Lung Area Extraction Using Histogram Equalization and Level Set Algorithm

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Abstract -. Segmentation provides the basis for all types of image processing experiments. It is an important element for the processing of images. In segmentation, the threshold value plays a vital role. Several algorithms are available for extraction of lung areas. Proposed method based on pulmonary extraction using histogram equalization and level set algorithm. The project aim is removing the unaffected portion in the chest or lung region using Histogram equalization and Level set algorithm. First automatic thresholding for chest X-ray images for lungs is tried with the help of available algorithms such as Otsu threshold, Nib lack threshold, Sauvola threshold. Later segmentation threshold using mean and standard deviation, based on RGB display. The lung region in this proposed method is extracted in two steps. They are working pre-processing and processing post. Acquisition of photographs is done primarily. In this preprocessing phase image filtering is done using Gaussian filter (used for smoothing) and equalization with Histogram. Therefore, the image is obtained equalized. After the processing of the equalized image post is complete. Set algorithm is performed during Post processing stage level. It is achieved through the conditions of Gradient, Updating, Evaluation and Neumann boundary. Segmented image is obtained in the next step. From this we isolate unaffected portion of the lung from the area concerned.

Keywords: Segmentation, Pulmonary extraction, ,Acquisation, Updation, Neumann boundary, Gradient, Histogram Equilisation.

I. INTRODUCTION

Image segmentation is a method to split a digital image into many parts that contains pixels. It simulates objects and boundary lines, curves within an image. The method of distinguishing the pixels and assigning each pixel for each label in an image so that the labeled pixels shares each of its similarity. The segmentation of image production is a mixture of a number of segmented images. [1] There are various techniques used in medical image processing to improve and classify the area affected in the deceased images. Yet some problems are also posed because the pathologists could not distinguish deceases. Currently, new techniques are being developed that are simplifying the difficulties.

[2] Algorithms set at levels are typically used as a statistical technique to identify the shapes and interfaces. Which are graphical representation of lines and curves to be useful for contours in computing. To decrease energy by means of mathematical equations. In level-set algorithms, contours or surfaces are defined as the zero level of higher-dimensional structure, which is called the level-set function. The level set method that was developed by osher and sethian in 1988 to define robust interfaces, curves and shapes. The degree of algorithms are used to implicitly denominate the problems in propagating curves and surfaces. This technique is useful in presenting initial contour as a zero level range of dimensional structure, which is called a level set function(LSF).The level set method that was introduced developed contour motion. There are many benefits to the level set algorithms: It is evident that level-set methods have free parameters and also promote the calculation of structural geometric properties. Singularities are created in gui, the topology is modified, curvature based and other problems appear. Heterogeneous statistics within the objects were effectively segmented by localized energies*[2]*

II. LITERATURE SURVEY

Photo segmentation is an essential step in the processing of images. Segmentation is the method of splitting photo into a few important subsets.

As of 2017. *[3]* P.Yugander discusses the benifits of kmeans clustering and distance regularized level set evolution (DRLSE) space. DRI.SE model removes the question of reinitialization in traditional fixed level system. When applied to noisy images, this leads to significant disadvantages such as the number of iterations and the rise in processing time. To prevent the inconveniences of traditional DRLSE, the author developed a system for combining median filtering. Clustering by K-means and pattern by DRLSE[3].

In 2016, [4]Rong Wang and Xuelong et.al used fuzzy region to characterize the level-set formulations. The random combination of selected components or items can be identified and monitored by this. The output was validated on a series of real and synthetic images. This method is consistent with simulation of gauussian mixtures. Bayesian clustering or other forms of probability estimation functions for segmentation by limited level collection.

The active contour method is one of the most popular and successful methods. This approach was successfully used for image segmentation, implemented by level set methods. The main idea of the active contour approach is to implicitly view a contour as a zero level set of the higher dimension level set function, and to formulate a level set function for contour evolution[4].

In August 2015. [5] New hybrid active contour model for image segmentation has been released. A new region dependent signed pressure force (SPF) functionl was described by the authors Zhiwei Liu et al.. That combines information regarding the local and global picture. The model will segment all Image Domain objects. This model was compared by the author with and vest model 171. And the results show that the model applied is less sensitive to the initial contour. Experiments show that these models can segment the picture of synthesis and actual images [5].

