Multi Scale Region based Advance Scheme for Breast Cancer Detection and Classification

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ABSTRACT

BREAST cancer diagnosis is usually performed by doctors based on Digital Mammography (DM) or on Medical Images (MI). In order to assist doctors to process big amount of images for different patients, Breast Cancer Computer Aided Diagnosis (BC- CAD) is becoming, nowadays, an appealing area of research Using image processing techniques for computer-aided diagnosis that involves the feature extraction for cancer detection, so as to help doctors towards making optimal decisions quickly and accurately. Features play an important role in detecting the cancer in the digital mammogram and feature extraction stage is the most vital and difficult stage. In this research, an enhanced feature extraction method named Multi-scale Surrounding Region Method (MSRM) is proposed to be effective in classifying the mammogram images into normal or benign or malignant. This proposed system is based on a four-step procedure: Regions of Interest specification, segmentation base on edge and thresholding, and multi-scale surrounding region dependence matrix computation and feature extraction. After that we apply machine learning mechanism for classify breast cancer on early stage as soon as possible and we also use segmentation approach for that. after Implement Proposed Algorithm achieve more than 93% Accuracy for detect and Classify Breast Cancer with Benign and Malignant type tumors.

Keywords: ***Breast Cancer, Classification, Segmentation, Feature Extraction***

1. INTRODUCTION

Breast cancer is one of the frequent diagnosis diseases among women. It tends to be distinguished by clinical breast examination, yet the discovery rate suffers to be extremely low. Also, the unusual abnormal areas that can't be felt can be very testing to check utilizing traditional methods however can be effectively observed on a conventional mammogram or with ultrasound. Mammography is as of now the best technique for identifying breast cancer at its beginning time. The issue with mammography pictures is they are intricate. Subsequently, picture processing and features extraction methods are utilized to help radiologist for recognizing tumor. Highlights extricated from suspicious locales in mammography pictures can help specialists to find the presence of the tumor at continuous in this way accelerating treatment process. Recognizing breast cancer can be a significant testing work. Specially, as cancer is certifiably not a solitary illness however is an accumulation of numerous infections. Therefore, every malignant growth is not the same as each other disease that exist. Likewise, a similar medication may have diverse response on comparable kind of malignant growth. Subsequently, disease change from individual to individual. Contingent upon just a single strategy or one calculation to identify breast cancer may not give us the most ideal outcome. As one malignancy contrast from another, comparably every bosom shows up uniquely in contrast to another. The mammography image can likewise be undermined if the patient has experienced some breast medical procedure [11]

2. PRE-PROCESSING

Image pre-processing is the name for operations on images at the lowest level of abstraction whose aim is an improvement of the image. We have use filtering techniques Median, Weiner and Gaussian filter. Median filtering is a nonlinear operation used in image processing to reduce noise. Weiner filter is to filter out noise that has corrupted a signal. The Gaussian noise is independent at each pixel and signal intensity.

3. MORPHOLOGICAL OPERATIONS

The morphological tasks are connected to the improve the image. Disintegration and Dilation are the two essential tasks in the numerical morphology. In arithmetic the sets are characterized as mixes of related components. Essentially, in image handling it is characterized as items. The objects of a picture resemble the sets in Mathematics. One set is full image, and another is the piece of the picture which goes about as the organizing element [15].

4. CLASSIFICATION

A classification unit is characterized as the picture portion which depends on grouping choice. A classification unit could be a pixel, a gathering of adjoining neighboring pixels or the entire picture.

1) Convolutional Neural Networks

In Convolutional Neural Network, few of the hubs in an underneath layer are associated with the hub in the following layer and the last layer is a completely associated system where the genuine order task is performed. Profound learning is broadly utilized in finding of the restorative images. Preparing a profound CNN takes a ton of time and it needs high figuring assets like GPU processor to prepare a CNN network. Profound design of CNN is the essential structure square which is utilized to remove the highlights of a picture. CNN requires a lot of marked information to prepare the neural system which is hard to get if there should arise an occurrence of the medicinal image [1].

