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PSO, Genetic Optimization and SVM Algorithm used for Lung Cancer Detection

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ABSTRACT

This paper discusses the formation of Lung cancer detection system by using the techniques of Image processing. The system formed can take any type of medical image within the three choices consisting of CT, MRI and Ultrasound images. Here the proposed model is developed using PSO, Genetic Optimization and SVM algorithm used for feature selection and classification. This paper is an extension of image processing using lung cancer detection and produces the results of feature extraction and feature selection after segmentation. The system formed accepts any one of medical image within the three choices consisting of MRI, CT and Ultrasound image as input. After preprocessing of image, canny filter is used for Edge detection. This present work proposes a method to detect the cancerous cells effectively from the CT, MRI scan and Ultrasound images. Super pixel Segmentation has been used for segmentation and Gabor filter is used for De-noising the medical images. Simulation results are obtained for the cancer detection system using MATLAB and comparison is done between the three medical images.

Keywords: Super pixel Segmentation, Image processing, Particle Swarm Optimization, Genetic Optimization.

INTRODUCTION

One of the major reasons for non-accidental death is cancer. It has been proved that lung cancer is the topmost cause of cancer death in men and women worldwide. The death rate can be reduced if people go for early diagnosis so that suitable treatment can be administered by the clinicians within specified time. Cancer is, when a group of cells go irregular growth uncontrollably and lose balance to form malignant tumors which invades surrounding tissues. .Cancer can be classified as Non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC).In this paper we confine to Non- small cell lung cancer (NSCLC) as it is more prevalent than small cell lung cancer (SCLC). There's a difference between the diagnosis and treatment of non-small cell and small cell lung cancer. The various ways to detect lung cancer is by the use of image processing, pattern recognition and artificial neutral network to develop Computer aided diagnosis. In this paper, CT scan image, MRI scan image and ultrasound images are used. A CT scan or Computerized Axial Tomography (CAT) scan is the most sensitive and specific detection modality produces cross-sectional images of specific areas of scanned object by the use of computer processed combination of many X-ray images taken from different angle. Radio waves and magnetic field is used to form images of a body in an imaging technique known as Nuclear Magnetic Resonance Imaging (NMRI) The aim of this paper is to design a system which can take any one of the three images as input and produces the desired output. The algorithms used are efficient in terms of sensitivity, specificity and accuracy. The proposed model consists of following steps such as: Collection of lung image data set, preprocessing, edge detection, morphological processing and segmentation of CT and MRI images. Every step is described in further sections.

EXPERIMENTAL SECTION

In this section, the methods used for the proposed model is described. From this, the best method which can detect cancer and extract cancer tissue information from the two images is found. Finally the comparison is done amongst all the images. The steps to classification of lung cancer are given in the Fig.1

The data used for this paper includes 6 CT and 15 MRI scan images of lungs. The lung's image have a dimension of 512 x 512.

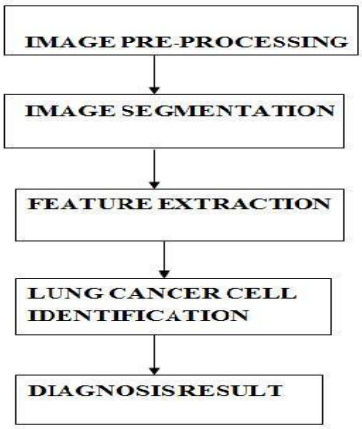


Fig.1: Flowchart of Lung Cancer detection system

I. Image Preprocessing

Image pre-processing is used to reduce noise and prepare the images for further steps such as segmentation. It diminishes distortion in image and enhances the relevant features. Thus a rectified image is obtained. For this purpose, MATLAB software has been used. The various steps involved in image processing are smoothing, image enhancement, green layer separation and gray level conversion.

II. Image Enhancement

The various image enhancement techniques can be categorized as spatial domain methods and Frequency domain methods. Different image enhancement techniques are used for all the different images. This includes smoothing of image and removal of noises, blurring etc. Gabor filter was found to be suitable for both the CT and MRI images . The filtering of image proves to be useful for further steps.

III. Layer Separation

An image is formed of pixels. Each pixel consists of RGB values. In this paper, layer separation is used to eliminate the effect of other two colors i.e. red and blue and represent the image in green color. It reduces the complexity for proper conversion to gray level.

IV. Gray Conversion

This includes conversion of colored image with pixels having RGB level into Gray level. A Gray level image can be easily processed in comparison to colored image. The reason are the pixels to be processed separately which have different RGB values. Therefore Gray conversion is preferred.

