Classification of Breast Cancer using PNN Classifier

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Abstract **- To detect any disease and to monitor the patients having these diseases, involvement image processing technique has a major role to play. One of the most important elements is breast cancer detection. It is a difficult task to segment the tumour cells in breast because of the low contrast issues and the images won't be that clear. A good technique has been developed here where the noise is removed, and some improvements will be done on the images so that diagnosis can be done perfectly. After that the image will be segmented, here GMM segmentation method is used along with thresholding method for segmentation of the boundaries of the breast so that the tumour region can be determined of the picture. The next step is feature extraction which is done using Discrete Wavelet Transform (DWT). Probabilistic Neural Network (PNN) with radial basis function is used to classify Breast Tumour whether it is benign or malignant. If the breast tumour is detected in early stage, then it could save many lives. Here for automated breast tumour classification for excellent classification, feature extraction and segmentation should be perfect.**

Index Terms **- PNN classifier, GMM segmentation, breast cancer, mammography, Image processing, DWT, Noise reduction.**

1.INTRODUCTION

Breast cancer is nothing but uncontrolled growth of cells. When the cells grow larger than 1.5mm within every 3 months. Breast tumour is one of the most common cancer found in women, it can also lead to lead. The reason for breast cancer is not yet known till now. To prevent this disease is also not found yet. Only once the type of tumour is determined doctors can decide what type of treatment to be given. Cancer is nothing but abnormal cells. They can start anywhere in our body. Nature of the tumour depends on whether they are malignant or benign. Malignant or benign can occur anywhere in our body When these cancer cells grow too much, they become tumour. A growth is malignant when it develops different tissues and has cells that can split away and go through the blood or lymphatic framework and spread to lymph hubs and far off pieces of the body. When the cancer spreads from one place to another is called metastatic cancer. When that cancer cells develop and grow into tumour cells and these tumours cells are called as metastases. There is non-cancerous tumour also which does not lead to cancerous and are called as non-cancerous tumour. A proper classifier always gives the best result so that proper treatment can be given. With the help of machine learning diagnosis of diseases can be made perfectly also with more accuracy. To classify normal and abnormal breast cancer neural network or deep learning method is used. Among this Artificial neural network is one the most commonly used and widely used method to detect tumour cells. Generally, ANN is network of neurons which learn from experiences. For classification and detection, here probabilistic neural network and fuzzy logic are used. Using wavelet transform feature extraction is done. For prediction of breast cancer ANN is used. Different types of neural network can be used for classification of mammogram images for breast cancer. For scanning breasts mammography is the medical imaging. This helps for the detection of cancer in breast at an early stage and it can also detect the regions.

2.LITERATURE REVIEW

1. In recent years, domestic and foreign scholars have done a lot of detailed work on CAD of breast tumour recognition. Q. Jin et al. worked on the Back Propagation (BP) neural organization by adding force and transformation rate to diminish the necessary season of preparing the model.
2. Abirami et al. utilized wavelet change to remove picture highlights. Multi-facet Perceptron was utilized as a classifier to acquire better grouping results on open datasets.

3. Lin et al. proposed a support vector machine (SVM)-based classification method with better performance than K-nearest neighbours.
4. Sequential Minimal Optimization (SMO) and Particle Swarm Optimization calculation, working on the presentation of SVM. Every one of the examinations above have a place with two-class mammogram order, however mammogram has typical properties other than harmless and dangerous. For three-class mammogram grouping.
5. The components of discrete cosine changes and wavelet changes, utilizing assortment of classifiers for characterization.
6. Extreme Learning Machine (ELM) as classifier and demonstrated that the strategy is better than different methods. As of late, profound learning has gotten broad consideration in the picture handling field. They used convolutional neural networks (CNN) to classify mammogram and compared the performance of SoftMax and SVM as output layers. In contrast to the strategy for streamlining classifiers, precise division of neurotic elements in pictures can likewise work on the exactness of finding.
7. A hybrid algorithm based on regions and contours, combined cluster segmentation techniques to identify benign and malignant tumours. Although the techniques above show certain adequacy in the particular order measure, it is hard to meet the necessities of the assistant clinical finding,