2) Support Vector Machine

Support Vector Machine (SVM) is a standout amongst the most powerful training systems for supervised learning. It was used for many applications for classification, regression and feature selection. In classification, support vector machine determines an optimal separating hyperplane using the concept of margin which is the essence of the SVM. The edge is the separation between the hyperplane and the nearest indicates it on either side, which we need to amplify for better speculation. There is a trade-off between boosting the edge and limiting the quantity of the misclassified precedents. There are a few limits that administer the connection between the model execution and its ability. This can be utilized to adjust the exchange off between the model inclination and the model variance [20].

5. PROPOSED SYSTEM

Algorithm of Proposed System

Step 1: Read Image

Step 2: Apply pre-processing utilizing wiener/Gaussian filter.

Step 3: Apply Region of Interest (ROI). After choice of explicit region use region base segmentation utilizing multi-level thresholding and edge detection.

Step 4: For edge detection we use sobel method and for thresholding we use Otsu multi-level thresholding

Step 5: Apply specific morphological operation. For select feature using erosion and dilation operation.

Step 6: Use Deep Neural Network (DNN) on specific feature point.

Step 7: Output.

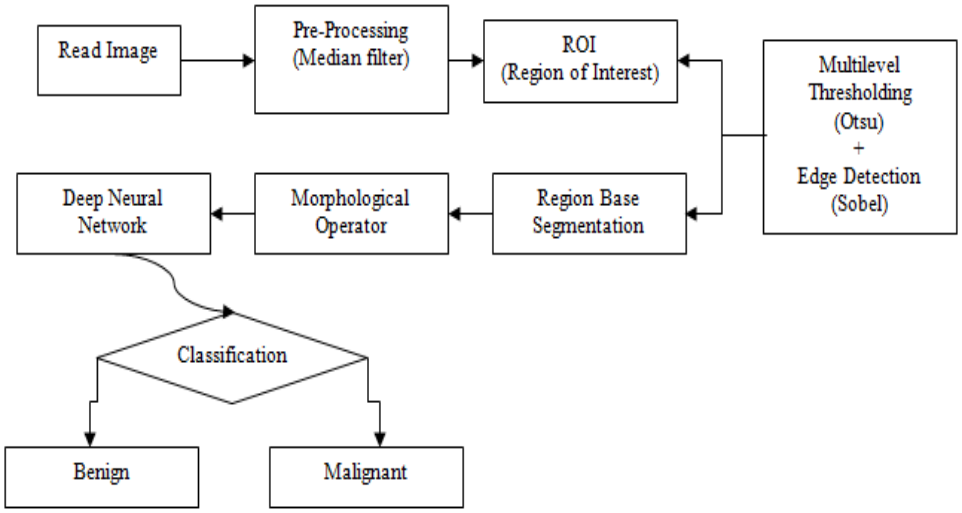


Figure 1: Proposed system

Parameters

False Positive (FP): An input without breast cancer is incorrectly diagnosed as having cancer.
False Negative (FN): An input with breast cancer is incorrectly diagnosed as having no cancer.
True Positive (TP): Its means patient having a breast cancer.
True Negative (TN): Its means patient having no cancer.

Precision: Precision is the number of correct results divided by the number of all returned results

$$\text{Precision} = \frac{tp}{tp + fn}$$

Recall: Recall is the number of correct results divided by the number of results that should has been returned.

$$\text{Recall} = \frac{tp}{tp+fn}$$

F1-Score: A measure that combines precision and recall is the harmonic mean of precision and recall

$$\text{F} = 2 \times \frac{\text{precision} * \text{recall}}{\text{precision} + \text{recall}}$$

Sensitivity: Sensitivity is expressed in percentage and defines the proportion of true positive subjects with the disease in a total group of subjects with the disease (TP/TP+FN). Sensitivity is 4 defined as the probability of getting a positive test result in subjects with the disease (T+|B+). Hence, it relates to the potential of a test to recognise subjects with the disease.
Sensitivity = $TP/(TP + FN)$ = (Number of true positive assessment)/(Number of all positive assessment)

