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MACHINE LEARNING: DEVELOPING A FRAMEWORK FOR MAMOGRAM IMAGE CLASSIFICATION IN THE EARLY DETECTION OF BREAST CANCER

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ABSTRACT

Objective: To make an early diagnosis of breast cancer from a mammogram image. Methods/Statistical analysis: To avoid the misdiagnosis, we proposed a system to sort the suspicious masses from the mammogram image by using an extreme learning machine algorithm. The ELM based classifier is used to classify the input data as malignant and benign classes with the abnormal class. The effectiveness of the ELM algorithm is superior to the other existing algorithms for mammogram classification problems with its reduced training time and classification accuracy. Findings: We provide an optimistic method for binary class classification of mammograms using extreme learning machine algorithms. Mammography is a technique that is preferred for the early diagnosis of breast cancer. On the other hand, in most cases, it is not easy to differentiate benign and malignant tumors without biopsy; hence, misdiagnosis is always possible. The machine learning algorithm provides high accuracy than other techniques, and also the execution time is very low when compared to normal diagnosis. The existing methods are very slow compared to this proposed technique. The input images are the mammogram image and the segmentation, and pre-processing is performed to remove the noises present. Application/Improvements: The main application of the system is the early diagnosis of cancerous cells present and also classifies the normal and abnormal images.

1. INTRODUCTION

There are many screening methods for breast cancer diagnosis viz., MRI, Mammogram and Ultrasound, etc. Among them, mammograms may be the superior means for detecting breast cancer. But it does not diagnose cancer at an early stage, so the physical examinations still prevail. In modern existence, the occurrence rate of breast cancer has significantly augmented1. But, a biopsy is the only way to identify whether the detected tumor is benign or malignant, which is an invasive procedure that eliminates the tumor cells or tissue from a patient. A non-invasive method of detecting abnormalities in mammograms can diminish the need for needless biopsies, which reduces the patients of trouble and reduction of medical expenses.

Altogether, breast cancer endurance rate is enhanced over the past few years with the advancement of more efficient investigative methods and growth in healing methodologies. The American Cancer Society had anticipated that about 230480 new cases of persistent breast cancer and over 57,650 new cases of non-invasive breast cancer had been analyzed in the United States in 2011,

and nearly 39,520 women would expire due to breast cancer2. The highly accepted analytical method known as mammogram uses X-rays of low dose, high contrast, and high-resolution detectors. An X-ray system designed exclusively to image the breasts is the mammography method. A mammogram is used for screening and analysis of breast cancer. Screen Film Mammography (SFM) and Full-Field Digital Mammography (FFDM) are the two types of mammography screening systems used for diagnosis. SFM uses a film screen as a final recording device, and FFDM uses digital detectors as the recording media. The digital images obtained by FFDM have many advantages than SFM which produce a processed and enhanced image

2. PROPOSED METHODOLOGY

In the proposed system, the input image is gathered fromthe mammography with a dataset of mammogramsgiven by the Singapore Anti-Tuberculosis AssociationCompHealth, Singapore. Test input from mammogramsis taken from normal, benign, and cancerous breasts.The entire test images are taken from victims of the age group45 to 70 years. Test inputs are collected, and they are processedto obtain a resolution of 1024 × 1680. Every sampleis processed in two views, namely the craniocaudal viewand the mediolateral-oblique view. From the proposedsystem, the images which are number is larger when comparedwith the abnormal images with a ratio of 223:90 inwhich the abnormal image consists of both benign andmalignant, which provides a highly accurate result basedon ELM classification.Before classifying the image pre-processing, segmentationand feature extraction are done, and that image isthen sent for classification to get high accuracy and lesserror rate.

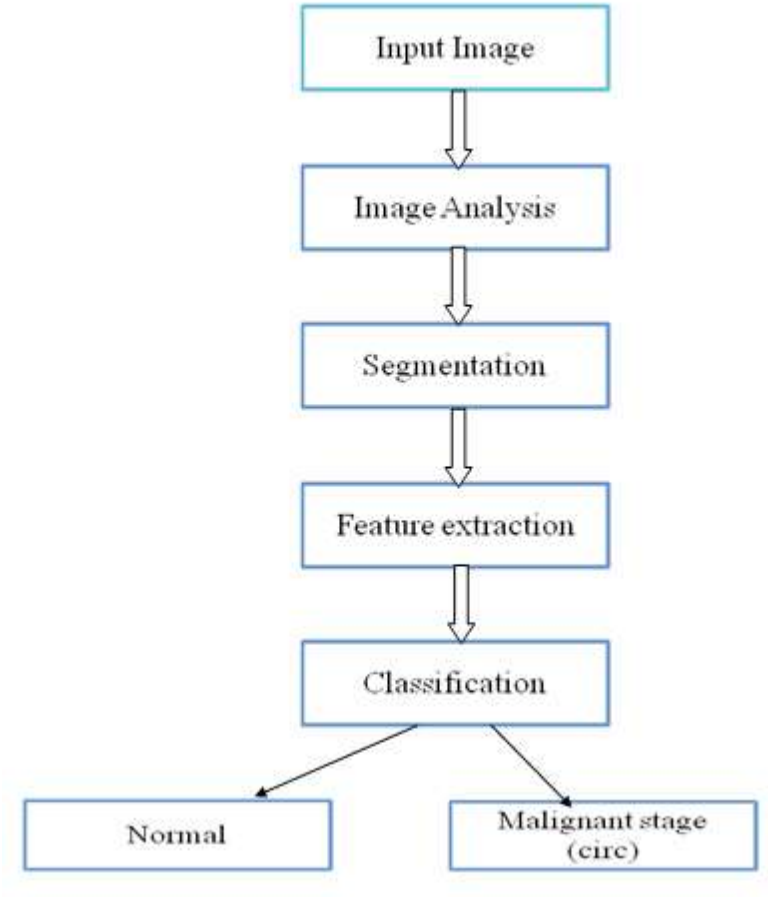

Figure 1 describes the steps involved in the process.

