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A Novel Approach of Cancerous Cells Detection from Lungs CT Scan Images

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Abstract— A novel approach for detection of cancerous cells from Lungs CT scan images is proposed in this paper. Locating lung cancer at an early stage is a challenging task since there are few or no symptoms in this stage of the disease and majority of the cases are diagnosed in the later stages of the disease. Treating cancer in the early stages can provide more treatment options, less invasive surgery, and increases the survival rate. The majority of lung cancers originate as a small growth or nodule in the lung. Screening CT scans are extremely sensitive in detecting nodules as small as 2 or 3mm within the lungs. CT screening is efficient in locating majority of lung cancers. Lung CT Scan helps in detecting lung cancers at an early stage. This present work proposes a method to detect the cancerous cells effectively from the CT scan images by reducing the detection error made by the physicians' naked eye for medical study based on Sobel edge detection and label matrix.

Keywords— *CT scan, Lungs Cancer, Sobel Edge Detection, Label Matrix*

I. INTRODUCTION

Cancer is a disease characterized by uncontrolled growth of abnormal cells. There are more than 100 types of cancer cells, which are classified by the cell they initially affect. Cancer cells divide continuously forming lumps or tumors. These tumors can interfere with the normal functioning of the body affecting digestive, nervous and circulatory systems. Tumors which stay stagnant are less harmful. They may also spread to other parts of the body through blood and lymph systems. Lung Cancer [1]-[3] is characterized by uncontrolled cell growth originating in the lungs. The most common cause of Lung Cancer is smoking however in some cases it can also be attributed to genetic factors, radon gas, asbestos, and air pollution including passive smoking. Lung cancer can be detected using chest radiograph and CT scan. Chest radiograph is used to investigate the occurrence of the disease however the extent and the type of the disease can be exposed using CT scan. A CT scan stands for Computed Tomography scan. It is also known as a CAT (Computer Axial Tomography) scans [9]. CT scanner is a special kind of X-ray machine, which combines many x-ray images instead of just one with the help of a computer. It employs the process of generating a 2-dimensional image with the help of the computer. In some cases a 3-dimensional image can also be formed by taking many pictures of the same region from varying angles. The density and the strength of the X-ray beams help in providing a cross-section of the body. CT scan [4]-[6] helps in inspecting the interiors of the body and also in differentiating normal and abnormal structures, thus guiding in providing the necessary treatment. In recent times it has become a necessity in locating tumors and treatment with radiotherapy. CT scanner can be used now to take pictures of any part of the body, including brain, lungs, kidney, liver and spine. About 12.7 million cancer cases and 7.6 million cancer deaths are estimated to have occurred in 2008. Lung cancer is the leading cancer site in males, comprising 17% of the total new cases and 23% of the total cancer deaths. In this paper the proposed method detects cancerous cells from the CT scan images of Lungs. The efficacy of the proposed method claims the robustness

II. METHODOLOGY

A. Sobel Edge Detection

In image processing it is essential to detect the boundary, border or edges [7] of the objects in the image. The edges separates each object from the other, from the background in an image and also helps us to detect or identify a specific object in the image.

Sobel operator [8] helps to find the edges in an image; it does so by finding the image gradient. Image gradient is the change in the intensity of the image. The intensity of the image will be of maximum value where there is a separation of two regions i.e. two dissimilar regions thus an edge must exist there. The image gradient will be greater where the intensity value is very large. Sobel operator uses this greatest value to find edges in an image. Sobel operator uses two 3X3 kernels and filters the image to estimate the value of each pixel by convolving with the original image. The value of one kernel is simply taken obtained and the other is obtained by rotating it by 90°. The kernels are called G_x and G_y respectively.

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

The filters help to estimate the value of gradient along both the axis, the X-axis (horizontally) and Y-axis (vertically). The values of the co-ordinates increase in the right for X-axis and in the down direction for Y-axis. The G_x filter estimates the value along X-axis thus detects all edges horizontally and the G_y filter estimates the value along Y-axis and detects edges vertically. If our image is defined as a matrix I then for

Horizontal edges:

$$G_x = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} * I$$

Vertical edges:

$$G_y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix} * I$$

The results (gradient value) of the two filters are taken separately and determination of value of each pixel is approximated by its summation. It is given by:

$$|G| = \sqrt{Gx^2 + Gy^2}$$

Generally, we use the simple equation:

$$|G| = |Gx| + |Gy|$$

this is easy and faster for computation.