Specificity: Specificity is a measure of a diagnostic test accuracy, complementary to sensitivity. It is defined as a proportion of subjects without the disease with negative test result in total of subjects without disease (TN/TN+FP). In other words, specificity represents the probability of a negative test result in a subject without the disease (T-|B-).
Specificity = $TN/(TN + FP)$ = (Number of true negative assessment)/(Number of all negative assessment)

Accuracy:

$$\text{Accuracy} = \frac{tp + tn}{tp + tn + fp + fn}$$

Structure Similarity Index Method (SSIM): Structural Similarity Index Method is a perception based model. In this method, image degradation is considered as the change of perception in structural information. It also collaborates some other important perception based fact such as luminance masking, contrast masking, etc. The term structural information emphasizes about the strongly inter-dependant pixels or spatially closed pixels. These strongly inter-dependant pixels refer some more important information about the visual objects in image domain. Luminance masking is a term where the distortion part of an image is less visible in the edges of an image. On the other hand contrast masking is a term where distortions are also less visible in the texture of an image. SSIM estimates the perceived quality of images and videos. [26]

Features Similarity Index Matrix (FSIM): Feature Similarity Index Method maps the features and measures the similarities between two images. To describe FSIM we need to describe two criteria more clearly. They are: **Phase Congruency (PC)** and **Gradient Magnitude (GM)**.

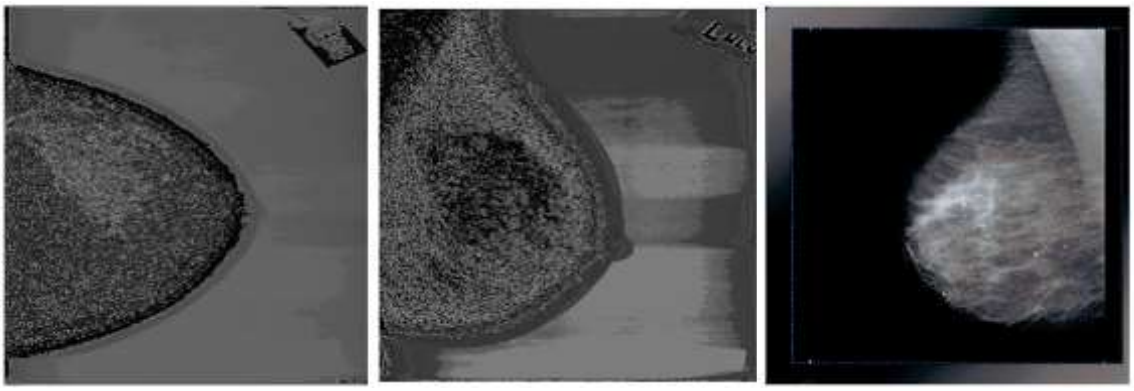
Phase Congruency (PC): A new method for detecting image features is phase congruency. One of the important characteristics of phase congruency is that it is invariant to light variation in images. Besides, it is also able to detect more some interesting features. It stresses on the features of the image in the domain frequency. Phase congruency is invariant to contrast.

Gradient Magnitude (GM): The computation of image gradient is a very traditional topic in the digital image processing. Convolution masks used to express the operators of the gradient. There are many convolutional masks to measure the gradients. [26]

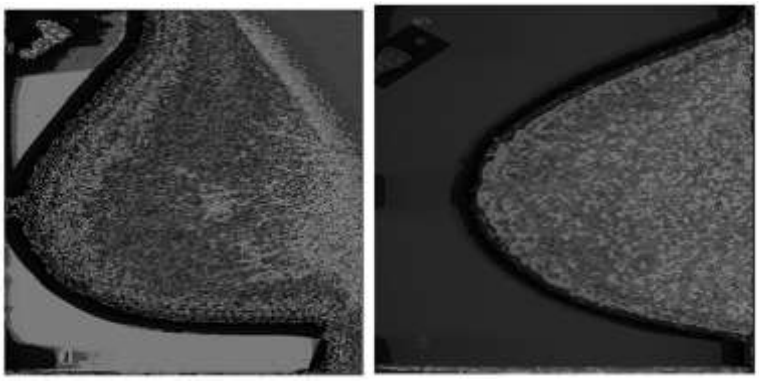
6. RESULT ANALYSIS

I have few images for this paper result data in Breast Cancer images:

1. 2. 3.

