MEDICAL IMAGE SEGMENTATION BASED ON INTENSITY THRESHOLDING

Abstract- **Segmentation is very important step in most of the image processing algorithm. Here the segmentation of an image is done using the intensity based thresholding. The initial step before segmentation is the grey level conversion as to differentiate the intensity well in the grey scale. Then the segmentation is done in two different paths and at the end we add both the segmented images to form the complete segmented image which labels the different parts within it as objects. The objective to obtain segmented labels of objects inside the image is achieved however.**

INTRODUCTION:

Image segmentation is a process of splitting the image into objects as to make it easier for analysing or further. There are various types of methodology for segmentation. This includes thresholding based segmentation which we are using it for our algorithm. Adding to that , histogram based method, clustering method , region growing method and the like. The type of image segmentation methods being used differs depending upon the purpose of the entire algorithm. The purpose of segmentation usually includes differentiating the region of interest from the rest, pre-processing to better understanding before analysing the image, segmenting for effective navigational vision in robots, diagnostic purpose, object detection and many more. Mostly the segmentation involves the labelling of objects based on pixel values. Here similar kind of methodology has been used for effective segmentation. The segmentation has interesting application in the areas where image processing and image analysing is stretching it hands.

Image conversion:

The given image dataset is in DICOM format. The Digital Imaging and Communication format includes raw image taken from the medical device along with the patients details. The raw image is separated from the other information in the DICOM dataset. The image obtained is scaled intensity image. For good representation of its intensity, grey conversion is done by scaling the image in the range of 0 to 1. The minimum intensity and the intensity values below the minimum is set to zero. Similarly, the intensity values above the maximum intensity and itself is set to 1. The values in between these ranges are scaled from 0 to 1 using the formula:

$$Inew = \frac{[Iold(i) - (Iold)\ ]}{max(Iold)}$$

Segmentation:

The segmentation is done based on the intensity thresholding in three steps. Here we are obtaining two segmented images and then adding those gives the complete segmented image.

Since the intensity ranges variably, two different path of segmentation is done. The first path includes thresholding the image based on the intensity value of 0.3. As most of the values in the lung lobes ranges below the threshold value, this path of segmentation would result in the lobes of lungs. The principle behind this method is that the pixels in the image whose value above the threshold value are set to zero and those pixels above threshold is set to

1's. The threshold value has been selected based on trial and error method.

Similarly, the original grey image is subjected to intensity thresholding based on the intensity value of 0.5. In a similar fashion, the value above threshold is set to 1's and value below is set to 0's. Now along with the segmented lungs, we also get some ex-thorax regions. To erase them off, one can use the area based filtering. Initially the regions inside the image are extracted as objects based on the connectivity and then the areas of them are calculated based on the number of pixels inside each object. The largest two objects are extracted based on the area. This process can be done only in the binary images. The connectedness is found based on the value of their neighbouring pixels. The pixels are connected if their surrounding pixels of horizontal and vertical direction are of same value. This is in case of four neighbourhoods. However in this case, the eight neighbourhood is considered where the neighbouring pixels along the diagonal are also considered. Thus regions are formed based on the connectedness and they are considered as objects. The number of pixels inside the objects gives the area of that object. Here the spinal cord is actually the combination of the two largest objects. So the area filter which retains the two objects of the largest areas would give the spinal cord.

The image of segmented lobe of lungs is converted to negative image as to obtain the lung lobes in white pixels. This is necessary because the spinal cord is also in white pixels. Thus we perform simple addition between these segmented image to obtain complete segmented image. Now count of objects labelled inside the image is 12 including spinal cord and the lung lobes.

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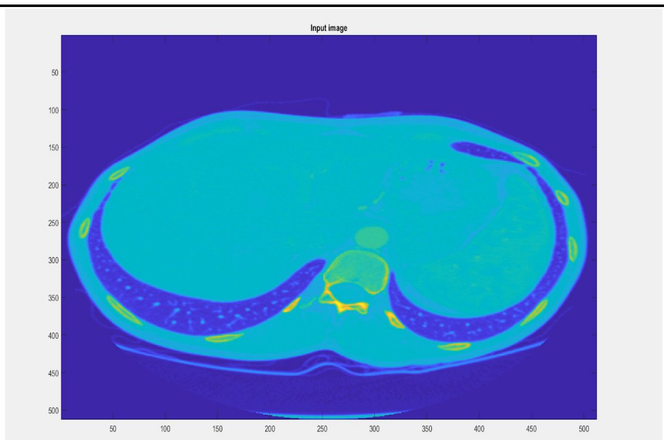
Fig.No	IMAGE	TECHNIQUE
1		Read Input image
2		After grey conversion
3		Segmented lung lobes

