OPEN ACCESS

Greenfort International Journal of Applied Medical Science

Abbreviated Key Title: Grn Int J Apl Med Sci | ISSN 3048-6904(P) | ISSN 2584-2420(O) |
Greenfort International Publisher, Assam, India
Journal homepage: https://gipublisher.com/journals/gijams

Review Article DOI: 10.62046/gijams.2025.v03i03.003

Tumor Growth Stage Prediction on Ultrasound Breast Cancer Images with Backpropagation Network

Heber Anandan[1], Dhanisha JL[1], Vinitha B[1], Joe Roseny J[1], Jasper Beulah J[1], Kavitha M[1]

[1]Dr. Agarwal's Eye Hospital, Tirunelveli, Tamil Nadu, India

***Corresponding Author:** Heber Anandan | **Received:** 12.03.2025 | **Accepted:** 26.04.2025 | **Published:** 01.05.2025

Abstract: Neural Networks are computational models for solving various complex problems. Systematic learning without user support for ultrasound-screened breast cancer images aims to predict the growth of the tumor. Even though technology is improving towards the maximum, automatic cancer prediction through systematic learning boosts disease identification. To provide quality imagery and classification of tumors, breast cancer tumor prediction is processed. Apart from a radiologist's suggestion, to give a new source for finding tumor growth, automatic learning over the system is done through a neural network. The goal of this study is to reduce errors by modifying the backpropagation network. The dataset is ready for testing, validation, and training. The neural network backpropagation is implemented with stable, bounded dependent variables to reduce the error rate of the learning parameters. The proposed methodology maintains a platform for reducing the error to a minimum for learning and classification.

Keywords: Neural Network, Ultrasound, Breast Cancer, Tumor, Image Segmentation.

Citation: Heber Anandan *et al*. Tumor Growth Stage Prediction on Ultrasound Breast Cancer Images with Backpropagation Network. Grn Int J Apl Med Sci, 2025 May-Jun 3(3): 118-121.

INTRODUCTION

Neural Network Learning is a process of exhibiting the original phenomena of any object in the network to simulate the desired output. Likewise, briefly processing the attributes of tumor identification from an ultrasound-screened image is a way step to process it. A systematic approach for detecting the malignant tumor is problematic approach. Given this fact, the data set used to classify breast cancer tumors is less noisy.

An ultrasound-screened image is a basic scanned image of a cancer tumor, which usually has the primary staging properties. Classification of malignant tumors in an ultrasound image is not as easy as possible for radiologists to predict the disease symptoms. Thus, automatic prediction is a challenging task for such images. The neural network approach deals with the task of learning the entire characteristics of a tumor. The basic attributes for the characterization of a tumor are size, height, width, shape, and calcification. Nowadays, automatic breast cancer detection systems are not applicable in our area. Thus, to keep on checking the growth of the tumor is a must for people who are affected by cancer. Machine learning technique is a second helpful opinion for a radiologist to classify the disease. A system with accurate predictions of tumor growth is essential. Researchers face difficulty in meeting human expectations over cancer prediction since the symptoms of cancer are not present in the early stages. The complexity of the problem should be solved with the number of inputs given for training and testing. Any machine learning technique depends on the user input given for training.

The classification of malignant or benign cancer depends on the characteristics given as input. Logically, the characteristics of a malignant tumor depend on its height, width, and shape. The system for automatic prediction of the growing period of a tumor should specifically display an alert sign in case of the hazard stage. Extraordinarily, the ratio of breast cancer among women is growing rapidly.

Screening the breast cancer tumor using an ultrasound device seems low in its resolution, thus, it takes time to diagnose the disease. Also, several secondary testing devices, like a biopsy, are needed to make sure the tumor is malignant.

The system proposed meeting the inadequacy of the missionary part. As a substitute for all the secondary devices, the proposed methodology works with a similar task. Cancer statistics in 2016 report that even in villages, the spreading of malignant tumors is a cause of nature. A report in October 2016 says that the growth of breast cancer among women in Chennai, INDIA, is certainly rising towards 26k per year. Moreover, the affected cases may be defeated if no proper awareness is

raised. Several modalities emerged to detect breast cancer and the diagnosis carried with it; also, some moments lost their life. The following sections spotlight feature extractions from images and are passed as input to the neural network for self-learning [1].

RELATED WORK

An automated diagnostic system that detects breast cancer using a neural network. The learning process is carried out by a conjugate gradient algorithm. The Deep Belief Network (DBN) performs RIW-BPNN (Resource In Waiting- Back Propagation Neural Network) learning through Levenberg-Marquardt learning, which also still works best for classifying breast cancer tumors.

The performance of classification gives 99.68% accuracy, proposing a concept for the reduction of feature selection properties with Independent Component Analysis (ICA), which selects the original 30 features along with one reduced feature, and the classifier accuracy is predicted with k-nearest Neighbor (k-NN) and Artificial Neural Network (ANN). The one-dimensional feature vector causes the Radian Basis Function Neural Network to have increased accuracy from 87.17% to 90.49%. The prediction of malignant samples has with sensitivity rate from 93.5% to 96.63% for RBFNN, and for SVM, the rates increase from 96.07% to 97.47%. Analyzing the results, applying ICA for feature reduction for processing with neural network forms to be greater in performance. Extreme Learning Machine (ELM) is an algorithm that trains the hidden layer on a forward basis. The efficiency of an algorithm is compared with deep learning and gives a better junction than existing learning methods [2].

