# Hybrid Approach of Tumor Detection in Mammogram Images by Using Soft Computing Techniques

Sridevi Tharanidharan[1], Nazik Ahmed Osman Medani[2], Anamika Raj[3], Randa Mohamed AbdElhalim[4]
*Lecturer, Department of Computer Science Applied Collegem Khamis Mushyat King Khamis Mushyat, King Khalid University, Abha, Kingdom of Saudi Arabia*

***Abstract:*** **In the current era, the pandemic situation medical image processing may struggle with diagnosing the disease so the help of using soft computing techniques in the healthcare industry is very much useful to diagnose the disease, especially in mammogram images easily. Here we introduced the novel approaches of fuzzy-based dimensionality reduction by using soft computing techniques in the mammogram image dataset without loss of information. The efficient morphological operations are used for preprocessing, segmentation, and feature extraction the fuzzy logic and membership function has been used and the decision tree classification is used for classifying the tumors easily.**

***Keywords-Clustring Segmentatio, Hybrid Neuro-Fuzzy Systems Decision Tree and Morphological Operation.***

## I.INTRODUCTION

In past decades, Enhancement is one of the important and fee powerful elements in scientific photograph processing. In current years, exceptional sorts of enhancement strategies had been broadly studied and used in photograph detection and locating the tumor of the photograph. A mammographic photograph is the best approach for breast most cancers screening and early detection of loads or abnormalities. It can hit upon ninety to ninety-five percent of all breast cancers. The radiologist will have a look at the breast modifications in mammographic photographs that appear strange scenarios and discover the variations among photographs of breasts evaluate the maximum current ones beyond mammographic photographs of an affected person to test for modifications with virtual X-rayed mammography, the radiologist exams digital the breast photographs, the use of unique excessive-decision monitors. The radiologist or medical expert can adjust the image's brightness, customise the comparison, and zoom in for close-ups. One of the main benefits of virtual technology is the ability to regulate scientific images. Radiologists and surgeons must have special training and passion in order to read, interpret, and diagnose the gray-scale mammographic image. Radiologists and surgeons must have special training and passion in order to read, interpret, and diagnose the gray-scale mammographic image. The following factors make the task of tumour and dispersed function detection in virtual mammographic images challenging: mammographic photograph interpretation is a tough undertaking because of negative comparison and excessive noise tiers within side the photograph which could range as much as 10-15% of the most pixel intensity. This is a trouble due to the fact the photograph enhancement procedure may also undesirably decorate noise factors inside the photograph, and the lesions in mammographic photographs may also seem pretty diffused. There are physiological sorts of breasts: dense breasts and non-dense breasts. Dense breasts are the maximum tough ones to analyze; the lesions in those photographs are regularly now no longer seen beneath Neath the glandular tissues, which makes the procedure of Boundary detection tough for us. The non-dense breasts are simpler to analyze because of much less fatty and glandular tissue making the lesions without problems distinguishable from different elements of the breast many enhancement techniques are used to enhance the visible look of mammographic photographs, Therefore, enhance scientific analysis to collect precise first-class photographs so that the Doctors could make use of those Images to reach accurate conclusions. In this paper, we gift a top-level view of mammographic photograph enhancement processing strategies. More specifically, processing techniques primarily based on totally heuristic strategies of mammographic photograph enhancement are categorized and the hybrid neuro-fuzzy enhancement strategies are explained.

