCES

[1] Oad M. L., Devi J., Sajida P.(Feb.-2018) , A review on computer aided diagnosis of breast cancer using image processing and pattern recognition techniques,International Journal of Electrical, Electronics and Data Communication,
[2] Devakumari, D., &Punithavathi, V. (2018). Study of Breast Cancer Detection Methods using Image Processing with Data Mining Techniques. International Journal of Pure and Applied Mathematics, 118(18), 2867-2873.
[3] Mohamed S. E.,Wahbi T. L., Sayed M. H.(April 2018). Automated Detection and Classification of Breast Cancer Using Mammography Images,International Journal of Science,, Engineering and Technology Research (IJSETR).
[4] Abdallah, Y. M., Elgak, S., Zain, H., Rafiq, M., Ebaid, E. A., &Elnaema, A. A. (2018). Breast cancer detection using image enhancement and segmentation algorithms. Biomedical Research, 29(20), 3732-3736.
[5] Cahoon, T. C., Sutton, M. A., &Bezdek, J. C. (2000, May). Breast cancer detection using image processing techniques.In Ninth IEEE International Conference on Fuzzy Systems.FUZZ-IEEE 2000 (Cat.No. 00CH37063) (Vol. 2, pp. 973-976).IEEE.
[6] Mehdy, M. M., Ng, P. Y., Shair, E. F., Saleh, N. I., & Gomes, C. (2017). Artificial neural networks in image processing for early detection of breast cancer. Computational and mathematical methods in medicine, 2017.
[7] Giri, P., &Saravanakumar, K. (2017). Breast Cancer Detection using Image Processing Techniques. International Research Journal of Computer Science and Technology.
[8] Paramkusham, S., Rao, K. M., &Rao, B. P. (2013, September). Early stage detection of breast cancer using novel image processing techniques, Matlab and Labview implementation. In 2013 15th International Conference on Advanced Computing Technologies (ICACT) (pp. 1-5).IEEE.
[9] Tuteja, N., Singh, P., &Bansal, M. (2018). Comparative analysis of different techniques for breast cancer detection in Mammograms..
[10] Nahid, A. A., & Kong, Y. (2017). Involvement of machine learning for breast cancer image classification: a survey. Computational and mathematical methods in medicine, 2017.
[11] Tan, Y. J., Sim, K. S., & Ting, F. F. (2017, November). Breast cancer detection using convolutional neural networks for mammogram imaging system.In 2017 International Conference on Robotics, Automation and Sciences (ICORAS) (pp. 1-5).IEEE.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

[12] Yadav, B. K., & Panse, M. S. Different Image Pre-Processing and Feature Extraction Techniques for Breast Cancer Detection in Labview.
[13] Yadav, A. K. Early Breast Cancer Detection By Using Image Processing, International Journal of Innovations in Engineering, Research and Technology,IJIERT-ICITER-16,ISSN:2394-3696
[14] El Atlas, N., El Aroussi, M., &Wahbi, M. (2014, November). Computer-aided breast cancer detection using mammograms: A review. In 2014 Second World Conference on Complex Systems (WCCS) (pp. 626-631). IEEE. ".
[15] Badawy, S. M., Hefnawy, A. A., Zidan, H. E., &GadAllah, M. T. (2017). Breast cancer detection with mammogram segmentation: A qualitative study. (IJACSA) International Journal of Advanced Computer Science and Applications, 8(10).
[16] Zou, L., Yu, S., Meng, T., Zhang, Z., Liang, X., &Xie, Y. (2019). A Technical Review of Convolutional Neural Network-Based Mammographic Breast Cancer Diagnosis. Computational and mathematical methods in medicine, 2019.
[17] Kashyap, K. L., Bajpai, M. K., &Khanna, P. (2015, September). Breast cancer detection in digital mammograms.In 2015 IEEE international conference on imaging systems and techniques (IST) (pp. 1-6).IEEE. ".
[18] Singh, A. K., & Gupta, B. (2015). A novel approach for breast cancer detection and segmentation in a mammogram. Procedia Computer Science, 54, 676-682.
[19] Jenefer, B. M., &Cyrilraj, V. (2014). AN EFFICIENT IMAGE PROCESSING METHODS FOR MAMMOGRAM BREAST CANCER DETECTION. Journal of Theoretical & Applied Information Technology, 69(1).
[20] Guzmán-Cabrera, R., Guzmán-Sepúlveda, J. R., Torres-Cisneros, M., May-Arrioja, D. A., Ruiz-Pinales, J., Ibarra-Manzano, O. G., & Parada, A. G. (2013). Digital image processing technique for breast cancer detection. International Journal of Thermophysics, 34(8-9), 1519-1531.