Figure 1. The flow chart of the proposed method.

2.1 Input Image

Before gathering the info information, arrangements ofprepared pictures are gathered and are stacked in the classifier.At that point, the information pictures are gatheredfrom the dataset for additionally preparing. The gatheredpictures won't be in the same pixel measure, so it is hardto process the picture. For that, the gathered pictures arechanged over into standard pixel esteem either as 512 ×512 or 640 × 480 for simple handling of information.

2.2 Pre-processing

Images are effectively get influenced by the clamorintroduce in the framework or because of the outsideenvironment. The different kinds of clamors introducein restorative pictures are Gaussian commotion, salt andpepper clamor, Poisson clamor, and so forth. These commotionswill lessen the execution. So legitimate demonizingmust be performed. Commotions can be expelled eitherby sifting or by Thresholding. In this paper, the middle channelis utilized. It is a sort of non-straight

channel which isutilized to decrease the power variety in the pictures. Inthe middle separating the pixel estimation of the picture issupplanted by the area's middle esteem.

2.3 Segmentation

Segmentation is the technique for isolating the pictureinto the required parts. It is performed to find the requiredlimit of a picture which is utilized for grouping. The pixelswhich are of the same power, shading, or surface are dividedinto a gathering. A diagram cut strategy is utilized for portioningthe picture. The chart cut calculation basicallyin view of max stream/min-cut enhancement. Diagramcut calculation will suits best for Binary arrangement.Minimization is performed utilizing min-cut calculation.For max stream, Boykov-Kolmogorov is the proficientcalculation. It is an iterative procedure, and the procedureis rehashed until the point when the merging is accomplished.In the iterative diagram, the improvement is made inlight of hues by utilizing k implies group.

2.4 Feature Extraction

The component extraction is utilized to separate or selectthe base measure of pixel esteem from the vast contributionby disposing of the excess esteem. The requiredhighlights are removed by utilizing this procedure. Theelement extraction strategy incorporates nearby parallel examples, Haar wavelets, Histogram of OrientedGradients (HOG), Speeded Up Robust Features (SURF),shading histogram. The method utilized as a part of thispaper is neighborhood twofold examples. Nearby pairedexamples (trim) are, for the most part, utilized for surfacearrangement of pictures. The picture to be inspected isisolated into a number of cells with pixel esteem. At thatpoint, every pixel in the cells is: contrasted, and the areapixel, a histogram is acquired, and the gotten histogram isthen standardized, which gives an element sector.

2.5 Classification

The last procedure is the characterization of the extricatedpictures to distinguish the sick picture. An outrageousLearning Machine classifier is utilized to group the extricatedpicture. Extraordinary Learning Machine classifieris a regulated machine learning calculation. The arrangementof the picture is made with the prepared information, which is, as of now, exhibit in the informational collection.Extraordinary Learning Machine (ELM) is a Solitaryconcealed Layer that nourishes Forward Neural Network(SLFNN) system, which at irregular chooses input weightsand shrouded neuron predispositions without preparing.The yields weights are systematically computed utilizingthe standard minimum square arrangement and Moore-Penrose reverse of a general straight framework, whichpermits a noteworthy lessening in preparing time. Theinitiation work like sine, Gaussian, sigmoidal, and so forthcan be decided for concealed neuron layer and straightenactment capacities for the yield neurons7. The SLFNNassessed here utilizations added substance neuron outlinerather than partly based, henceforth irregular parameterdetermination. SLFNs are considered as a direct framework.The one of a kind least standard minimum square(LS) arrangement is demonstrated as 3. ResultsThe input image has been processed, and the classified

resultobtained by using the ELM classification algorithm in ourproposed system is shown in Figure 2. The test image iscompared with the trained image, and the result producedis either normal or abnormal image, which representsbenign or malignant cancer or not.

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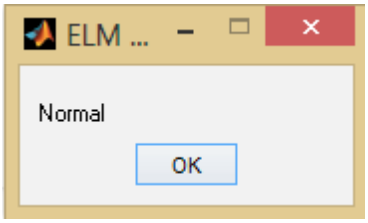
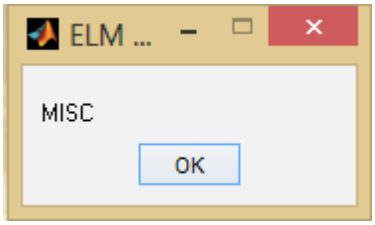
3. RESULTS

The input image has been processed, and the classified resultobtained by using the ELM classification algorithm in ourproposed system is shown in Figure 2. The test image iscompared with the trained image, and the result producedis either normal or abnormal image, which represents benign or malignant cancer or not.

(a)



(b)



(c)

Figure 2. (a) Input image, (b) Normal output image after classification, and (c) Abnormal output image after classification.

4. CONCLUSION

The main motive of the proposed system is to classify thecancer cell from the mammogram image. The images areclassified using extreme learning machine based classifieras malignant and benign classes with the abnormal class.The overall system accuracy achieved is around 92%, andthe elapsed time of the algorithm ranges between 0.002-0.019 seconds. The efficiency of the ELM classifier is moreefficient when compare with other existing classifier algorithmsfor mammography image classification problemswith its reduced training time and classification accuracyto classify the image according to its features and to groupthem in the malignant, benign and normal groups. Thefuture work is to implement the process with the newdeveloping E2LM algorithm, which is a much superioralgorithm to every other algorithm available in artificialintelligence algorithms.