Hybrid Extraction of Detecting Breast Cancer with Fuzzy

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ABSTRACTION:

Breast Cancer early detection using terminologies of image processing is suffered from the less accuracy performance in different automated medical tools. To improve the accuracy, still there are many research studies going on different phases such as segmentation, feature extraction, detection, and classification. The proposed framework is consisting of four main steps such as image preprocessing, image segmentation, feature extraction and finally classification. This paper presenting the hybrid and automated image processing based framework for breast cancer detection. For image preprocessing, both Laplacian and average filtering approach is used for smoothing and noise reduction if any. These operations are performed on 256 x 256 sized gray scale image. Output of preprocessing phase is used at efficient segmentation phase. Algorithm is separately designed for preprocessing step with goal of improving the accuracy. Segmentation method contributed for segmentation is nothing but the improved version of region growing technique. Thus breast image segmentation is done by using proposed modified region growing technique. The modified region growing technique overcoming the limitations of orientation as well as intensity. The next step we proposed is feature extraction, for this framework we have proposed to use combination of different types of features such as texture features, gradient features, 2D-DWT features with higher order statistics (HOS). Such hybrid feature set helps to improve the detection accuracy. For last phase, we proposed to use efficient feed forward neural network (FFNN). The comparative study between existing 2D-DWT feature extraction and proposed HOS-2D-DWT based feature extraction methods is proposed.

Keywords: *Breast Cancer; Preprocessing; Segmentation; Region Growing; Noise Removal; Filtering; Orientation; Gradient Magnitude; Higher Order Statistics; FFNN*

INTRODUCTION :

Cancer is the major threat for human being health and its number of patients increasing word wide due to the global warming, even if there are new therapies and treatments proposed by research doctors, but level of cancer defines the ability of its cure. There are different types of cancers from which human being is suffering [male and female]. In this paper we are focusing on breast cancer in women, rest all cancers are out of scope of this paper. Large number of women population is affected by the breast cancer. A different type reasons causes the breast cancer such as X-Ray [1]. For women's, breast cancer is most common cancer, and it has been increasing since from last decade. The countries like under developed and developed in which breast cancer is commonly observed in females. The estimation of death caused by breast cancer for every year is approximately 40,000 females. This estimation is measured by WHO (world health organization). The world health organization is recognized organization for conducting the research on different cancer diseases. The world health organization also provides the number of breast cancer diagnosis approximately around 200,000. The breast masses evaluation in men is same as in women by considering the mammography [2]. The objective of mammography is conduct the early detection test for breast cancer disease. Mammography is performed based on masses properties as well as micro calcifications. Mammography technology helps to detect the breast cancer before it can happen to individual. But still this approach is not completely accurate. In addition to this, for radiologists it is difficult task to find out the difference between the malignant tumors as well as benign tumors. In mammography, presence of breast cancer is basically reflected. The present approaches considering that recording of image is done over the X-ray film and then that image is interpreted by the medical expertise. However, such approaches are highly vulnerable to visual inspection error and human error. This can be later improved by mammogram images which is of poor quality. The early detection rate is increases based on automated analysis

mammogram screening as per the reviews and instigations by different researchers. Another approach is screening mammography which is accurate radiological method currently available for early detection of breast cancer. However as the large number of mammograms needs the analysis, false detections resulted from the radiologists. Therefore, novel techniques for automatic and scalable detection are applicable to overcome such problems. The detection or segmentation of micro-calcification supporting the digital mammogram screening in order divide the clusters as benign or malign [2].

The reason for detection of early breast cancer is that it can helps to cure breast cancer via the proper treatment completely. Such early detection are done by the self-examination process in every month for woman in earlier days. But as discussed in above paragraph, since from last decade mammography approach is used by many doctors and hospitals for early detection of breast cancer. Micro calcifications and masses characteristics are helps to detect the early cancer for particular individual and hence these are vital factor in detection process. X-ray machines are used to perform the mammography test over the naked upper part of individual. Here in detail mammography is performed as both breasts of women are compressed between the 2 plates with goal of capturing the both photos every breast with help of X-ray pulse. Other well-known methods for early detection breast cancer are CAD (computer aided detection), clinical breast analysis, and blood tests. In order to cure breast cancer completely, it becomes very important to detect it early [3] [4].