V. Lung Region Extraction

Super Pixel Segmentation

Separation of objects and regions of interest from the other parts of the image is used so that the image can be properly analyzed. For performing segmentation the techniques used depends upon specific application, imaging modality and other factors etc. For instance ,the image pixels are classified into anatomical region, such as muscles, bones and blood vessels or into pathological regions such as tissue deformities , multiple sclerosis and cancer based on its usefulness in a particular application [13]. To achieve a better orientation the image segmentation of lung region in all the three type of image is performed. Image slicing algorithm is the first step to the processing of the images of raw data. The best image is chosen from the resulting binary images. This is very in extracting the lung region with certain degree of accuracy and sharpness. Other techniques can be used for different use in a sequential manner resulting in further improvement of chosen image features.

The various morphological processing techniques like, Erosion and dilation steps reduces irrelevant details that may

increase difficulties to the lung border extraction process [13].The aim of the outlining border is to extract the structure's border called as lung border extraction. It is helpful in eliminating useless structures from lungs. [11]

VI. Feature Extraction

The image feature extraction stage is an important step which represents the final output and by using algorithms and techniques we can determine the normality and abnormality of an image. The algorithms and techniques detect and eliminate various non-desirable portions or shapes (features) present in an image during image processing. The segmentation is carried out first on lung region followed by steps of feature extraction to get its features. Finally in relevant with some diagnosis rule the cancer nodules can easily be detected in the lungs. To have better diagnosis, these diagnosis rules can be used to eliminate the false detection of cancers nodules resulted through segmentation. Among the features used in the diagnostic indicators which were found the literature were:

• Area of interest
• Shape
• Size of nodule and
• Contrast Enhancement

To obtain accurate diagnosis we experimentally found the above suitable texture features. As a matter of fact, the first feature (the area of the candidate region or object) is used for:

• Elimination of very small candidate object (Area is less than a threshold value).
• Elimination of isolated pixels (seen as noise in the segmented image).

By the use of necessary feature, the elimination of the extra candidate regions that probably will not form a nodule can be achieved. Moreover, it's utilization helps in minimizing the computation time required in the upcoming diagnostic steps.[13]

VII. Feature Selection and Classification

Good classification results can be obtained by the use of various types of features at the same time. This is because different types of features may contain complementary information. By selecting distinguishing features from the various feature space we can bring better classification performance. [20]

Particle Swarm Optimization Method

In this paper Particle swarm optimization method is used which is a multilevel threshold method segmenting images. The threshold problem is solved using the principle of particle swarm optimization. To obtain an appropriate partition of target image in accordance with a fitness function by finding the appropriate values of threshold, PSO algorithm can be used. The experimental results show the effectiveness of method used and has been tested on all the three images. Particle swarm optimization (PSO) is a population-based optimization algorithm modeled after the simulation of social behavior of birds in a flock. This algorithm looks for optima by updating generations after initializing with a group of random particles. Every particle's position is adjusted based on it's distance from it's own personal best position and also the distance from the best particle of swarm throughout the search space. The closeness of a particle from the global optimum i.e. it's performance is obtained using a fitness function which relies on the optimization problem.[21]

Genetic Optimization method

Genetic algorithms belong to the larger class of evolutionary algorithms, which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover.