From the two computed values we can also determine the angle of the gradient's direction (given by Θ) i.e. the angle of the edge. It is calculated by:

$$\theta = \arctan(Gy/Gx)$$

III. PROPOSED METHOD

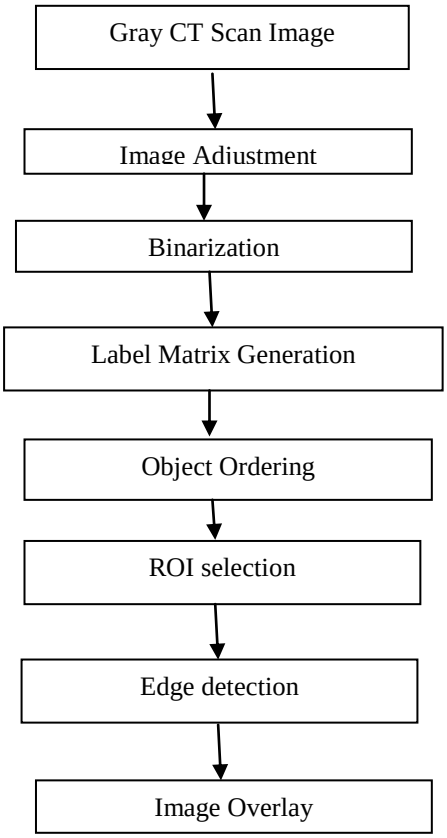


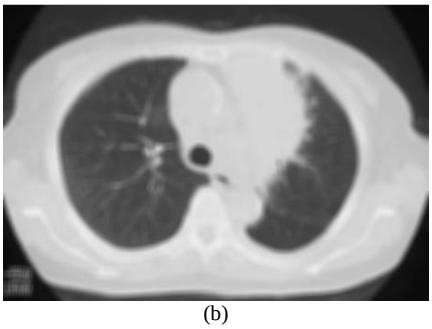
Fig 1 Detection of cancerous cells (ROI)

Step 1. Gray CT scan image is filtered followed by image adjusts.
Step 2. Adjusted image is binarized.
Step 3. Label matrix is produced from the binarized image.
Step 4. Objects are ordered.
Step 5. Select cancerous cells Object (ROI).
Step 6. Edge detection is applied on detected cancerous cells.
Step 7. Edge detected image is overlaid on the Original gray image.

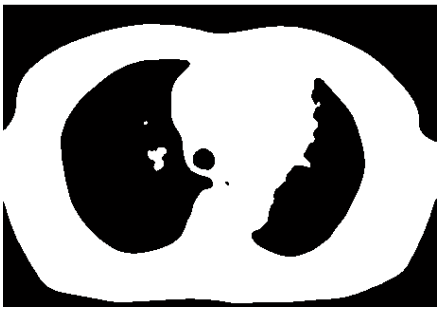
IV. RESULT AND DISCUSSION

MATLAB 7.0.1 Software is extensively used for the study of lungs cancer detection from CT scan images. Concerned images obtained in the result are shown in Figure 2.

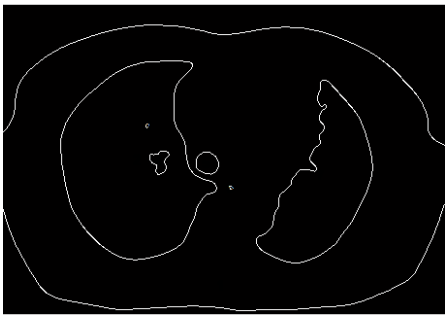
(a)



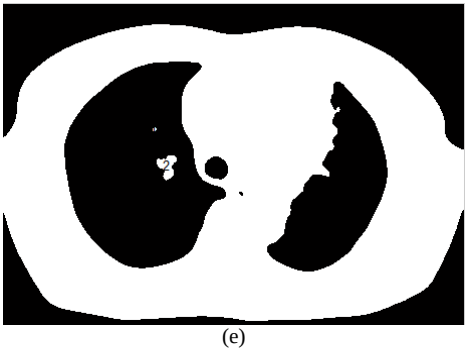
(b)



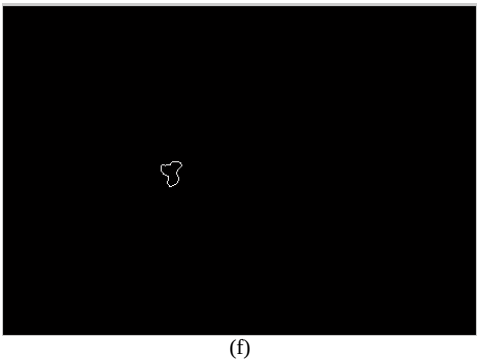
(c)