CAD becomes interesting area of research since from last decade for early detection of breast cancer to number of researchers as there are number of CAD based automated methods presented by various researchers. The objective of CAD technique is to support radiologists in analysis of breast images by giving the second opinion. The vital goal of CAD is to detect the breast cancer early in women's. Methodology of CAD is based on more than one technique consisting of image preprocessing methods to recognition methods CAD for the detection of CAD based abnormalities in mammograms of breast cancer image. Since from last two decades, number of research groups presented their studies on computer aided diagnosis for early breast cancer detection based on image processing terminologies. CAD takes input as computerized mammographic image which can be generated from the digitally acquired mammogram or traditional film mammogram [4].

The system which is designed based on computer helps to find the abnormal regions of mass, density and calcification in order to diagnose the presence of breast cancer in input image. After detection of this regions, CAD tool highlighting such regions over the original image with aim of further analysis by radiologist. CAD methodology supporting radiologists to make patient management by providing the different recommendations. Since from last 5-7 years, there many advanced CAD systems are proposed by researchers with goal of improving efficiency and accuracy of early breast cancer detection and the objective of assisting the radiologists in interpretation of medical images by providing a second opinion [7]. An important application of CAD is in the diagnosis of breast cancer, which is a common form of cancer diagnosed in women. CAD is an interdisciplinary field, involving elements from basic image processing to advanced machine learning techniques. Therefore use of CAD based detection techniques use is increasing in which image processing concepts are used on input photos from X-ray for automatic detection of breast cancer with its level. CAD system helping to save efforts, time and costs factors for hospitals and doctors. Image processing is nothing but physical method and it is applied in order to convert the breast image signal into the physical image. The image signal is also known as digital image signal, and output of this process is either physical image or its related characteristics. Breast cancer detection is wide range of research in which different researchers preparing their research articles and proposing the new techniques and solutions for breast cancer detection with practical evaluation using the image processing concepts. CAD based techniques are composed of several steps to detect the early detection of breast cancers like acquisition of image, preprocessing of image, segmentation of image, possible feature extraction and then classification for diagnosis. This research paper is contributed by presenting three different phases and algorithms for improving the overall accuracy of breast cancer detection. In this paper contribution is done in four main phases in this work such as preprocessing, image segmentation, feature extraction and classification. Our contributions showing that proposed work improved the detection accuracy as compared to existing approach. In rest of this paper, section II is discussing about the different methods of presented so far on automated breast cancer detection framework. Section III is showing the proposed algorithm, its steps, and inside details for breast image segmentation. Section IV is showing the practical results for this segmentation work on different breast cancer images. Section V presents the conclusion and future work.

LITERATURE SURVEY:

The literature review study of existing methods is considered as one of the important factor that keep the foundation of further system enhancement and development. Therefore, in order to get the information about the existing approaches or systems for breast cancer detection CAD system, a review has been prepared. Below recent ten methods are listed and discussed below for breast cancer detection based on terminologies of CAD system.

- In [4], author Pawar, P.S. et al proposed the novel CAD system architecture for breast cancer detection by implementing back propagation neural network and the authors compared their work with radial basis function network for performance evaluation. The results obtained justifies that back propagation based system performs better for detect breast cancer.
- In [5], author Sameti, M. et al introduced the new image feature extraction technique for the analyzing the screening mammograms retrospectively. This method is taken prior to the detection of a malignant mass in order to detect early breast cancer. For individual mammographic projections of the malignant breast the two specific regions were categorized. The first was for malignant mass subsequently developed and another for similar to region one on the same mammogram. The author employed a stepwise discriminant analysis that exhibited that most of the features could be employed for highly effective classification process of malignant and benign cancer.
- In [6], author Sajjadieh, M.H.S. et al introduced the clutter suppression method referred as DAF/EDF technique which is helps in isolating tumor response from the complete response of tumor and clutter successfully. The presented approach by author is mainly consisting of DFA (data adaptive filter) as well as EDF (envelope detection filter) methods. The benefits of DFA and EDF is that they does not needs any prior training. The implementation approach