Support Vector Machine

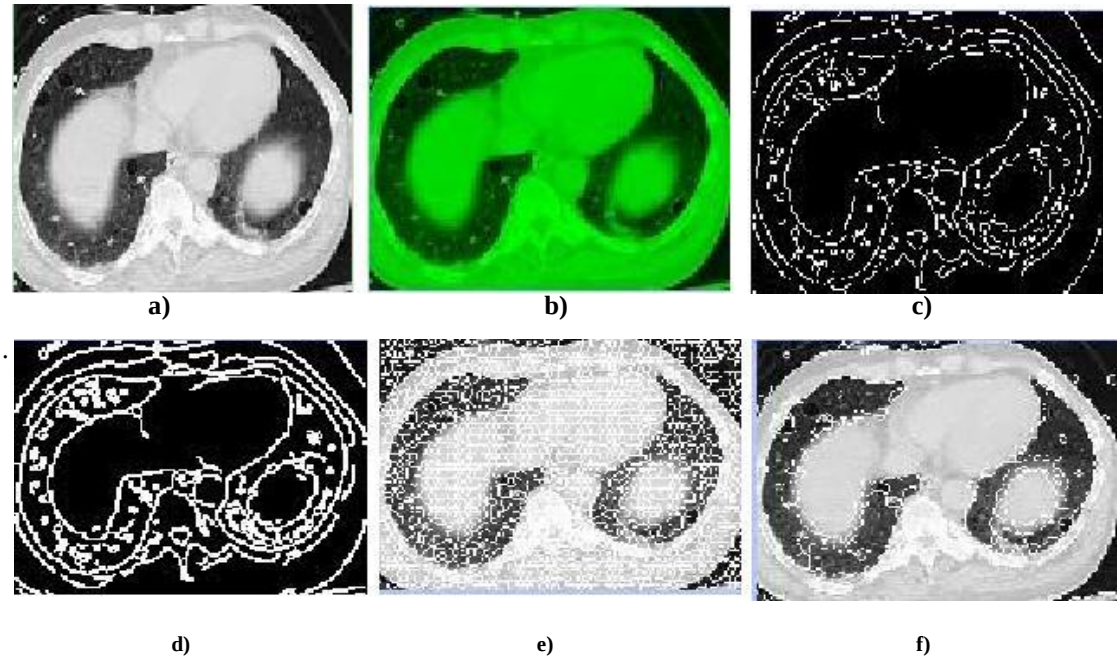
To analyze data and recognize patterns for classification purpose , supervised learning models with associated learning algorithms are used in this paper also known as support vector machine It initializes by taking a set of input data and predicts for each given input the specified class among the two choices available, which makes it a non-probalistic binary linear classifier.For mapping the given data into a different space SVM uses kernel function such as polynomial , BF , quadratic, Multi- Layer Perceptron (MLP). The separations can be made even with very complex boundaries. [18]

RESULTS AND DISCUSSION

In this paper Lung CT, MRI AND Ultrasound images used were obtained from a specialist medical imaging center. The image enhancement is done using Gabor filter. After enhancement step, the images were passed from layer separation step and then converted to Gray level image. For segmentation Super pixel segmentation algorithm was

used thus lung region or (ROI) is extracted. The steps applied on CT, MRI and Ultrasound images as shown in Fig. 2, Fig. 3 and Fig. 4 respectively.

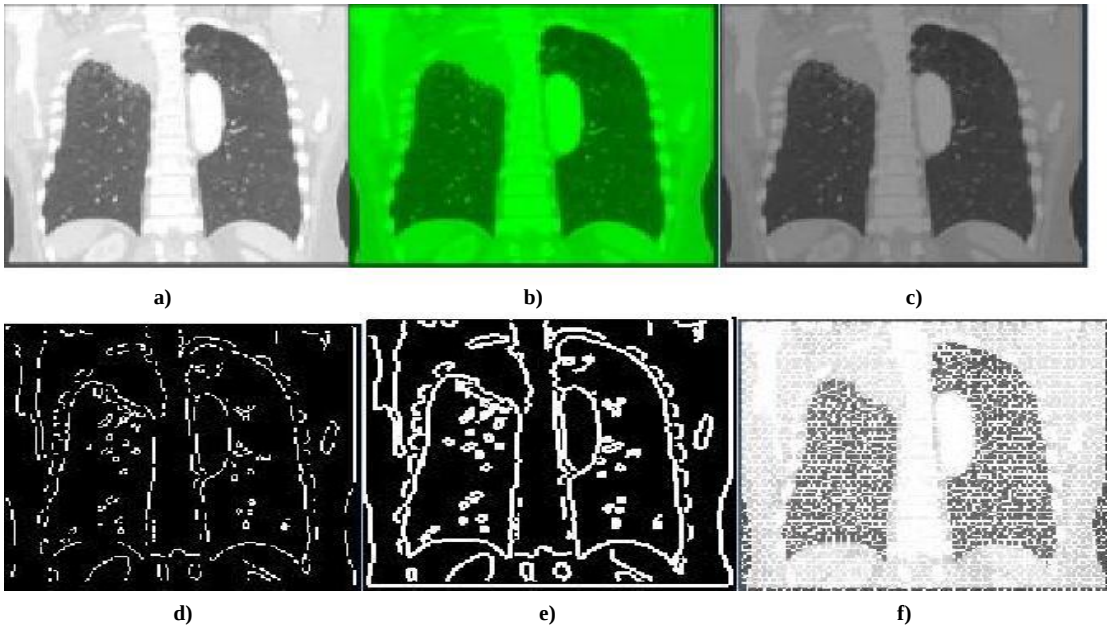
Further Feature extraction and Feature classification steps are applied on the images in GUI i.e. Graphics user interface in MATLAB which gives the result as normal or abnormal.