3.METHODOLOGY

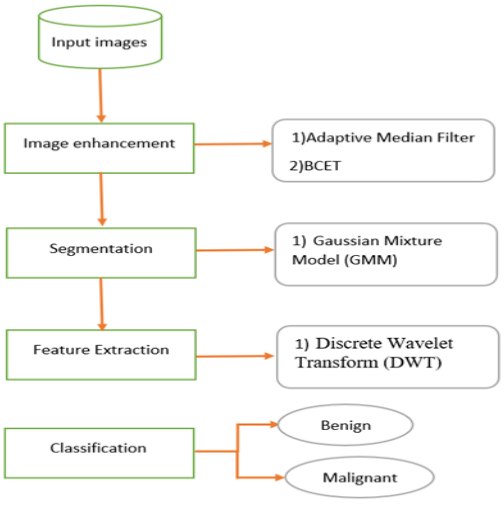


Fig1: -Block diagram of proposed system

Seeing at the image the doctor understands and identifies what type of tumour it is. This method will help the doctor to diagnose what type of breast cancer it is. And with the existence of proposed system, doctor can train the system with some known data and afterward utilize this framework to create the picture report of the patient in the wake of testing the information. The result of the processing can be affected by the quality of the image given to the system. Due to technological features of device, there can be noise in the image which can be clearly seen.
At first whatever images are captured are converted to grayscale. After that the computational steps are done like image enhancement, BCET, applying thresholding and Fuzzy c mean segmentation methods, DWT for feature extraction. Finally, detection and classification of tumour using PNN.

The region where the tumour lies are generally having more intensity compared to other portion.
1.Image Enhancement
Filters are mainly used to remove the noise part in the image but at they can also be used to remove or highlight certain features in an image. Here adaptive mean filter is used to remove the noise. It can easily detect fine noise also. To determine which portion of the image is affected with impulse noise we use adaptive median filter. By comparing each pixel in the image to surrounding pixel it classifies pixels as noise. The threshold and neighbourhood size of the pixel can be adjusted. Pixel which is different from its neighbours is labelled as noise. These noise pixels will be replaced by median pixel values of pixels in neighbourhood. The image is converted to grayscale using rgb2gray () and after that adaptive mean filter is applied to the result. This is then converted to unsigned integer 8 using unit8() function.
BCET (Balance Contrast Enhancement Technique) is used to highlight the area of interest. Without changing the histogram pattern, it is possible to stretch or compress the image.

2.GMM segmentation:
At its simplest, GMM is also a type of clustering algorithm. As its name suggests, each bunch is demonstrated by an alternate Gaussian distribution. This flexible and probabilistic approach to modelling the data means that rather than having hard

assignments into clusters like k-means, we have soft assignments.

3.Threshold segmentation:
To identify the boundaries and objects in images segmentation is used. The consequence of picture division is a bunch of locales that aggregately cover the whole picture, or a bunch of forms extricated from the picture. Pixels in the region will be similar either in colour, intensity or texture. By binary partitioning of the image intensities the MR images are segmented. I (p) = 1; if it's Gray level > T =0; if it's Gray level < T.
Original image is converted binary image first by grey level tin and then by turning each pixel black or white depending upon the grey value greater than or less than T.

4. Feature extraction and selection
For feature extraction DWT (Discrete Wavelet Transform) coefficients as feature vector. This is one of the powerful mathematical tools for feature extraction. Since they inform about the localized information about the function of signal, it can advantage. Which is very much important for classification.

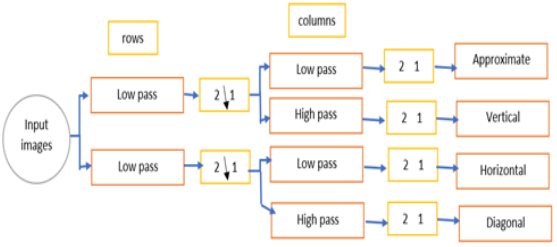


Fig2: -DWT

5.A probabilistic neural network (PNN)
It is a feedforward neural network, which is widely used in classification and pattern recognition problems. In the PNN calculation, the probability distribution function (PDF) of each class is approximated by a Parzen window and a non-parametric capacity.

Probabilistic neural network for classification
PNN was introduced by Donald Specht. This is mainly based on estimation of probability density function and theory of Bayesian classification. The input vectors have to be classified into one of the two classes in Bayesian optimal manner. Here PNN has three layers first the input layer second the radial basis layer and third competitive layer. Vector distances between the input vector and row weight vectors in weight matrix are evaluated by radial basis layer. Nonlinearly these functions are scaled. The competitive layer finds the shortest distance. After that the training pattern closet to the input pattern will be found based on the distance.