Algorithm 3: Feature extraction algorithm

Input: Segmented Breast Image

Step 1: Extract Texture Features from Input and form feature vector GeF

Step 2: Extract Gradient Features: Gradient and Direction

Step 2.1: Apply mean and standard deviation on gradient

Step 2.2: Apply mean and standard deviation on direction

Step 2.3: Form final 4 features gradient vector called GrF

Step 3: Apply 2D DWT

Step 3.1: Apply mean and standard deviation on LLD

Step 3.2: Apply mean and standard deviation on LHD

Step 3.3: Apply mean and standard deviation on HLD

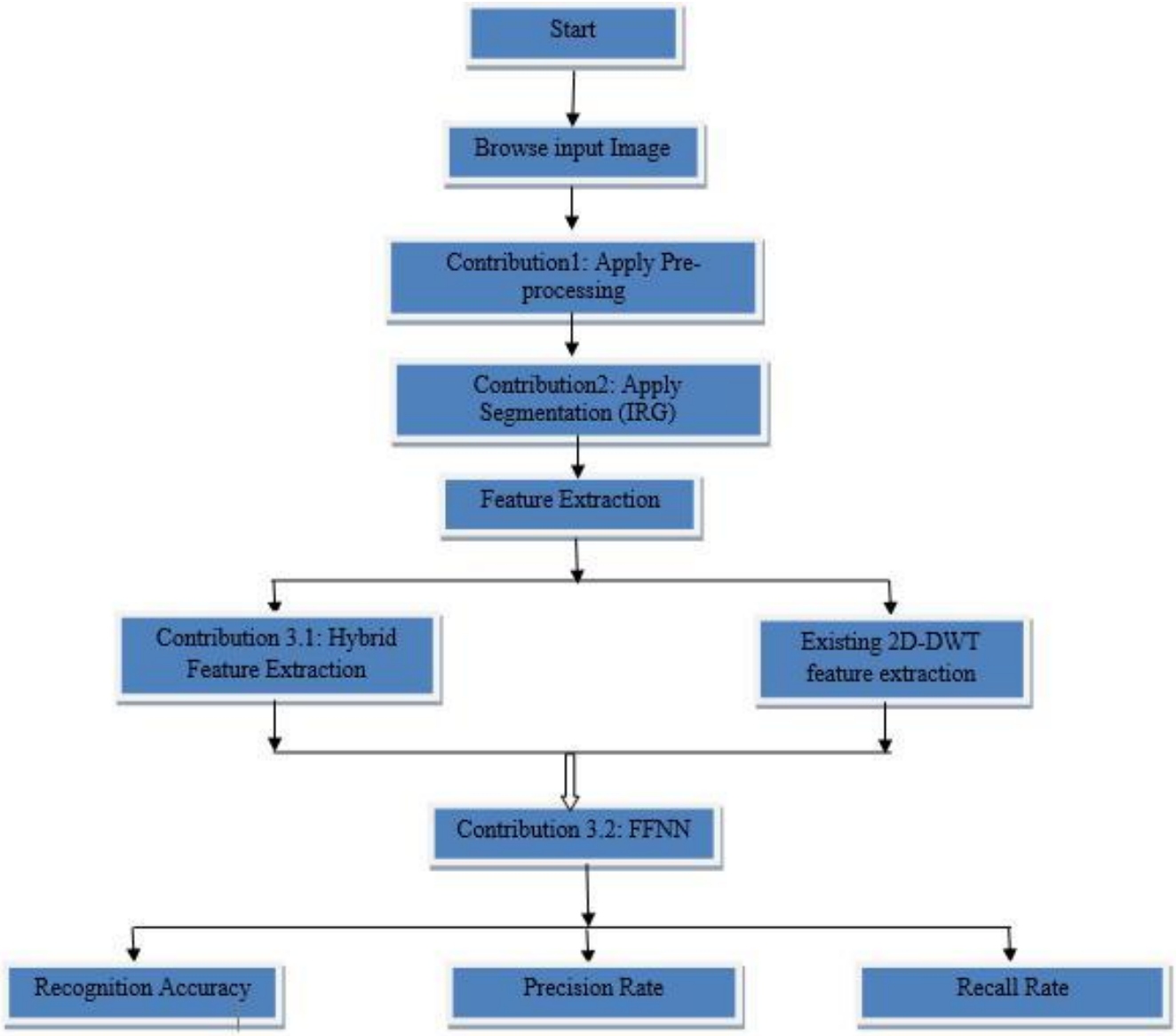
Step 3.4: Apply mean and standard deviation on HHD

Step 3.5: Form final 8 feature 2D-DWT feature vector called DiF.

Step 4: Apply and Extract Higher order statics using skewness and kurtosis and store all features in vector HoF.