a) **b)** **c)**

d) **e)** **f)**

Fig.2: Segmentation steps for CT Image a) input de-noised image, b) green layer separation, c) gray level intensity, d) edge detection, e) morphological processing f) segmentation



a) **b)** **c)**

d) **e)** **f)**

Fig.3: Segmentation steps for MRI Image a) input de-noised image, b) green layer separation, c) gray level intensity, d) edge detection, e) morphological processing f) segmentation

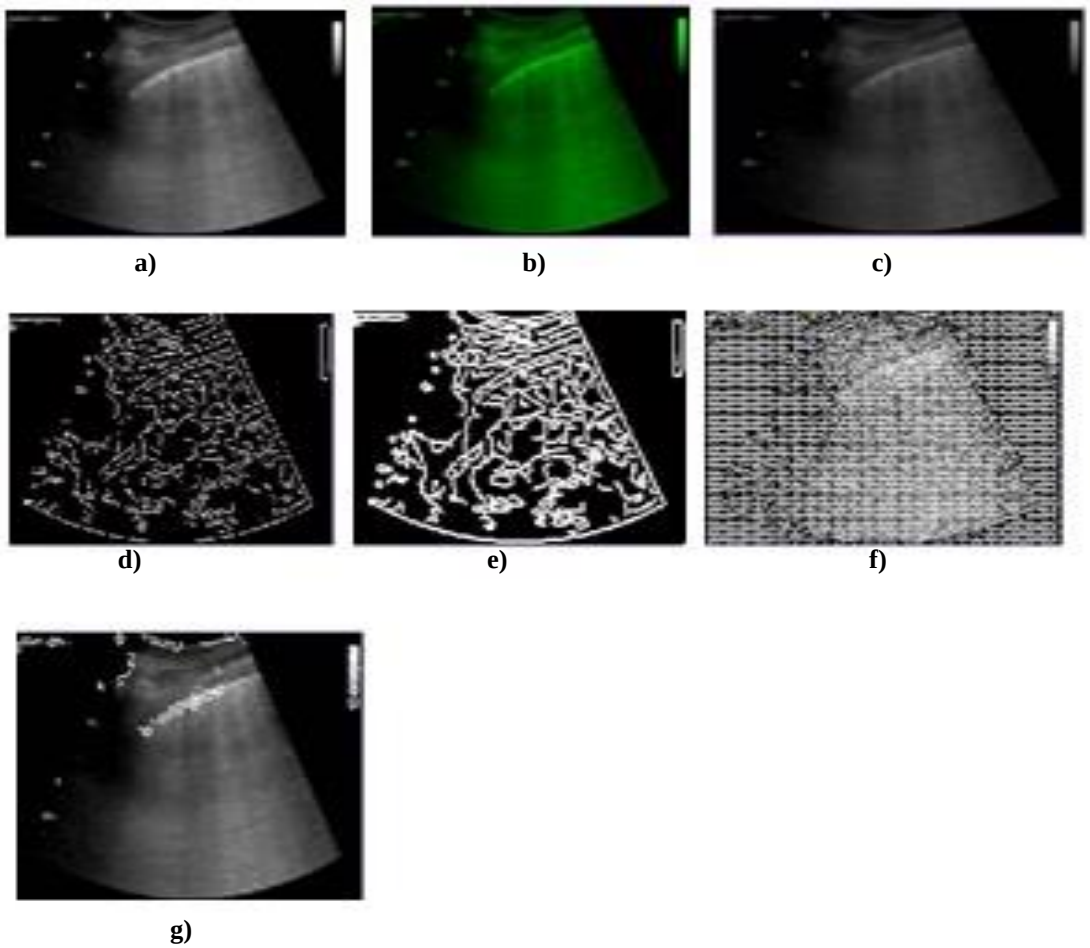


Fig.4:Segmentation steps for Ultrasound Image a) input de-noised image, b) green layer separation, c) gray level intensity, d) edge detection, e) morphological processing f) segmentation, g)super pixel segmentation