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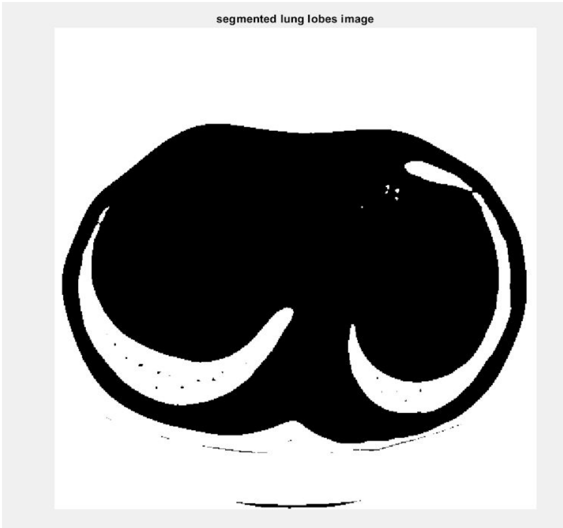
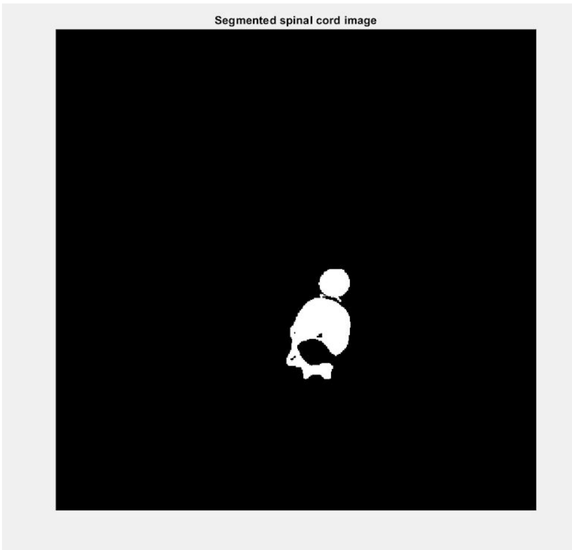
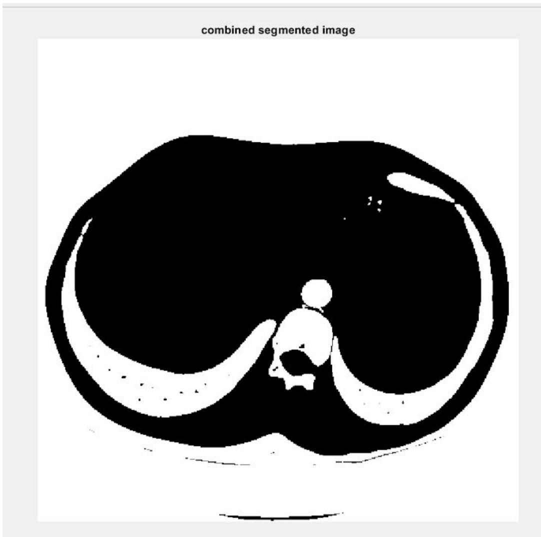
4		Negative of segemented lung lobes
5		The segmented spinal cord
6		The complete segmented lung image

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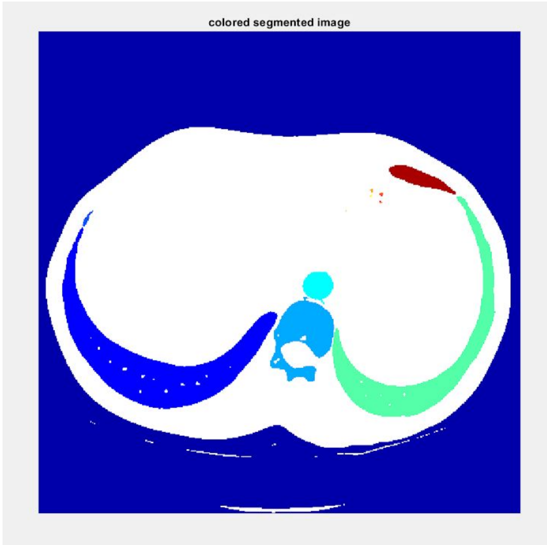
7		The final segmented image(labelled)

MATLAB CODE:

```
clc;
clear all;
close all;
info =
dicominfo('C:\Users\Admin\Downloads\example.dcm');%reading
the dicom file
Y = dicomread(info);%reading the image
figure
imagesc(Y);% display image with scale colors
title('Input image');
Z=mat2gray(Y);%converting the scaled image into gray image
figure
imshow(Z);% displaying gray image
title('Grey image');

a=imbinarize(Z,0.3);% segmenting objetcs in binary image
form based on threshold
figure;
imshow(a);
title('segmented lung lobes image');
a=~a;
figure;
imshow(a);
title('negative of segmented lung lobes image');
b=imbinarize(Z,0.5);% segmenting objetcs in binary image
form based on threshold
```

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```
b=bwareafilt(b,2);%finding the largest two objects inside
the image
% based on the area of the connected components
figure;
imshow(b);
title('Segmented spinal cord image');
c=a+b;% combine the two segmented image to get the
complete segmented image
figure;
imshow(c);% combined segmented image
title('combined segmented image');

[p,n]=bwlabel(c);% labeling each objects
R=label2rgb(p);% coloring each objects based on the label.
figure;
imshow(R);
title('colored segmented image');
cc = bwconncomp(c);% details of all the objects inside the
object
disp(cc);
```