## II. RELATED WORK

Mithun Kumar Kar et al [1] introduced a somatic segmentation of deep learning algorithms in automated image algorithms by using CNN and RNN. Janmenjoy Nayak et al [2] say the firefly algorithm with swam intelligence in biomedical healthcare and they used nature-impaired algorithm methodology. Author muralikrishnan et al [3] developed novel approaches of deep learning algorithms with convolution neural networks in medical image segmentation and further they have classified the images. Berk ustum et al [4] says that the discrete linear classification and sleep apnea supervised classification in the medical scoring systems. Esther jebarani et al [5] introduced the computer-aided diagnosis for local binary patterns and concentrated on gray-level co-occurrence matrix with fuzzy local binary patterns. Ritam Guha et al [6] says the classification accuracy provided by machine learning models with feature selection (FS) and introduced whale survival algorithm to improve the classification accuracy. Mainly concentrated on fitness-dependent death mechanisms. Uma maheshwaran roa et al [7] mainly focused on Convolution neural networks by using mammography to detect and classify the normal and abnormal individuals and benign and malignant the implementation made in python. H D Cheek et al [8] introduced the adaptive fuzzy logic contrast enhancement methods and concentrated the contrast enhancement and defuzzification. Ravindra et al [9] say that cancer is a lethal disease using a soft computing technique. Hybrid soft computing has been implemented in the paper on breast cancer detection. Author Baljinder Singh et al [10] discussed the classification of breast cancer channels and used a green channel. The probabilistic neural network has been used and archives high accuracy. Jamsher ahemed et al [11] provides the swarm intelligence that has been introduced in their research and the segmentation, and feature extraction is made by using principal component analysis. The classification is concluding the final decision of their result. Punitha et al [12,13 &14] Introduced Using Fuzzy Rough-in Mammogram Images, Hybrid Segmentation and Feature Extraction to Detect Tumour Based in Women's Breast, Fuzzy rough instance selection (FRIS), fuzzy-rough nearest neighbor (FRNN) and other 13 and 14 mainly concentrate the tumor detection in mammogram images. the results obtained using the proposed methods are compared in various performance measures such as accuracy, sensitivity, and specificity are calculated accurately.

## III. PROPOSED WORK & METHODOLOGY

In the Mammogram image contains a tumor potion given as an input image and the work should have three phases.

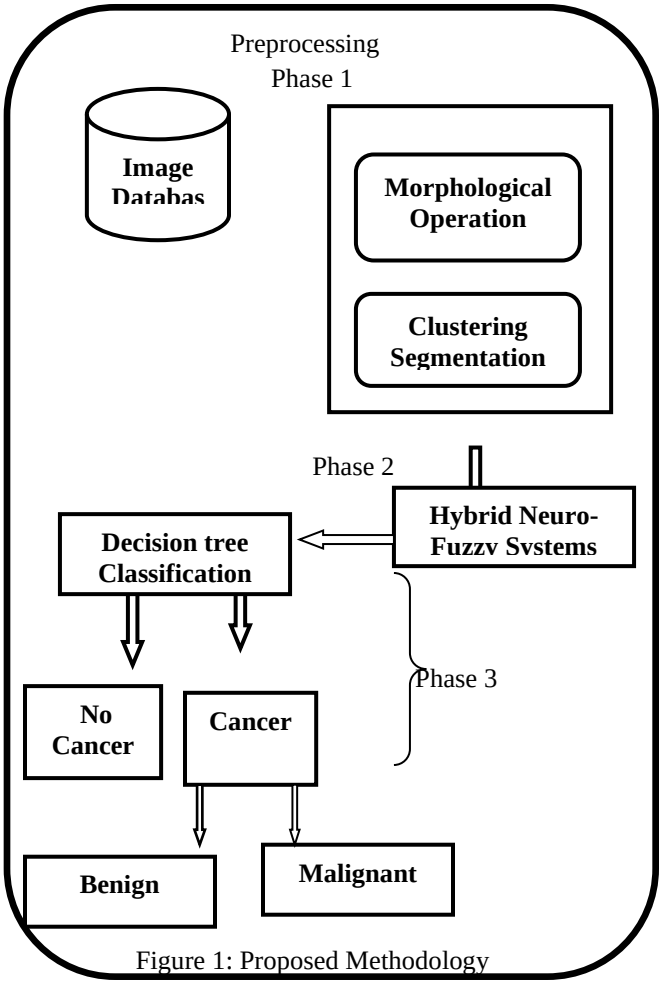



Figure 1: Proposed Methodology

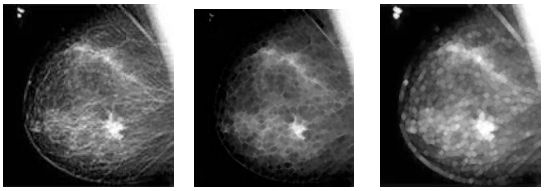
Phase 1: The preprocessing of the Morphological operation has been done and Clustering Segmentation can be done.

Phase 2: Hybrid neuro-fuzzy techniques used for feature Extraction.

Phase 3: classification can be done by using a Decision tree and the proposed technique can be compared by the various image quality measures with high accuracy.

A.Perform Preprocessing - Morphological operations

Here we are using Morphological operation for preprocessing and it is mandatory for image processing. It helps to denoise the images. Here Morphological erosion and dilation are used to add the pixels and subtraction the pixel in the given input mammogram images.