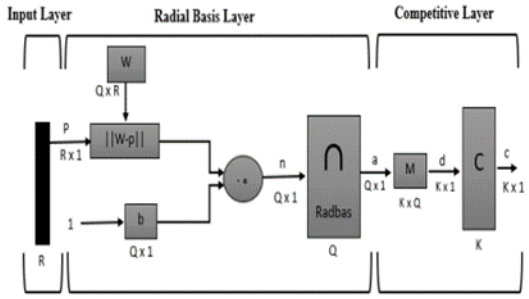


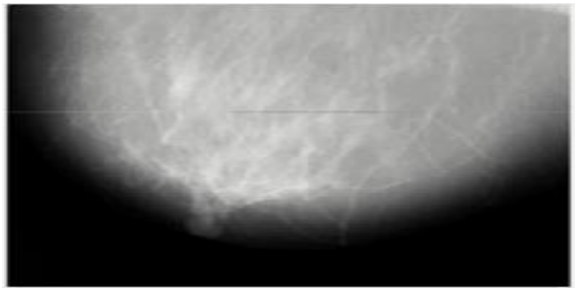
Fig3: -PNN Layers

PNN layers
1)Input Layer: The input vector, denoted as p, is presented as the black vertical bar in Fig.5. Its dimension is R × 1. In this paper, R = 3.
2)Radial Basis Layer: In Radial Basis Layer, the vector distances between input vector p and the weight vector made of each row of weight matrix W are calculated. Here, the vector distance is defined as the dot product between two vectors. Assume the dimension of W is Q×R. The dot product
between p and the i-th row of W produces the i-th element of the distance vector ||W−p||, whose dimension is Q×1, The minus symbol, "−", indicates that it is the distance between vectors. Then, the bias vector b is combined with ||W− p|| by an element-by-element multiplication, represented as ".∗" in Fig.5. The result is denoted as n = ||W− p|| .∗p. The transfer function in PNN has built into a distance criterion with respect to a centre.
3) Some characteristics of Radial Basis Layer: The I-th component of an equivalents to 1 if the information p is indistinguishable from the ith column of info weight framework W. A spiral premise neuron with a weight vector near the info vector p delivers a worth close to 1 and afterward its yield loads in the serious layer will pass their qualities to the cutthroat capacity. It is additionally conceivable that few components of an are near 1 since the information design is near a few preparing designs.

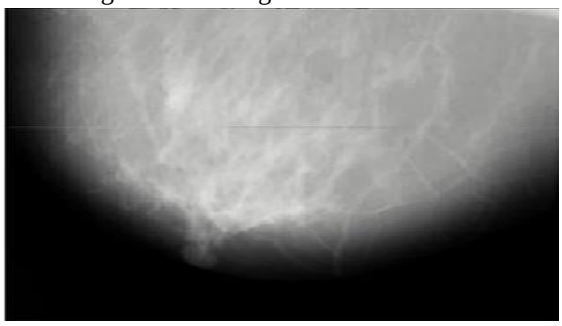
4) Competitive Layer: There is no predisposition in Competitive Layer. In Competitive Layer, the vector an is first and foremost duplicated with layer weight lattice M, delivering a yield vector d. The serious capacity, signified as C. produces a 1 relating to the biggest component of d, and 0's somewhere else. The yield vector of cutthroat capacity is meant as c. The record of 1 in c is the quantity of growth that the framework can arrange.

4.EXPERIMENTAL RESULTS

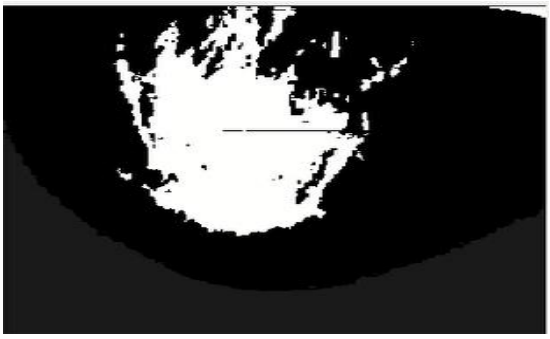
75 images are selected for this setup. Every medical image has different breast tumour with various shape, size, density etc. The different ion of the normal cells and the tumour cells also help to calculate the area of tumour affecting portions. Even with the help of DWT area of tumour can be determined.