August 2015. [6] The Alain coron et.al described a level-set segmentation of 2D and 3D Ultrasound data using energy-fitting gamma distribution based on local region. To deal with the local Speckle Noise numbers. The data term of the level set energy feature is based on local gamma distributions that have demonstrated the ability to model clinical images of the B-mode envelope data and gray-level pixel intensities. Regional statistics are calculated using a smooth function to a controllable scale. This method provides for a high coefficient of Dice similarity (DSC) on simulated 3D results. [6] It also outperforms approaches that use Gaussian local statistics rather than gamma local statistics.

III. EXISTING METHODOLOGY:

First automated thresholding for chest X-ray images for the lungs is evaluated with the help of available algorithms such as threshold Otsu, threshold Niblack, threshold Sauvola. In the above algorithms, several modifications are made to fit X-ray images in the chest and improved portion of these algorithms does not result in the desired automatic thresholding.

A.Otsu threshold :

For most images the Otsu method gives the best performance. It works on the definition of histogram form. Next, the chest X-ray image converted to 2D gray image and changes made to the portion of efficient measurement and estimation of threshold.

B. Niblack threshold :

This measures threshold based on the notion of local mean and standard image deviation. The HSV part of the picture is first extracted and reinforced with imadjust. Using the formula TNiblack= m-k*S, where k is taken as.3, mean and standard deviations are used to correct threshold. The author assigns the value of k as.2. For just a few photos the outcome of this approach gives good performance.

C. Savola threshold:

It is the extended version of the ni black threshold algorithm and the changes made in the following portion of TSauvola = m*(1+.2*(s/180)-1)) to change the value of k and it gives good segmentation than Niblack but the portion of the lungs is not extracted for all images in a well-defined way.

D.Automatic thresholding based on green channel:

It has image acquisition, picture preprocessing (median filter, histogram equalization), automatic threshold segmentation based on mean and standard deviation in RGB channels, Dice similarity coefficient framework ..

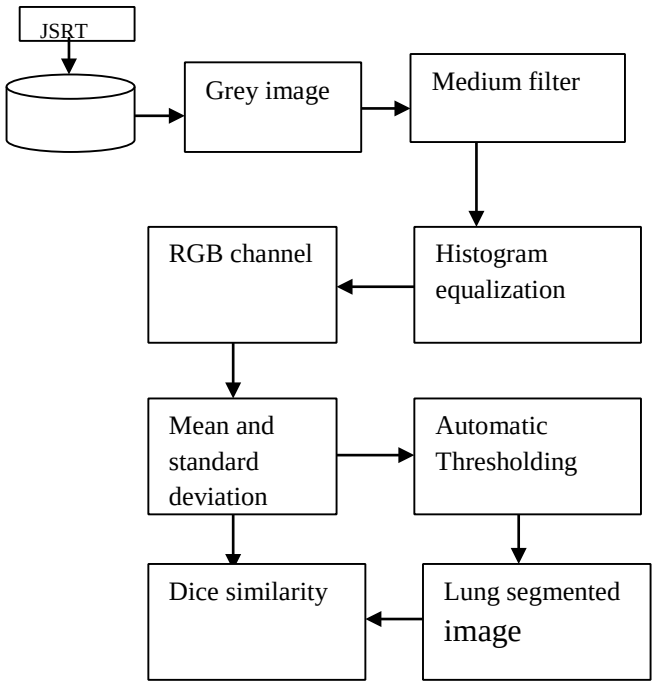

Fig:Automatic thresholding based on green channel .

E.Segmentation by Automatic Thresholding:

Segmentation is an important step in image processing, so finding suitable method for images is difficult, and it takes longer. Essentially segmentation divides the image into section numbers based on similar image features such as form, texture, color etc. Threshold is one of the twinborn segmentation techniques. The gray-level images easily produced binary images through a simple threshold value (T) selection, resulting in good segmentation as the foreground and background of image. This process makes the value below T become black and the value above that level becomes white. It just results in fine, simple segmentation.