Step 5: Combine GeF, GrF, DiF and HoF to form hybrid feature vectors called CHF.

Output: Feature Vector CHF.



PROPOSED SYSTEM:

The image of the skin is parted with two departments, like the forepart and processing, though this is the newly approached system. The model has analyzed with its every edge, and a pre-analyzed image enhances its feature using the gamma scale. After that, the classifier of CAD acts for histogram processing to get the uttermost range and spot value of image and reaches its final malignant. However, this CAD system shows the filtering system very strictly means here; this happens two times with the reverse process. Image-based computer aided diagnosis systems have significant potential for screening and early detection of malignant melanoma (Masood and Al-Jumaily 2013).

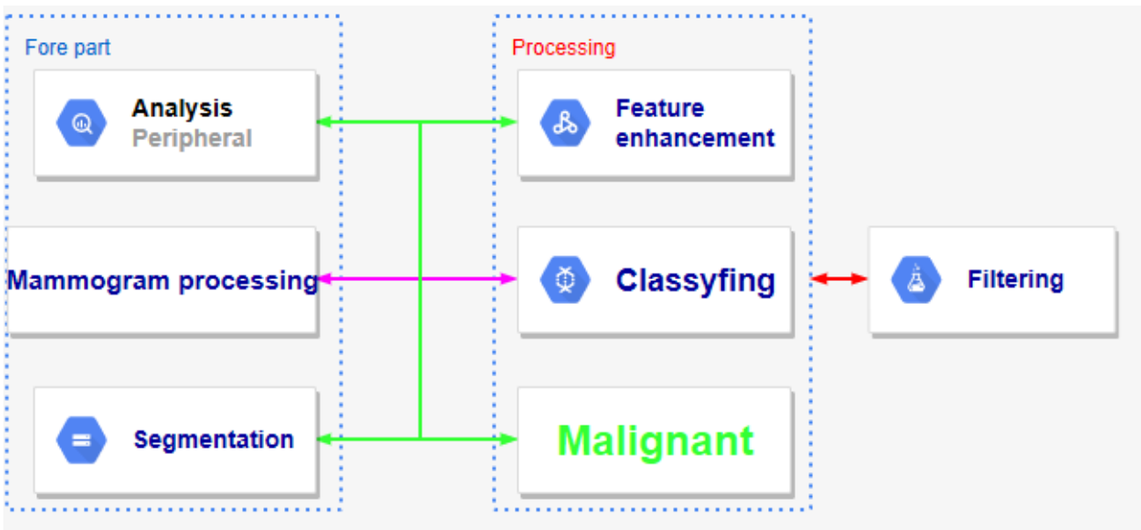


Figure 1: Diagram flow of CAD system for skin abnormality

The input image of a noisy skin interacts with flowing the proposed system. The model has cropped with its particular region, which is very noisy rather than other areas. This method has formed with the pre-processing arena to segmentation, which provides a train set of noisy regions. Here, a simple process has given below:

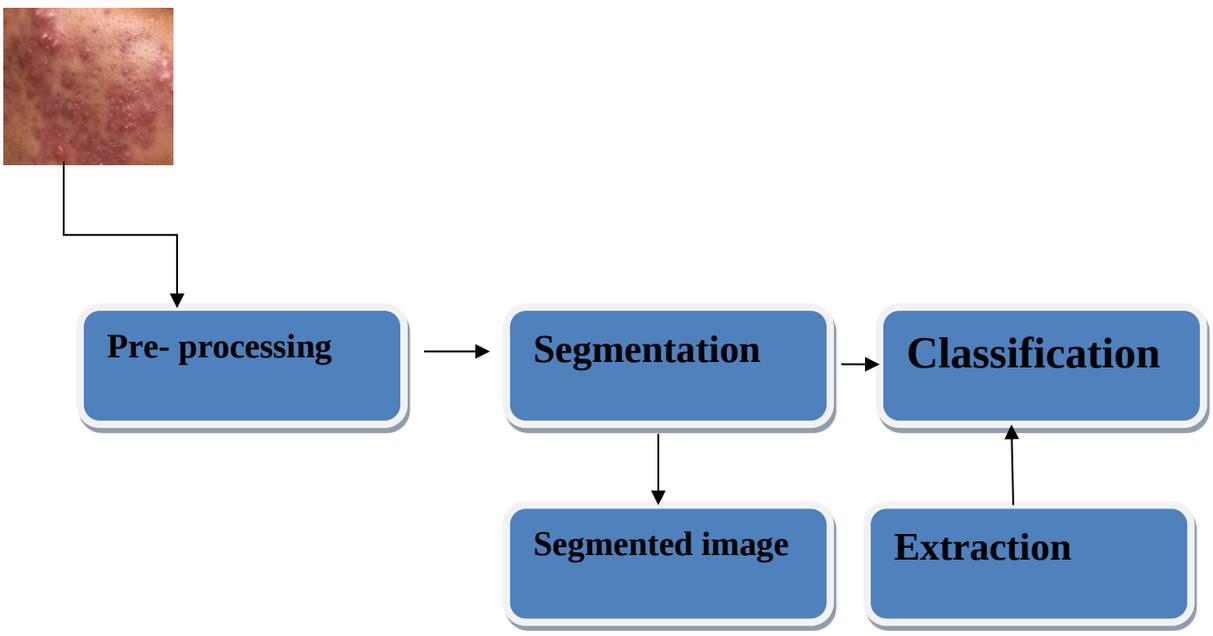


Figure 2: Pre-processing stage primary tab

MATERIALS AND METHODOLOGY:

Integrating the fuzzy filtering with linear fusion operators, we developed a new fuzzy enhancement scheme called HIFS for histogram enhancement and originality of targeting region. There we combined two parts such as forepart and back section.

We used these parts for parting the threshold and filtered areas. Where an original histogram $H(u)$ is separated into the forepart are H_0 and back part area H_b. Now, we have gotten the filtered area both forepart and rear part according to $f_0(u), f_b(u)$. Steps for histogram enhancement using fuzzy algorithm as follows:

Step 1: Separate a histogram into forpart and backpart data.

Step 2: Bring fuzzification generators for both part and covert plane pixel to membership pixel.

Step 3: Take respective membership degeers and make these hyperbolic.

Step 4: Again, transform membership pixel to plane pixel for normalization.

Step 5: Get the filtered result and compare with original.

For an input histogram, the following is used to find a global threshold:

I. Initialize threshold T ; $[\ T = 1.5\ (I_{max} + I_{min})]$; I is the value of the maximum and minimum gamma scale of the histogram.
II. Segment the histogram using T with two-part. One is I_1, and another is I_2. Where $I_1 > T$ and $I_2 < T$.
III. Calculate H_1 and H_2, comparing I_1 and I_2.
IV. Compute $T = 1.5(H_1 + H_2)$.

V. Get the final goal of the threshold.

Algorithms:
1. Apply reverse curve-let transformation towards noisy image
2. In the curve-let domain remove insignificant curve-let from noisy image to get threshold.
3. Apply inverse curve-let transform to reconstruct function.

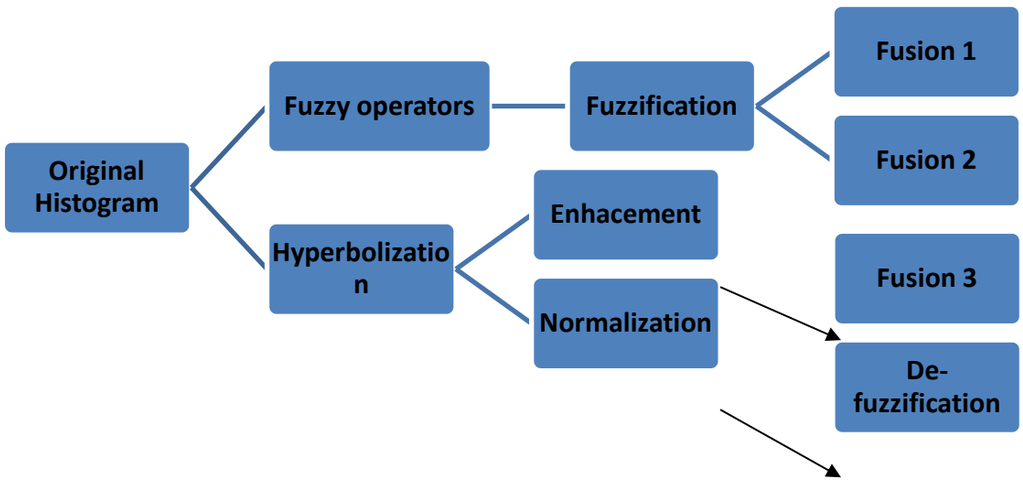


Figure 3: Diagram representation of HIFS

RESULT AND DISCUSSION:

A. Dataset Information: Number of research datasets for breast images is publically available for research studies. For this research two well know datasets such as Mammographic image analysis society (MIAS) and digital database for screening mammography (DDSM) are used. These two datasets are widely used for CAD systems and research works. This dataset we divided into two main classes normal and abnormal with varying number of image samples such as 30, 60, 90, 120, 150 and 180 per class for training and classification purpose.

