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Size Estimation of Lung Tumor by Using Image Segmentation & BPN

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Abstract—An image is an array of pixels arranged in rows and columns. Segmentation is an important task in all kinds of image analysis. In image analysis has a great clinical value since they could be to localize organs or pathologies for diagnoses. A CT-scan image is vital tool for the diagnosis of lung cancer. We proposed computerized system for lung nodule detection in CT-scan images. The segmentation process will result in separating lung tissue from rest of the image, and only the lung tissues under examination are considered as candidate regions for detecting malignant nodules in lung portion.The back propagation is a systematic method of training multilayer neural networks in a supervised manner. The objective of our work is to take CT scan images and perform segmentation of their using OTSU's thresholding method and various shape parameters include optimal thresholding, area, energy, entropy etc. On the basis of their parameter back propagation network is trained to classify the tumor as per its extent. If the calculated parameter value above the threshold value then extent of cancer is high otherwise low. This work has been done on few CT images and results are analyzed graphically as well as numerically.

Keywords—OTSU's thresholding, Segmentation, Neural network, Back propagation, Region of interest.

I. INTRODUCTION

An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. An image, digital image, or still image is a single computer generated graphic or modified picture that appears on-screen. Below is an example of a computer generated image. This image is generated by only using a computer software program.An image may be well-defined such as a two-dimensional function F(x, y).Where x and y are spatial (plane) coordinate, and the amplitude of F at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y and the amplitude values of are all predetermined discrete quantity, we will call the image as digital image. A digital image is collection of a finite number of elements, in which each element has a certain value and location. These elements of digital image are known as image elements, picture elements and pixels. Pixel is the word mostly used refer to the elements of a digital image.

A. Image processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it.Image processing refers to processing of a 2D picture by a computer. An image defined in the "real world" is considered to be a function of two real variables, for example, a(x,y) with a as the amplitude of the image at the real coordinate position (x,y). Visualization functions and apps let you explore images, examine a region of pixels, adjust color and contrast, create histograms, manipulate regions of interest (ROIs).

B. Segmentation Technique

Most of the image segmentation algorithms are based on one of the two basic properties of intensity values: discontinuity and similarity. Detecting discontinuities means to partition an image based on abrupt changes in intensity [10]. This includes image segmentation algorithms like edge detection anddetecting similarities means to partition an image into regions that are similar according to a set of predefined criterion [10].

1) Segmentation Based on Edge Detection

This method attempts to resolve image segmentation by detecting the edges or pixels between different regions that have rapid transition in intensity are extracted and linked to form closed object boundaries. The result is a binary imagebased on theory there are two main edge based segmentation methods- gray histogram and gradient based method [3].

2) Region Based Segmentation Methods

Edge based methods partition an image based on rapid changes in intensity near edges whereas region based methods, partition an image into regions that are similar according to a set of predefined criteria [1].There are two main edge based segmentation methods- region growing and region splitting and merging.

C. Thresholding Method

Thresholding technique is based on image space regions i.e. on characteristics of image. Thresholding operation convert a multilevel image into a binary image i.e., it choose proper threshold T, to divide image pixels into several regions and separate objects from background. Any pixel (x,y) is considered as a part of object if its intensity is greater than or equal to threshold value i.e., $f(x, y) \geq T$, else pixel belong to background.

1) Otsu's Thresholding

Otsu's thresholding method based on a very simple idea Find the threshold that minimizes the weighted within-class variance. This turns out to be the same as maximizing the between-class variance. Operates directly on the gray level histogram [*e.g.* 256 numbers] so it's fast once the histogram is computed [16]. The total variance does not depend on threshold. For any given threshold, the total variance is the sum of the within-class variances (weighted) and the between class variance, which is the sum of weighted squared distances between the class means and the grand mean.The number of pixels with gray level i is denoted fi, giving a probability of gray level i in an image of pi = fi / N.It is based on the interclass variance maximization. Wellthresholded classes have well discriminated intensity values.