Initially manual thresholding is set for all 247 chest X-ray pulmonary images and it takes longer and causes pressure for the eye to simplify the process. To mitigate such difficulty, automated threshold methods are available that are performed with few modifications to X-ray images in the chest suite. It does not yield expected results in lung segmentation, however. Three automated threshold algorithms were finally developed for X-ray images to the chest. Using green screen, this experiment takes three channels of red light, blue and picture is transformed into grayimage. The algorithm was developed based on mean and standard intensity deviation.

IV. PROPOSED METHODOLOGY

Local area statistics for each of the points along the changing curve have to be determined in the proposed method. It raises the algorithm's complexity. Local statistics computing is divided into two parts: initialization, and updates.

For example, computing the local means is simpler than calculating local histograms. Whenever the narrow band shifts to include an uninitialized pixel, an additional cost comes in. In this scenario, you also need to configure the local statistics for this new pixel. Therefore, the amount of initialization operations performed depends on how far the contour is initialized from its final position. The initialization process is performed for each pixel only once, and thus adds a constant increase in complexity. Nevertheless, these computations can be large, depending on the size of the local radius. The update phase occurs when any initialized pixel is crossed by the contour, or vice versa, shifting it from the inside out.

In this implementation, we retain local mathematical models in memory for each pixel initialized. Once the consumer crosses a line, the abstract representations of all pixels within the region are changed. By using local means, each pixel must maintain the number of pixels in the local regions and the pixel strength in those two regions both inside and outside the curve. Updating this model consists of transferring the values "behind" or vice-versa from the classes "inside." They hold a full histogram for each initialized pixel of the local interior and exterior regions for the energy of the histogram separation. Although this takes much more memory than the means model to handle, adjustments are just as simple: pixel intensities are subtracted from the inner histogram bins and added to the same bin of the corresponding exterior histogram or vice versa.

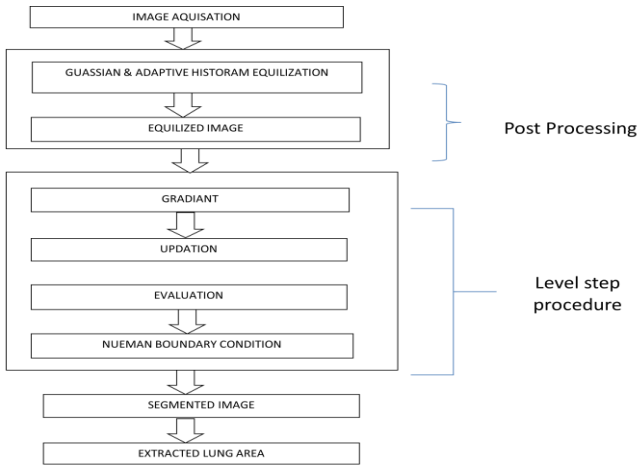

Fig:Block diagram for proposed algorithm

ALGORITHM:

Step1: Image acquisition.

[7]. It is the first stage or method of digital image processing, the foundational steps. Image processing may be as easy as offering an already digitally formed file. The image creation stage usually requires pre-processing, such as scaling etc.

Step2: Preprocessing.

Image filtering using Gaussian & Adaptive histogram equalization.:

A digital image generally contains noise. Due to this noise, undesired values are introduced along with original values. So, in order to remove these errors an image filtering technique is used. There a different types of image filtering techniques. One among those available filters are Gaussian filter. Generally it smoothens the image. This Gaussian filter considers the weighted sum of edge pixels, and then it smoothen the edge pixels. In detail Gaussian filter adds weight to neighbors based only on their distance from the current pixel.

Adaptive histogram equalization is an image manipulation technique used to improve contrast in images. It includes multiple histograms, each corresponding to a different part of the image, and uses them to redistribute the picture's lightness. It is thus ideal for improving local contrast and improving edge distinctions in every area of an image.

Adaptive histogram equalization has a propensity to overamplify noise in terms to homogeneous picture areas.

Step3: Obtaining equalized image.

After smoothing ,and reduction of noise an equalized image is obtained . The obtained image is free from introduced noise in the input signal. It is also a high contrasted image due to the application of adaptive histogram equalization. Obtained equalized image is processed through postprocessing technique. Here, post processing techniques is level set procedure.