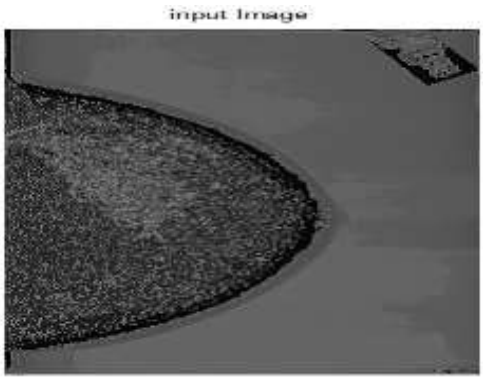


4. 5.

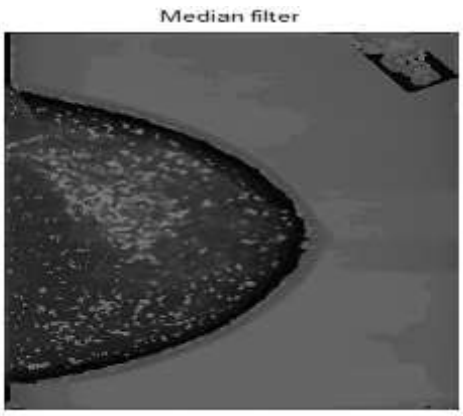


Experiment result 1:

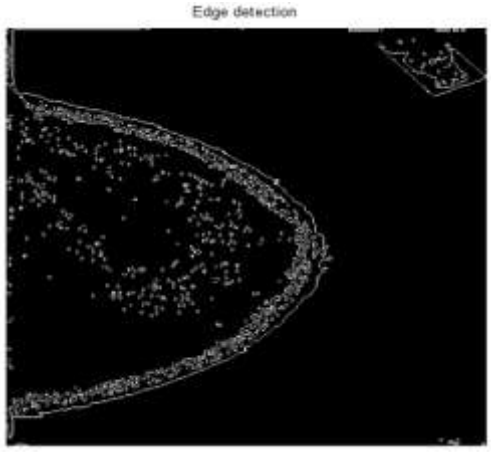
Step 1: Taking Input image



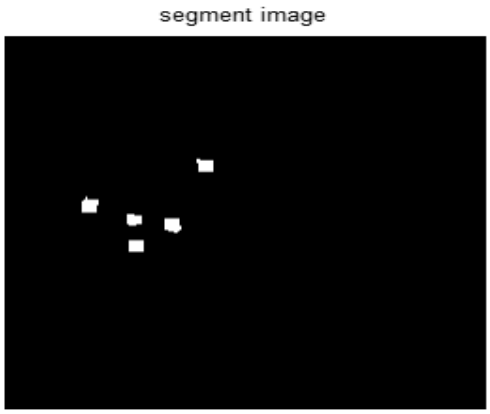
Step 2: Median Filter



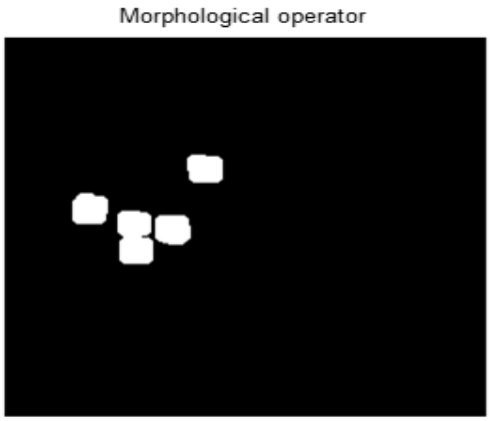
Step 3: The Sobel is used for edge detection. It works by calculating the gradient of image intensity at each pixel within the image



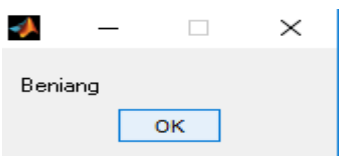
Step 4: Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels).