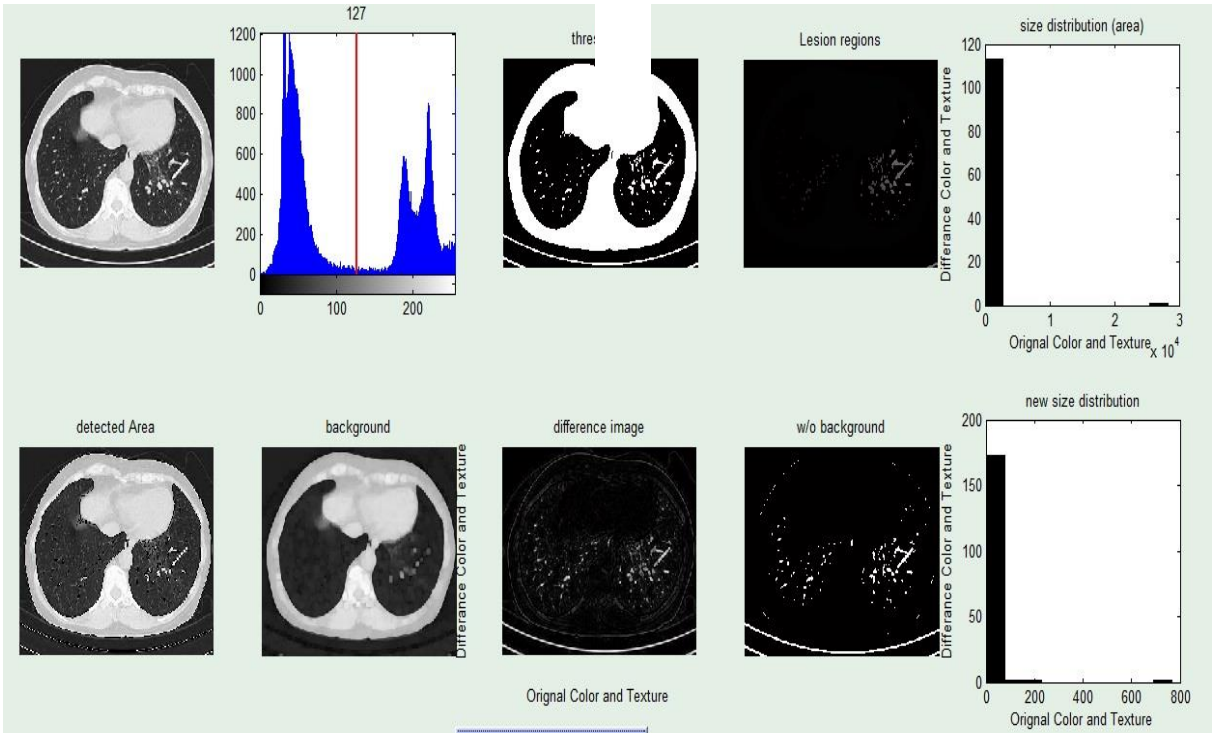


Fig.5: Feature Extraction for CT Image

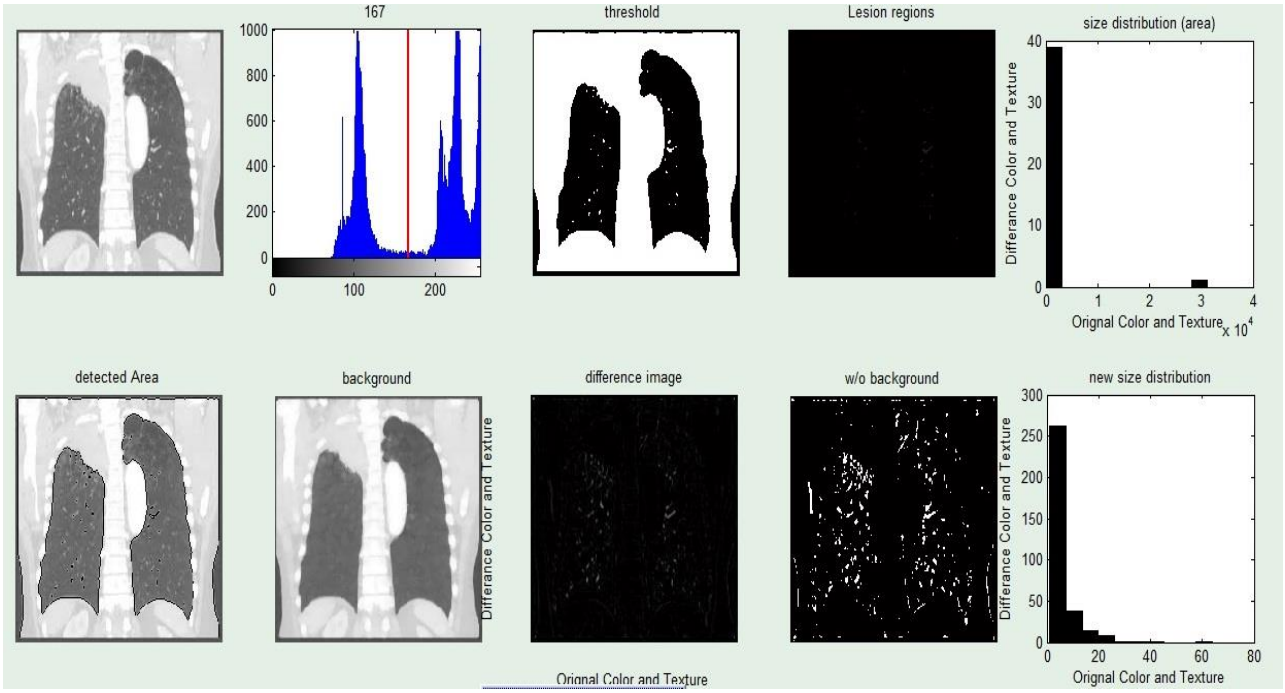


Fig.6: Feature Extraction for MRI Image

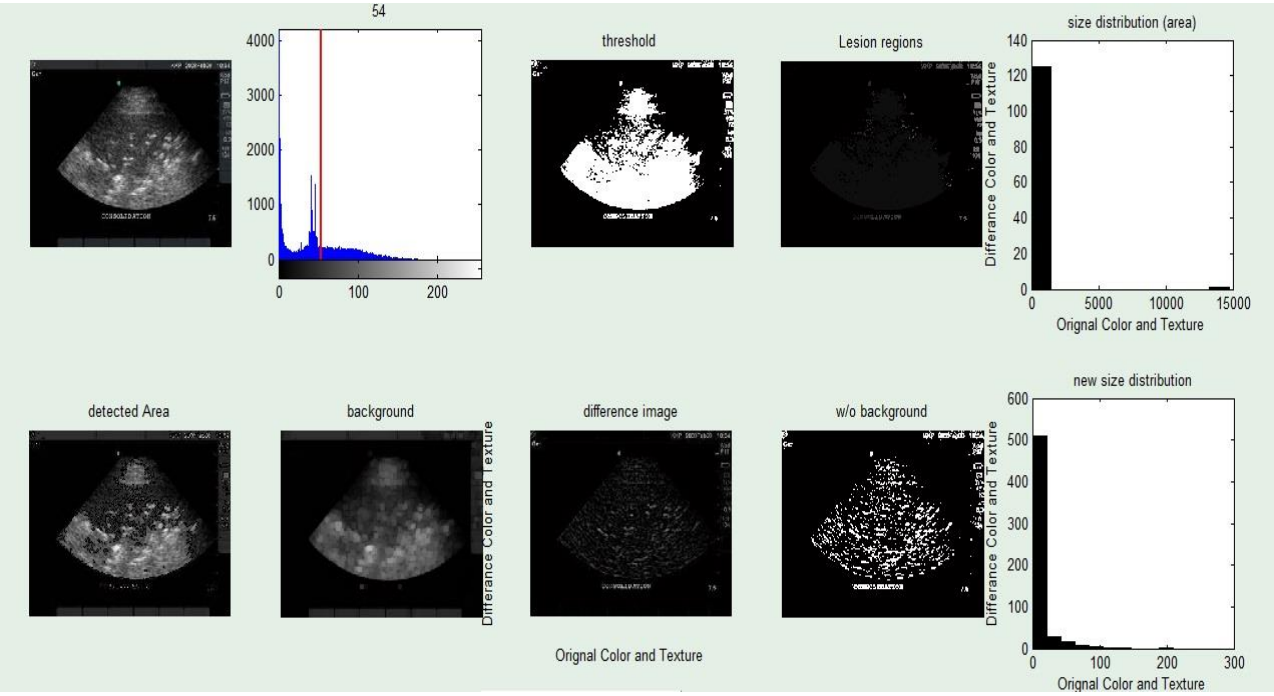


Fig.7: Feature Extraction for Ultrasound Image

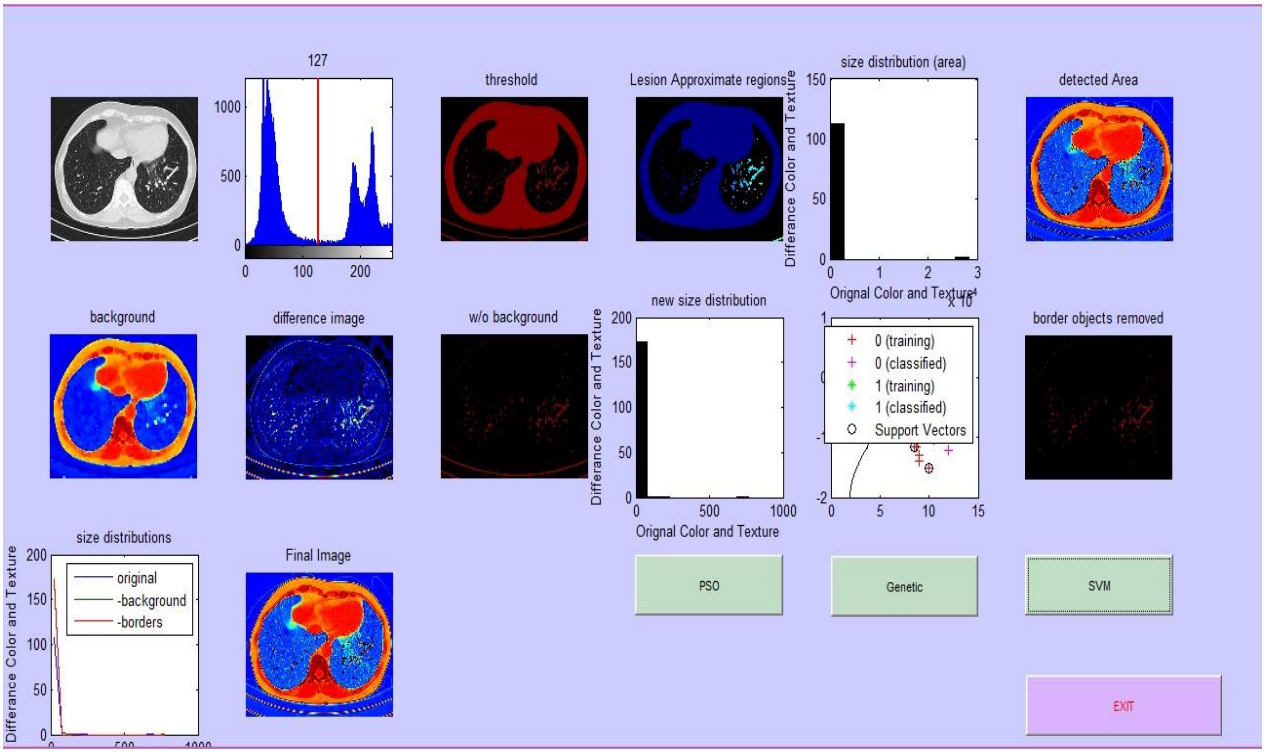


Fig.8: Feature Selection of CT Image

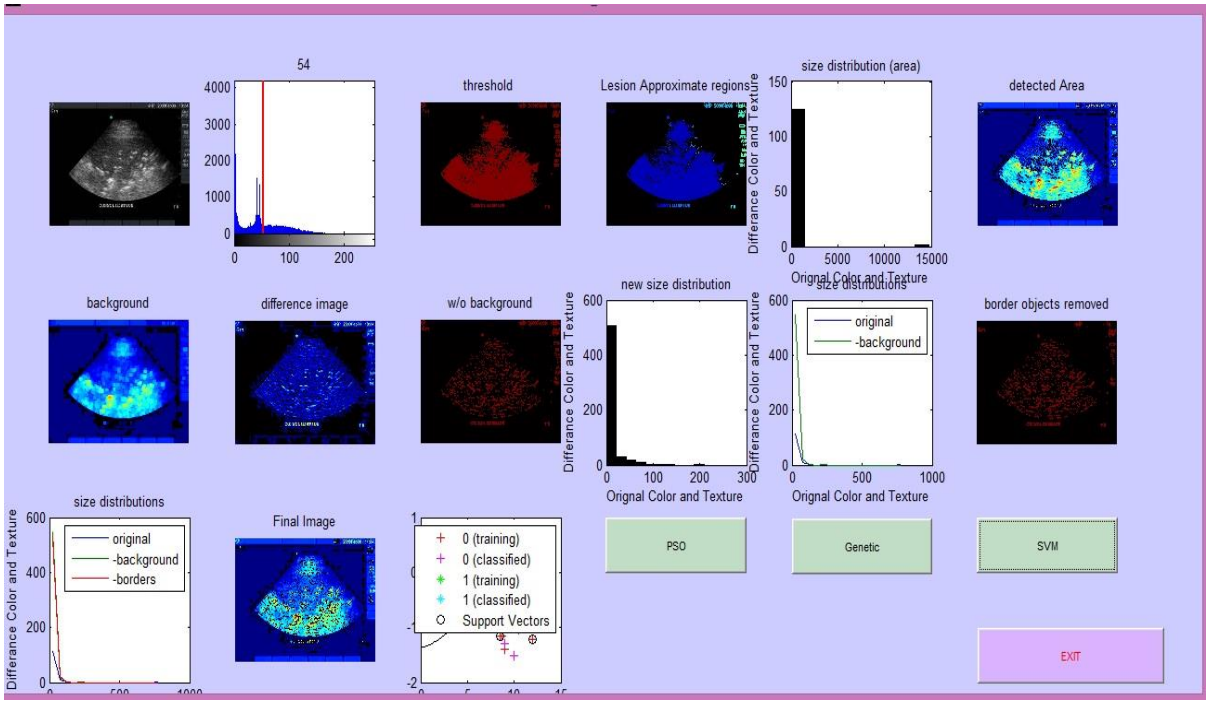


Fig.9: Feature Selection of Ultrasound Image

CONCLUSION

The major image modalities have been studied in this survey of cancer detection through image processing used on CT, MRI and Ultrasound images. We proposed a method for segmentation of MRI, CT and Ultrasound images. Correct identification of cancer cell is done by studying the necessary features extracted for the two images. Ultrasound images as well to detect the validity of this system. We used feature selection as well by the use of PSO, Genetic Optimization and SVM algorithm giving an accuracy of about 89.5% with reduction in false positive.