M × N image histogram:

L intensity levels, [0. . . L − 1];

ni #pixels of intensity i :

$$\sum_{i=0}^{L-1} n\,i$$

Normalized histogram:

$$Pi= ni /MN$$

$$\sum_{i=0}^{L-1} p\,i = 1 \text{ , } pi>=0$$

D. Artificial Neural Network

The neural can be used to extract patterns and detect too complex computer techniques. Neural networks are typically performed in layers. Layers are made up of a number of interconnected with 'nodes' which contain an 'activation function'. Patterns are given to the network via the 'input layer' that communicates to one or more 'hidden layers 'wherethe actual processing is done via a system of weighted 'connections'. The hidden layer is connected to an 'output layer'.

1) Feed Forward Neural Network

In this neural networks information always moves in one direction only, there is no any feedback. The information moves forward from input layer through hidden layer to the output layer. The networks are used are Hebb, Perception, Ada-line and Madaline networks in feed forward. In Hebb network author did modification of the weights of the neurons.

2) Feed Forward Back Propagation Neural Network

Theback propagation is a systematic method of training multilayer neural networks in a supervised manner. The back propagation method is based on the error-correction learning rule. The back propagation network consists of at least three layers of units: an input layer, at least one intermediate hidden layer and one output layer.

II. RELATED STUDY

Alluri.Samuyl et.al (20013) [2] studied a new Bayesian framework for image restoration that uses a product-based Student's-t type of priors. The main theoretical contribution of this work is that by constraining the approximation of the posterior in the variation framework, we bypass the need for knowing the normalisation constant of this prior. Thus, we avoid having to use improper priors, i.e. priors whose normalisation constant is empirically selected..

Katrina Palmer Lee et.al (2012) [9] proposed iterative image restoration a method, implementation of efficient matrix vector multiplication, and linear system solves for preconditions can be a tedious and time consuming process. Different blurring functions and boundary conditions often require implementing different data structures and algorithms. A complex set of computational methods are needed, each likely having different input parameters and calling sequences. This paper describes a set of MATLAB tools that hide these complicated implementation details. Combining the powerful scientific computing and graphics capabilities in MATLAB, with the ability to do object oriented programming and operator overloading, results in a set of classes that is easy to use, and easily extensible.

Priti Aggarwal et.al (2013) [13] reviewed a result from a comparative study of Wiener based & IWD based Image restoration method is presented. The method uses five metrics such as average absolute difference, signal to noise ratio, peak signal to noise ratio, image fidelity & mean squared error value that measured the performance to compare and analyse the results. Principalcomponents analysis (PCA) is used to improve the quality of restoration. The implementation of the IWD based image restoration obtains the higher PSNR value. The higher the PSNR value higher the quality of an image.

Ryotaro Nakamura et.al (2013) [18] discussed image restoration method based on blind image deconvolution with PCA the method proposed increases the performance it rating PCA restoration algorithm. Robustness against noise and boosting high frequency components are the suggested future works. This process is time consuming and not very efficient in restoration also andSu Xiao et.al(2013) [20]preferredimage restoration, as a linear inverse problem, should be regularised to obtain desired results. However, single regularisation may not enable restored images to demonstrate multiple characteristics. Therefore, to facilitate image restoration and to impose desirable characteristics on the results, a novel image- restoration alg that the proposed algorithm with hybrid regularisation obtains better results than the proposed algorithm with single regularisation. To address the image-restoration problem, a new model adopting hybrid regularization is initially established.

Yi Zhang et.al (2011) [26] described Sparsification of blurred image and blue kernel simultaneously is being proposed in this paper the author is proposing a double discreet wavelet transform for blur processing the future applications of DDWT are removing blurred due to object velocity and defocus blur which are useful for studying object.

Zhengwu Zhang et.al(2009) [27] proposed blurred image resolving in imaging in signals and image it works on the basis of making group of the blurring group using solution of heat equation. This section set intersect each orbit. Images blurred images are brought to same level of blur using a proper matrix is invariant to the level of blur chosen for comparison. This paper also provides geodesics for comparing image representations. There is a limit constraint up to which the algorithms could work in successfully clearing blur.