Step 5: Morphological Operator



Step 6:



Accuracy:

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Accuracy =

    0.9801
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Accuracy Table

Table: 1 Parameters Result

Sr.No	Experiment Results	Classification	Accuracy	Specificity	Sensitivity	SSIM	FSIM
1	Experiment Results-1	Benign	0.9801	1.0000	0.98	0.984	0.923
2	Experiment Results-2	Benign	0.9342	1.0000	0.9327	0.965	0.944
3	Experiment Results-3	Malignant	0.9142	1.0000	0.8958	0.982	0.926
4	Experiment Results-4	Benign	0.891	1.0000	0.8846	0.988	0.921
5	Experiment Results-5	Malignant	0.9909	1.0000	0.9909	0.9345	0.933
6	Experiment Results-6	Malignant	0.9545	1.0000	0.9523	0.944	0.934
7	Experiment Results-7	Benign	0.9428	1.0000	0.9396	0.964	0.96
8	Experiment Results-8	Malignant	0.9693	1.0000	0.9687	0.96	0.92
9	Experiment Results-9	Benign	0.801	1.0000	0.741	0.956	0.967
10	Experiment Results-10	Benign	0.9744	1.0000	0.9739	0.977	0.91
11	Experiment Results-11	Benign	0.9761	1.0000	0.9757	0.978	0.912

Results Comparison Graph

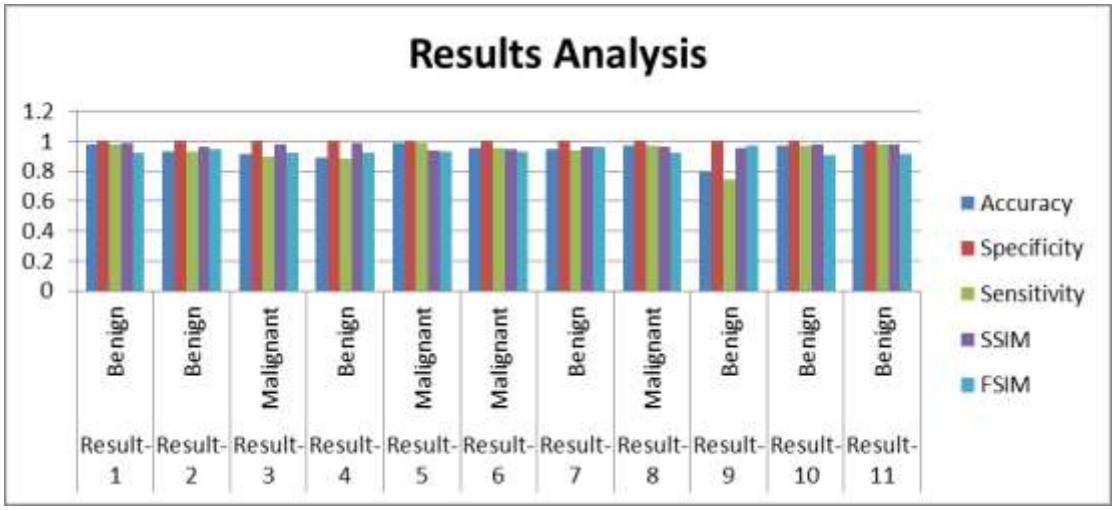

Figure 2: Results Comparison Graph

7. COMPARISON WITH EXISTING SYSTEM

In Existing system and proposed system in compare to work of existing system accuracy 90% and proposed system accuracy in 93%. We have improved to accuracy and better performance.

Table 2: Comparison of Existing System and Proposed System

System Work	Classification Type	Accuracy
Existing System	Malignant, Benign	90%
Proposed System	Malignant, Benign	93%

8. CONCLUSION

In this Paper design a new machine learning base approach for classifying breast cancer on early stage which can help the doctor and patient to start the early treatment for removing the cancer cells and starting the chemotherapy. By using machine learning along with thresholding and edge-based feature extraction for detection of breast cancer. AS Successfully implement proposed approach achieve higher Accuracy, specificity, sensitivity , time complexity , FSIM and SSIM as compared to existing system in future work on other database and try to improve accuracy as much as possible.

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