A.Original Image B.Erostion C. Dilation
Figure 2: Morphological operations

B. Clustering Segmentation

This The user starts the method by specifying the number of clusters (k) to be segmented from the input mammogram pictures. The algorithm is an unsupervised classification technique. It calculates the intensity's intensity distribution. The mean value of all the data points pertaining to k is the cluster centroid. Each pixel in the image is first clustered by being assigned to the nearest centroid of the mammography images, after which the centroids are swapped out for the mean values of the elements in the clusters. Up until there are no more pixels available for allocation to fresh cluster creation, these stages are repeated iteratively. The k-means algorithm has the following phases:

Let $X_i$ be the data set, where i = 1, 2,...,n.

1. 1. Adjust the mammography image's input cluster size to k.
2. Initialize the centroid of each cluster $C_i$=0, i=1,2...k.
3. Analyze the data and group the observations into a cluster in the mammography image.
4. Using the supplied mammography image, locate the centroids of each cluster.

The centroid of a cluster is found by minimizing the objective function

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2 \quad (1)$$

Where $\left\| x_i^{(j)} - c_j \right\|^2$ is a measure of intensity distance between a data point $x_i$ and the cluster center CJ For simplicity, the Euclidean distance is used as the dissimilarity measure of the mammogram images. The tumor portion is separated by using the clustering algorithms.

C. Hybrid Neuro-Fuzzy Systems

The main process of the hybrid Neuro-fuzzy System is to use for extracting the feature from the segmented Mammogram image.

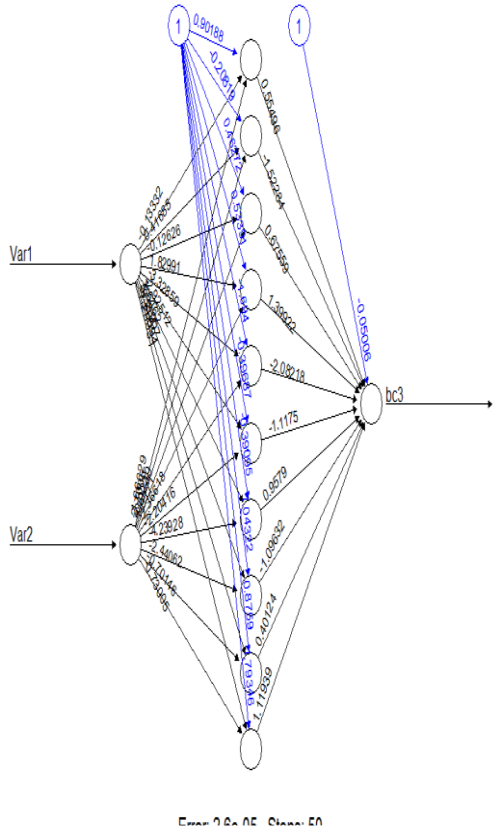



Figure 3: Implementation of neuro-fuzzy system

Here the neuro-fuzzy systems help to extract the features of given segmented mammogram images easily. This neuro-fuzzy system gives the accurate result of the tumor detection pixel ranges. Many feature extraction techniques gave a lower pixel range but our proposed system gives the accurate detection of tumors in the mammogram images.

D.Decision Tree

Here the decision tree plays a major role because it's the best classification in the current era, Simple to understand and interpret and people can understand decision tree models after a brief explanation. This is classifying the mammogram image whether having the tumor portion or not. If the mammogram image has the tumor further it has been classified as benign or malignant.

## IV. RESULT AND DISCUSSION

The data was obtained from Madurai Rajaji Government Hospital, and the experimental results of using hybrid feature extraction for mammogram image tumour classification are shown. The results images are measured by some image quality measures for better accuracy, such as accuracy, sensitivity, and specificity as follows:

- Sensitivity: The ratio of the variety of detected pixels as tumor to the entire variety of tumor pixels inside the image
- Specificity: The ratio of the variety of detected pixels as smooth to the entire variety of smooth pixels inside the image.
- Accuracy: To estimate the exactness of a test, we have to calculate the share of true negative and true positive in all evaluated images, and it can be described as:

  Accuracy=TP+TN / TP+TN+FP+FN
  Sensitivity = TP /TP+FN
  Specificity = TN / TN+FP

True positive = the number of extraordinary pixels which can be detected as extraordinary

True Negative = the number of regular pixels which can be detected as regular

False positive = the number of regular pixels which can be detected as extraordinary

False Negative = the number of extraordinary pixels which can be detected as regular

Table 1: Various Image Quality Measures of the Proposed Method

| Image | Accuracy | Specificity | Sensitivity |
|---|---|---|---|
| I1 | 99.8 | 95.4 | 90.3 |
| I2 | 96.1 | 93.6 | 95.4 |
| I3 | 97.6 | 94.3 | 94.8 |
| I4 | 96.8 | 93.2 | 96.4 |

Table 1 and Figure 4 Explain the image quality measures and the research has a high accuracy of 99.8%.