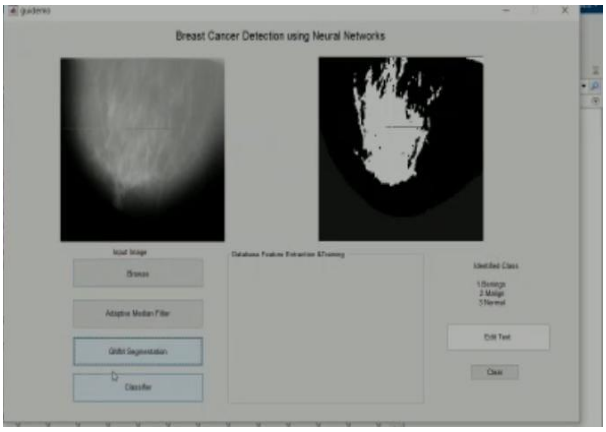
A.A benign tumour images



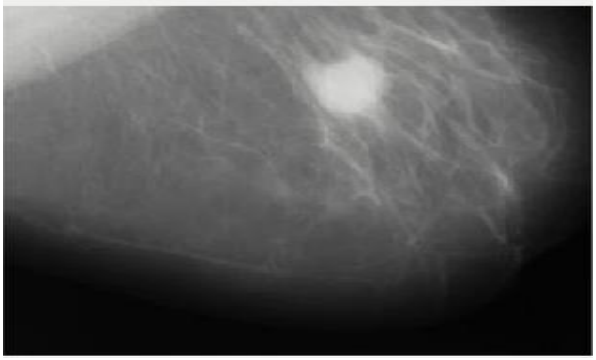
B. After applying adaptive median filter



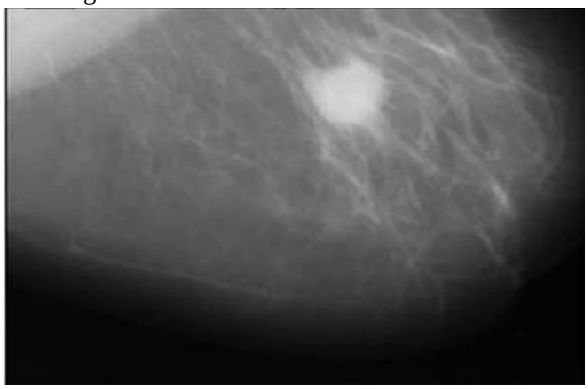
C. After segmentation



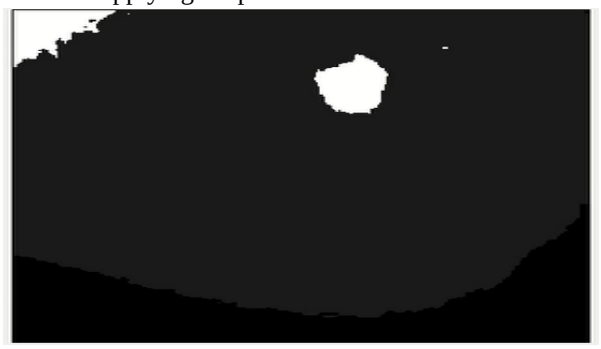
D.classified as Benign



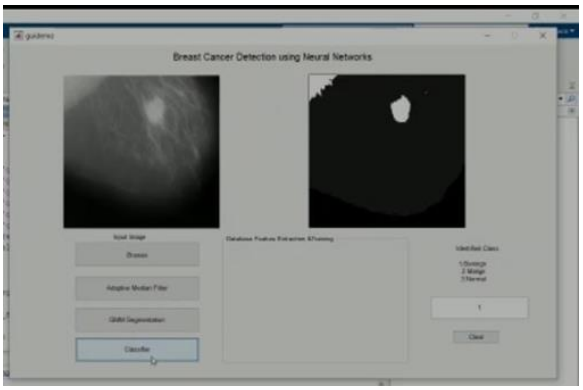
E. Malignant tumour



F. After applying adaptive filter



G. After segmentation



H. Classification of type of tumour (Malignant)

Image A, B, C and D are of benign tumour where image A is the original image, B is the image after performing adaptive median filter where noise is removed, image c is the result after segmentation and D is the final stage where classification is done and says it is benign.

Images E, F, G and H are of malignant tumour where image E is the original image, F is the image after performing adaptive median filter where noise is removed, image G is the result after segmentation and H is the final stage where classification is done and says it is malignant.

5.CONCLUSION

It is very important to analyse the tumour properly so that better treatment can be given. This proposal was designed to detect breast cancer so that proper treatment can be given to patients. For diagnosis of breast cancer mammography is used. In order to classify feature extraction is one of the important steps. Here DWT is used to calculate the area of the tumour. Detection of breast cancer is done by PNN method. Here mammogram images are classified into two groups benign and malignant. This system will help to assist doctors to speed up the diagnosis.

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