METHODS

This survey focuses on different approaches for breast cancer detection and Growth Prediction on Ultrasound images. Usually, this involves four stages.

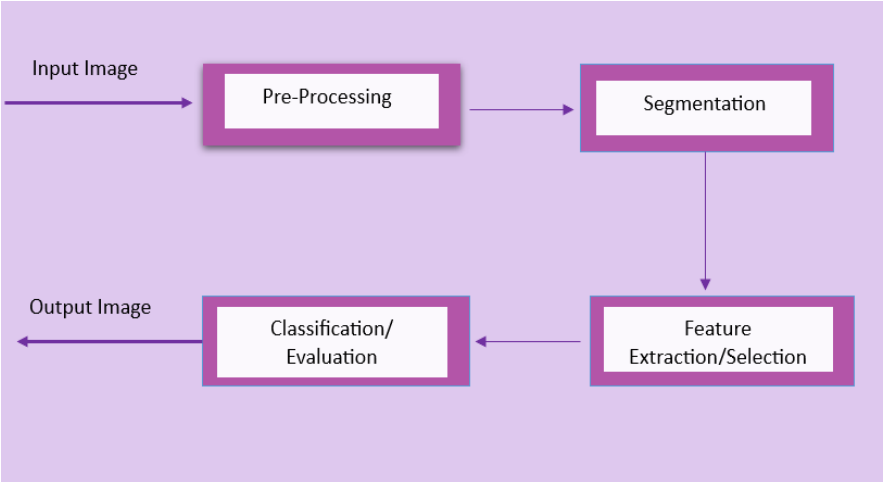

Fig-1: Stages of breast cancer detection and Growth Prediction on Ultrasound images

- Image pre-processing: Ultrasound images are affected by noise such as speckle noise [3,4], impulse noise, and multiplicative noise [5]. To suppress the noise, some filtering techniques [5,6], wavelet domain techniques [7-9], and de-speckling methods [10]are used.
- Image Segmentation: This method subcategory the image into several small portions and differentiates the object from the background [11].
- Feature extraction and selection: In this stage, we extract some of the features from normal tissue and abnormal cancer tissue. So, extracting and selecting some essential features for classification.
- Classification: After the feature extraction we classify the tissue and decide to conclude normal and abnormal [12].

PRE-PROCESSING

The pre-processing of breast ultrasound images consists of noise reduction and image enhancement. Speckle in the form of noise is generated by several scatterers [13] with random phase within the resolution cell of the ultrasound beam.

FILTERING TECHNIQUES

Filters can be divided into two types they are, linear and nonlinear filters.

LINEAR FILTER

- **Adaptive mean filter (AMF):** To eliminate the blurring effect, we used the Adaptive Mean Filter [14-16].
- **Low pass filter**: The low-pass filter is used to reduce speckle noise and blur the edges [17]. In this, we use the stick techniques to reduce the noise and improve the edge information. They also use the linear projection operation.

NON-LINEARFILTER

Order Statistic Filter: The Order Statistic filter can reduce noise. It preserves the edge sharpness and produces less blurring than the Median filters [5]. Specifically, it is effective, but most of the Ultrasound image is affected by impulse noise.

SEGMENTATION

In this segmentation method divide the image is divided into several small segments. Then the goal of segmentation is to identify the correct areas and to analyze the diagnosis. This method provides neural network segmentation. In this, we use the K-means algorithm to evaluate the clustering. In this Segment, we identified the Benign and malignant tumors using the K-Means algorithm [9].

K-MEANS ALGORITHM METHOD

The K-means algorithms are under the group of squared error-based clustering. The K-means algorithm is an iterative technique that is used to split an image into k clusters. K-means clustering is a method of cluster analysis that can portions n observations into k clusters, in which each observation is in the right place in the cluster with the adjacent mean. The basic K-means clustering algorithm is as follows:

- Pick the k cluster centers either randomly or based on some heuristic.
- Assign each pixel in the image to come together so as that minimize the distance between the pixel cluster centers.
- Re-compute the cluster center by averaging all of the pixels in the cluster. Repeat the last two steps until convergences are attained [11].

FEATURE EXTRACTION AND SELECTION

This feature extraction and selection step is important in cancer detection and classification. Textures extracted from the RF series and neural network classifiers used for the detection of prostate Cancer. To extract some of the features, such as geometric, statistical, texture, and histogram features. To evaluate the reduction and feature selection techniques, a simple classifier was used [18].

CLASSIFIERS

After the extraction of features and the selection process then we have to classify the images into lesion/benign/ malignant or normal/ abnormal classes. This Lesion detection is necessary before the classification. Neural Network Learning is a process of showing the original function of any object in the network to simulate the required output. The Neural network back propagation is used for learning the attributes for tumor classification [19].

CONCLUSION

In this paper, we reviewed Ultrasound Breast cancer detection and classification using ultrasound images in the literature. The techniques are processed in four stages (pre-processing, segmentation, feature extraction, and classification) and are summarized. Different performance matrices are discussed and also, and it is very useful for the research in image processing and radiology.

ACKNOWLEDGEMENT

We acknowledge the scientific input of Mr. J. Dhinesh Jegan Babu, Director, Messiah Enterprises, Chennai, which significantly improved our paper.

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