Step 4: Initialization of level set procedure

4.1: Gradient:

An picture gradient is a change in direction in intensity or color of an background. The color gradient is one of the basic building blocks of image processing. The Canny edge detector, for example, uses gradient picture for edge detection. The word gradient or color gradient is often used in graphics applications for digital image processing for a progressive mix of color that can be viewed as an even gradation from low to high values, as seen from white to black in the photos to the right. Another word for this is the evolution of colors.

4.2: Updating:

Weight adjustment can be interpreted as weight shift to render the mistake lower and lower. You presume any weights first and you get the estimate of the formula, and then the defect. You then take the error with respect to relation to weights, and eventually change the weights to reduce the mistake. You may also think of it as a minimum calculus finding problem. You consider the weight values, or claim the weight space point that makes you the least defect.

4.3: Evaluation:

Critical evaluation of the images you use for analysis, study and presentations is critical. Like for every other document, such as journal papers or books, photographs will be analyzed to assess their accuracy, authenticity and suitability. Photos need to be judged on many occasions. Visual interpretation is an essential phase in analyzing an picture and recognizing its meaning. It is therefore necessary to recognize textual material presented with the image, the origins of the picture and the original meaning of the picture, as well as the image's technological consistency. The following questions will help direct the analyzes and analyses.

4.4: Neumann boundary condition:

About the constraints of Neumann, they only need integral assessment around internal boundaries.

Step5: Obtaining segmented image:

After applying the level set algorithm the segmented is obtained. In this, the affected part of the lungs is separated by applying the algorithms and segmented image is obtained by drawing edges &boundaries and contours

Step6: Extracted lung area:

Extracting lung area is the final step in obtaining the affected lung area. This is done after obtaining the segmented image.

V. IMPLEMENTATION & RESULT:

Proposed method that is Level set based segmentation is implemented to extract the non effected part in the lung area. This algorithm gives the results related to abnormalities in the lung area it may any lung related diseases.

The level-set algorithm is performed on some of images of the lungs effected with diseases. By the following results we can observe this level set algorithm gives the best results in extracting the healthy part of lung area.

Existing method of automatic segmentation based on threshold takes mean and standard deviation of green channel and produces the output. This algorithm is based on only histogram equalization and level set algorithm.

VI. EXPERIMENTAL RESULTS:

The original image which is shown in fig 1 is first filtered using guassian and adaptive histogram equalization. This results in smoothened & equalized image which is free of articrafts, as shown in fig (2) & fig (3).

Fig 1 :Original image

Fig 2: Smooth image

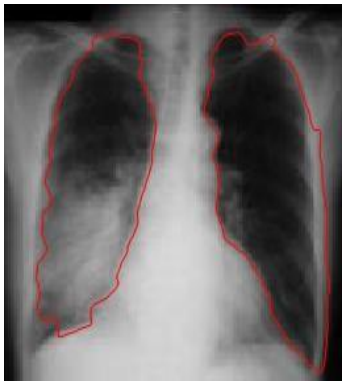

Fig 3:Equalised image

Fig 4:Segmented image

Fig 5:Extracted lungs

Further the equalized image is subjected to gradient operation &by updating the pixel values, using Neumann boundary condition the segmented image and extracted image are shown in fig (4) & fig (5).

From the tabular column voxel scale is a significant part of image quality. Voxel is the one-pixel 3-D analog. Voxel dimension has to do with both the depth of the pixel and the thickness of the slice. one can see the difference in the parameter values between input and output lungs. A convex hull id defined around the segmented nodule to measure the solidity.

Table 1. Experimental results.

Parameters	Right lung input	Right lung output	Left lung input	Left lung output
No of voxels	2864	2763	2864	2796
Perimeter	382.66	322.9064	382.66	322.906
Eccentricity	0.9460	0.9399	0.9406	0.9399
Solidity	0.8831	0.9175	0.8837	0.9175

VI. CONCLUSION

In this work we described the technique to extract the effected part of lung area using histogram equalization and level set algorithm, this gives more accurate output than the previous methods. Limitations expected in this project can be overcome in the future projects. It can be made more efficient for all type of images.

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