III. PROPOSED WORK

A. Existing System

1) Take digital chest radiograph contrast enhancement then removal of backgroundinformation.
2) Perform SNA Identification (by shape) and SNA Separation Feature Extraction.
3) Comparison b/w normal and affected lung then Classify the tumor.
4) Analysis of Results.

B. Research Methodologyof proposed System

Research methodology describes the steps are to be performed in this proposed system.

1) *Edge detection* -Choose CT images and initialize process with edge detection step. Edge detection is to be done on the required region of image. The image recovered will be fuzzy at the interface of normal and tumor region.
2) *Image restoration* -The recovered image after optimal threshold and<backgroundremoval>holes filling is further processed with efficient algorithm of image restoration starting from center of the ROI (region of interest) towards edges so that we could have clear image with least information loss.
3) *Image segmentation* -The image of the lungs thus received will be segmented with area threshold of 1-1.5mm to get difference in non-affected and affected parts of the lung within the tumor.
4) *Image registration* -Images of the lung taken at different angles of view will be stitchedto make a round view of the tumor. This will help in actual visual of the size of tumor.

C. Shape parameters

Following are in the list showing various decision parameters which will be used to predict the shape and size of lung tumour using CT images of lungs. Our proposed artificial neural network will be trained for prediction.
These features are:-

1) Area (*F*1) is a total number of pixels within a nodule.This feature helps to isolate small objects.

2) Energy (*F*2) is used to describe measure of informationin an image and is represented in equation 1.

$$\text{Energy}(j) = \sum_k \text{Intensity (k)}^2 \quad (1)$$

3)Entropy (*F*4) is a statistical measure of randomness thatcan be used to characterize the texture of the candidate region.

$$\text{Entropy} = \sum_i (\text{pi} * \log2(\text{pi})) \quad (2)$$

4) Mean and standard deviation (std) of gray levels within a Candidate Region (*F*5) and (*F*6).

The mean intensityvalue indicates the average intensity value of all thepixels that belong to the same region.

The*std*isa measure of how much that gray levels differ frommean. Mean and standard deviation are calculated usingequation 3 and 4 respectively.

$$\text{Mean}(g) = 1/N \sum_{k=1}^{N} (\text{Intensity (k)}) \quad (3)$$

$$\text{Std}(g) = 1/N \sum_{k=1}^{N} (\text{Mean(k)} - \text{Intensity (k)})^2 \quad (4)$$

IV. RESULTS& DISCUSSION

A. Input and output of Images:

Lung tumor is leading cause of cancer in both men and women. Therefore detection of lung cancer is not easy task. Analysis process includes segmentation using OTSU's thresh holding technique and shape parameters optimal threshold, area, energy, entropy, area etc. Result methodology of program is given below.