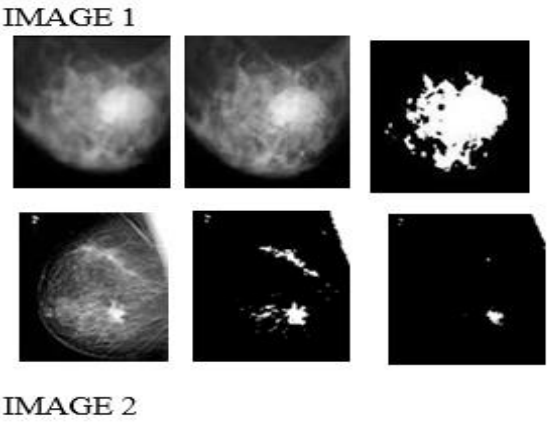



Figure 4: Graphical representation of Image Quality Measures of the Proposed Method

| Original Image | Denoised pixel | Segmented pixel |
|---|---|---|
| I1 | 0.38641 | 0.3554 |
| I2 | 0.64541 | 0.60251 |
| I3 | 0.46544 | 0.35265 |
| I4 | 0.74553 | 0.70289 |

Table 2 Resultant image of improved noise

DESCRIPTION INPUT IMAGEDENOISED SEGMENTED

The input image has been denoised and segmented in table 2. The first column has the original image, the second one a denoised version, and the third, a segmented version using the Clustering segmentation method. The image should have a different denoised pixel range after preprocessing, as indicated in Table 3. Following that, the denoised image segmented the tumour part without noise for all of the input mammography images. The segmented image has undergone training and testing for feature extraction. After segmenting the images, they should have been denoised, cleaned, and exact feature extraction for the tumour section of the given. Pixel calculation in Table 3

Table 3 Pixel Calculation for Segmented Image

Mammogram input images from which feature pixel ranges were extracted have been calculated for accuracy reasons; nonetheless, it is recommended that they be evaluated in various quality metrics to obtain a better accuracy result.

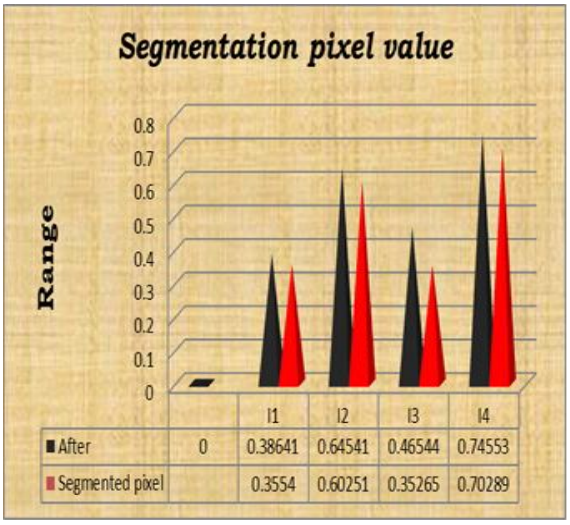



Figure 5: Graphical representation of Segmented pixel values

The pixel values for each image are noted in various colours on the aforementioned chart, which also displays the denoised segmented pixel range values.

A.Database

The Madurai Rajaji Government Hospital provided all of the mammograms used in this experiment. This study utilised a total of 60 left and right breast images from the Mini-MIAS database. All images that contain possible clusters of the aforementioned elements as well as a number of common types are taken into consideration. photos with a 1024 x 1024 resolution and an 8-bit grayscale.

B.Tools

The R Tool was used to implement this paper. This programme for picture processing is very user-friendly and of great quality. This tool produced an accurate result for us.

## V. CONCLUSION

Using a hybrid neuro-fuzzy system, this research has successfully and accurately identified cancers in mammography pictures. The primary objective of this suggested method is to locate the tumour with high precision and little pixel loss from the mammography image. The decision tree is used to classify tumours. The outcome, which achieves 99.8% accuracy, thereby demonstrates the better mutation of high-performance computer technology. Additionally, the combination of the proposed work is very helpful in the analysis and diagnosis of medical images.

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