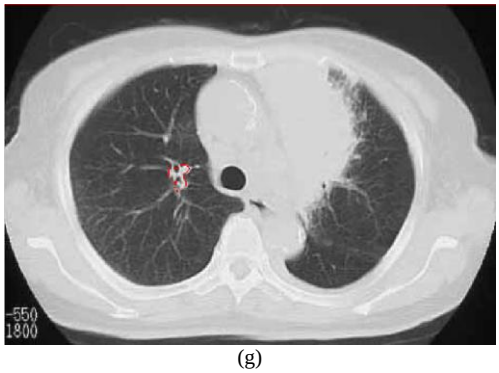
(d)



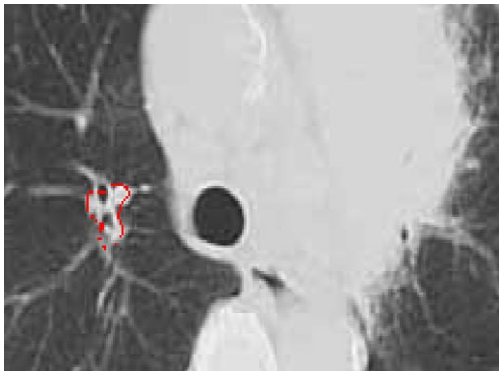
(e)



(f)



(g)



(h)

Fig 2 (a) CT Scan of Lungs with Cancer , (b) Filtered Image, (c) Histogram equalized followed by Binarization Image, (d) Sobel Edge Detected Image, (e) Labeled Cancerous Cells (f) Edge Detected Cancer Cells, (g) Marked Detected Cancer Cells, (h) Closer View of Cancer Cells

V. CONCLUSION

Edges in image processing help us to determine objects. In this method we have successfully identified the cancerous nodules in the lung by using their CT scan images. Physicians use the naked eye to detect the growth and spread of cancerous nodule in the lungs from the CT scan images. This may incorporate human error in detection and it is quite tedious too. The method we propose automatically detects and identifies the cancerous cells of the lungs. It can also help in determining the shape and pattern of the nodule which provide necessary information needed for the proper medication and also helps in determining the area affected by the cancerous cells. It also identifies the cells which might have been unnoticed by human eyes. Detection of lung cancer at an early stage can be difficult but using the proposed

work detection becomes uncomplicated and the chances of the early treatment of the patient and therefore chances of survival of the patient increases. Thus using an automated system not only reduces chances of human error but also increases the accuracy up to 90%.

REFERENCES

[1] Nisar Ahmed Memon, Anwar Majid Mirza, and S.A.M. Gilani, "Segmentation of Lungs from CT Scan Images for Early Diagnosis of Lung Cancer", World Academy of Science, Engineering and Technology 20 2006

[2] M.Gomathi, Dr.P.Thangaraj, "A Computer Aided Diagnosis System For Detection Of Lung Cancer Nodules Using Extreme Learning Machine", International Journal of Engineering Science and Technology Vol. 2(10), 2010

[3] Binsheng Zhao, Gordon Gamsu, Michelle S. Ginsberg, Li Jiang,Lawrence H. Schwartz, "Automatic detection of small lung nodules on CT utilizing a local density maximum algorithm", Journal of Applied Clinical Medical Physics, Volume 4, NUMBER 3, Summer 2003

[4] Disha Sharma, Gagandeep Jindal, "Computer Aided Diagnosis System for Detection of Lung Cancer in CT Scan Images", International Journal of Computer and Electrical Engineering, Vol. 3, No. 5, October 2011

[5] P. Bountris, E. Farantatos, and N. Apostolou, "Advanced Image Analysis Tools Development for the Early Stage Bronchial Cancer Detection", World Academy of Science, Engineering and Technology 9 2005

[6] Zhi-Hua Zhou, Yuan Jiang, Yu-Bin Yang, Shi-Fu Chen, "Lung Cancer Cell Identification Based on Artificial Neural Network Ensembles", Artificial Ingelligence in Medicine, 2002, vol.24, no.1, pp.25-36.

[7] Samir Kumar Bandyopadhyay, "Edge Detection from CT Images of Lung", International Journal Of Engineering Science & Advanced Technology Volume - 2, Issue - 1, pg: 34 – 37, Jan-Feb 2012

[8] Dr. H. B. Kekre, Ms. Saylee M. Gharge, "Image Segmentation using Extended Edge Operator for Mammographic Images", International Journal on Computer Science and Engineering, Vol. 02, No. 04, 2010.

[9] Yamomoto, S., Jiang, H., Matsumoto, M., Tateno, Y.Iinuma, T., Matsumoto, "Image Processing for Computer-Aided Diagnosis of Lung Cancer by CT (LSCT)", IEEE Workshop on Applications of Computer Vision, pp. 236 –241, 1996