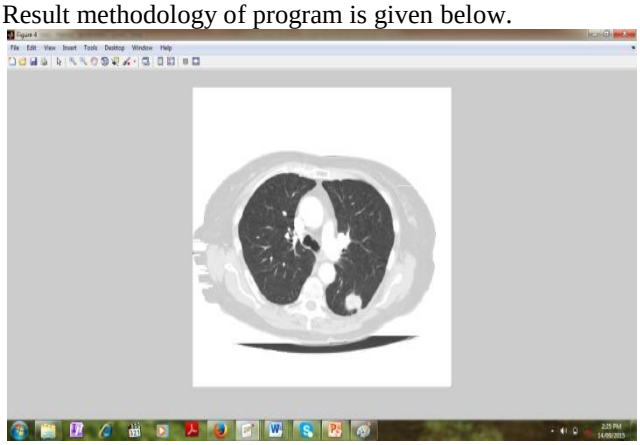

Figure1: MATLAB Shows Input Result Image1

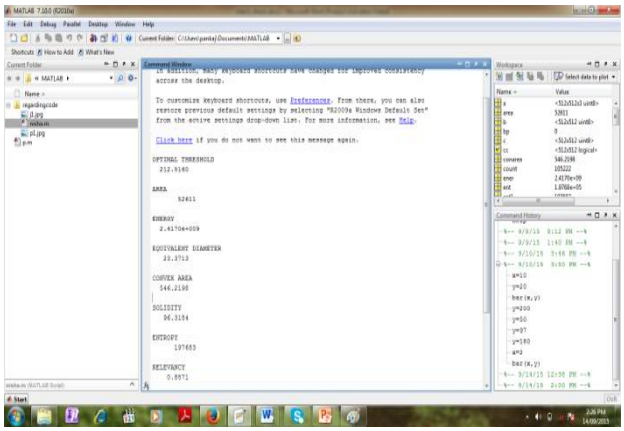

Figure 2: MATLAB Shows Result Screen Shot

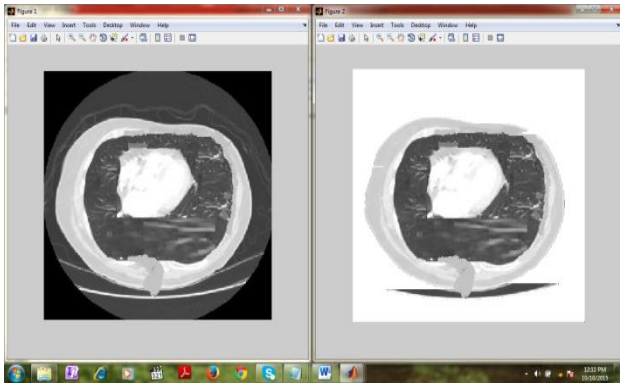

Figure 3: MATLAB Shows InputResult image2

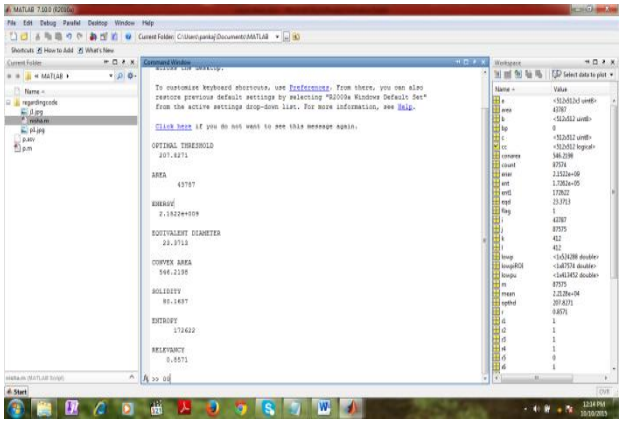

Figure 4: MATLAB Results of Image2

In this process author have segmented using OTSU's thresh holding technique and shape parameters such as optimal threshold, area, energy, entropy, area etc. In a table we set expected value if threshold value is less than 200 so it's less harmful if the same value is bigger than 200 so tumouris very harmful. Then we calculate area if value is less than 50.00 then we find out the tumour if area is more than 50.00 so tumour size is big.In this Comparison Graph shows our optimum results of proposed system over base values.

B. Comparison of results:

Compare the result of both images.

Table 1: Result Table

Description	**Consolidate Value [1]**	**Consolidate value[2]**
optimal threshold	212.51160	207.8271
Area	52.611	43.787
Energy	2.4170	2.1522
solidity	96.3184	80.1637

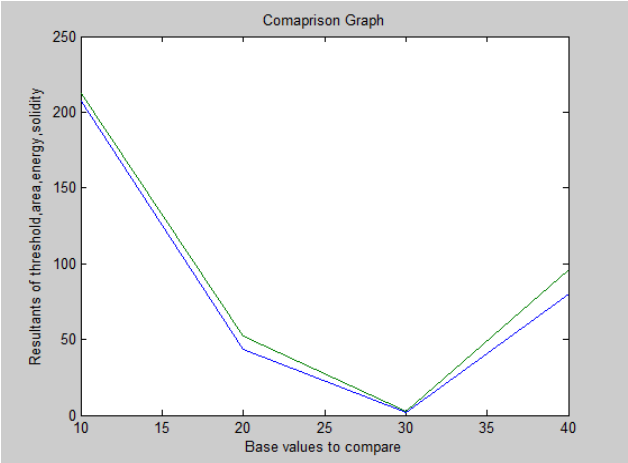

Figure 5: Comparison Graph

In the Figure 5comparison graph, green line shows the consolidate value [1] of proposed system. In the Figure 5 comparison graph, blue line shows the consolidatevalue[2] from the previous research on the detection of the lung cancer. In this graph outcomes of consolidate value [1] over the consolidate value[2] of previous result.