B. Performance Results

Total accuracy after evaluating the above equations:

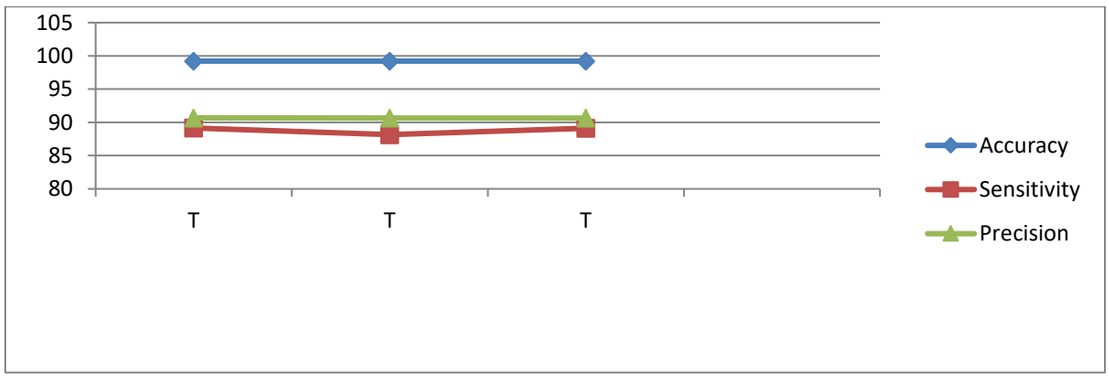
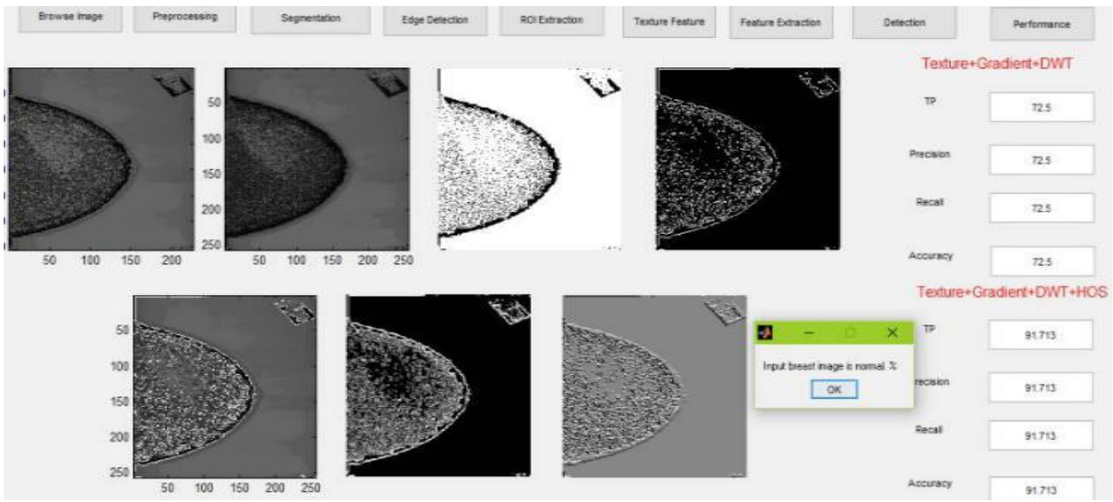


Figure 7: Evaluating the graphical view



CONCLUSIONS:

In this study, we proposed FK-NNE approaching with skin images and applied a gamma scale with R and B value to identify the proper spots. The model implies that the performance of this proposed system is more comfortable and more accurate comparing other proposals. The accuracy of the proposed system is 99.22%, which is a significant factor—moreover, the robustness of the approached method verified by extensive simulation. The proposed classifier is much higher than the existing classifier. That could be simple diagnostic support for clinical doctors.

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