FUTURE SCOPE

By the process used the complexity is reduced in the system and diagnosis confidence is enriched.. We have used Gabor filter for noise reduction for the two images. Canny filter is used for edge detection and finally we go for super pixel segmentation. Feature selection and classification through GUI Interface in MATLAB is used giving the result as abnormal or normal nodule. Abnormal nodule refers to cancerous nodule. Further we can do the classification through Pearson's and Spearman algorithm to detect the cancer prone region in all the three images.

REFERENCES

[1] Nooshin Hadavi; Jan Nordin; Ali Shojaeipour, *IEEE*, **2014**
[2] B.V. Ginneken,; B. M. Romeny ; M. A. Viergever ,**2001**, 20(12).
[3] American Cancer Society, "Cancer Statistics, **2005**", CA: *A Cancer Journal for Clinicians*, 2005, 55: 10-30
[4] D. Lin ; C. Yan, IEEE, *Neural Information Processing*, **2002** ,4.
[5] K. Kanazawa; Y. Kawata; N. Niki;, H. Satoh; H. Ohmatsu; R. Kakinuma, M. Kaneko; N. Moriyama ; K.Eguchi, Compute. Med. Image Graph, **1998**, 22(2), 157-167.
[6] A. El-Baz; A. A. Farag, PH.D., R. Falk, M.D. ; R. L. Rocco,M.D., *Information Conference on Biomedical Engineering, Egypt*, **2002**.
[7] B. Zhao; G. Gamsu; M. S. Ginsberg; L. Jiang; L. H. Schwartz, J*ournal of Applied Clinical Medical Physics*,2003 , 4
[8] *The DICOM Standards Committee*. , **2004**.
[9] Linda G. Shapiro; G.C. Stockman., Computer Vision: Theory and Applications, **2001**
[10] B.Magesh; P.Vijaylakshmi; M.Abhiram,, *International Journal of Computer Trends and Technology*, **2011**.
[11] Rachid Sammouda; Jamal Abu Hassan1; Mohamed Sammouda ; Abdulridha Al-Zuhairy; Hatem about ElAbbas ,*GVIP 05 Conference*, **2005**, 19-21.
[12] *Proceedings of 7th International Workshop on Enterprise networking and Computing in Healthcare Industry*, *HEALTHCOM*, **2005**, 378 –383.

[13] Disha Sharma; Gaga deep Jindal, International *Conference on Computational Techniques and Artificial Intelligence (ICCTAI'2011)*, **2011**, 17, 872-880.
[14] Ilya Levner,; Hong Zhangm ,*IEEE Transactions on Image Processing*, **2007**, 16(5).
[15] Anita chaudhary; Sonit Sukhraj Singh, *International Transaction on Computing Sciences*, **2012**, 4.
[16] B.V. Ginneken,; B. M. Romeny ; M. A. Viergever, IEEE *Transactions on Medical Imaging*, **2001** ,20(12)
[17] Tao Suna; Jingjing Wanga; Xia Li Pingxin Lvc; Fen Liua, Yanxia ; Luoa,Qi Gaoa ; Huiping Zhua; Xiuhua Guo, *IEEE Journal of Biomedical* , **2013**, 519-524.
[18] Xiabi Liu; Ling Ma, Li Song, Yanfeng Zhao, Xinming Zhao, and Chunwu Zhou, *IEEE Journal of Biomedical and Health Informatics*, **2015**,19(2).
[19] Joel George R, Anitha Jeba Kumari D, *International Journal of Engineering and Innovative Technology* (IJEIT) , **2014**, 3(10),191-195.