V. CONCLUSION

In this study, the overview of various segmentation methodologies applied for digital image processing is describe briefly. Computer-aided segmentation is a key step finding application in computer aided diagnosis, clinical studies, and treatment planning. In recent years a wide variety of approaches have been proposed to segment CT and MR images having their own merits and limitations. . In this paper, the author developed lung cancer detection system for early detection of lung cancer by studying a number of steps. The approach starts by extracting the lung regions from lung CT image using several image processing techniques in MATLAB including binary image, erosion, Gaussian filter and start with binary image including of threshold technique that is used in the initial steps in the extraction process to convert CT image into binary image, which is faster and user-independent. After the extraction step, the region growing segmentation algorithm is applied on extracted lung regions. Then the shape of nodule is calculated using shape formula with the help of area and perimeter of nodule. Finally, the extracted features help to find the cancerous and non-cancerous candidate in CT images. To differentiate the cancerous nodules from other suspected nodule area from CT images, an artificial neural network using back propagation is developed. This consists of classifying the suspicious regions of pulmonary nodules.This system facilitates the radiologist and physician to recognize the suspicious nodules that increase the sensitivity of the diagnosis.

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REFERENCES

[1] A. K. Jain, "*Fundamentals of Digital Image Processing*", Prentice Hall of India, First Edition, 1989.

[2] Bourjandi, M., "*Image Segmentation Using Thresholding by Local Fuzzy Entropy-Based Competitive Fuzzy Edge Detection*", Computer and Electrical Engineering, 2009. ICCEE '09. Second International Conference on (Volume: 2), 28-30 Dec. 2009, pp: 298 – 301.

[3] H. Hwang and R. A. Haddad"*Adaptive Median Filters: New Algorithms and Results*" IEEE Transactions on image processing vol 4. P.no 499-502, Apr 1995.

[4] HongweiGuo, Feng Jiang, Shaohui Liu, Debin Zhao," *Natural Images Scale Invariance And High-Fidelity Image Restoration*" June 2012.

[5] Igor Stojanovic, PredragStanimirovic and Marko Miladinovic ,"*Applying The Algorithm Of Lagrange Multipliers In Digital Image Restoration*" FactaUniversitatis (Ni ·S) Ser.. Inform. Vol. 27, No 1 (2012), 41-54.

[6] Katrina Palmer Lee, James G.Nagy, Lisa Perrone *," Iterative Methods for Image Restoration A Mat lab Oriented Approach*" May 15,2012.

[7] Nachtegael, M, Schulte, S, Vander Weken. Kerre, E.E.2005.*Fuzzy Filters for Noise Reduction: The Case of Gaussian Noise.* IEEE Xplore, 201-206 D, De Witte. V, 206.

[8] PritiAggarwal, Harish Kundra," *Image Restoration Using Intelligent Water Drops*"International Journal of Advances in Computer Science and Communication Engineering (IJACSCE) Vol I Issue I, November 2013.

[9] Ryotaro Nakamura, Yasue Mitsukura, Nozomu Hamada ," *Iterative PCA approach for blind restoration of single blurred image*" VOL 18 ,2013.

[10] S. Radhika and T. Santhanam ,*A Novel Approach to Classify Noises in Images Using Artificial Neural Network 1*", 2010.

[11] Su Xiao,GuoqiangHAN ,"*Hybrid Regularisation Based Restoration Algorithm for Sparse Images*" Journal of Computational Information Systems 9: 24 (2013) 9989–9996.

[12] Xiao-Juan Bai, Yong-Dong Huang, Jian-Wei Yang,"*Image Denoising Algorithms: A Comparative Study of Different Filtration Approaches Used in Image Restoration*" Proceedings of the 2013 International Conference on Wavelet Analysis and Pattern Recognition, Tianjin, 14-17 July, 2013.

