Lung Cancer Medical Image Recognition By Using Deep Neural Networks : A Review

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Abstract- *Lung cancer keeps on changing on various medical factors depending on topographic areas. The identification of Lung cancer at initial stages is of extreme importance if it is intended to degrade high mortality rate. The worldwide lung screening program focuses to imagine PET/CT examinations amongst most matured gatherings at danger to upgrade the early location rate. In spite of the fact that utilization of obtrusive procedures, side effects scarcely show up until infection is propelled making it troublesome for radiologist to recognize sores. Every year, the American Cancer Society appraises the quantities of new growth cases and passing that will happen in the world in the present year and aggregates the latest information on tumor frequency, mortality, and survival. Genuine and precise information is the basis of disease control initiatives. More than 3/4th of the illness is identified with tobacco utilization. This strategy is more about diagnosing at ahead of schedule and critical stages with keen computational procedures with different noise elimination by segmentation strategies and calculations which is the root idea of digital image processing. Location of CT pictures received from cancer research organizations is investigated utilizing MATLAB*

Keywords- CT(Computed tomography),PET(Positron emission tomography)ANN(Artificial Neural Network),Lung Cancer etc.

I. INTRODUCTION

Tumor is a noteworthy general health issue worldwide and is the second driving reason for death all over the world, regardless of age. Cancer can be clarified as uncontrolled cell development having capacity to spread everywhere throughout the body. Our body contains red blood cells (RBC's) as well as white blood cells (WBC's). The main function is to supply fresh oxygen (02) to all parts of the body with the help of blood flow, due to which blood appears red. [1] In the lungs, tissue receives oxygen (02) because of RBC's only. The hereditary substance of erythrocytes has high centralization of hemoglobin. The cell film comprises of proteins and lipids which is spine of physiological cell capacity. They don't contain any imperative piece of cell, which incorporates hemoglobin. Around 20 lakhs new RBC's are created every second. [2] The cells are delivered in the bone marrow and turn all through the body for around 4 months to an fro in arteries and veins.

Image processing is utilized to break down pictures at the most reduced level gave any quality. These operations don't amplify probability of data content, however they diminish it if entropy is a data measure. The principle necessity of preparing is to enhance pixel power by changing over from discrete to computerized picture, sectioning to pixels, completing numerical operations on pixels, and recreating of picture with better quality. [11] Pre-processing of CT pictures is the underlying stride in picture examination took after by division handle and finished with some morphological operations are connected to recognize the tumor spots/cells in the picture. Likewise it can be utilized to decide the measure of spreading of malignancy i.e. what proportion of lung is influenced wit disease. The morphological operations are essentially connected by looking at the size and state of the malignancy cell with ordinary cell, and after that the contaminated cells pictures showed onto dim scale picture with greatest intensity. Latest developments in Deep Learning and Deep Neural Networks facilitate the process of image recognition. Using Deep Neural Networks we can search for patterns in an image and determine if we recognize the pattern or not or we can search for multiple patterns and as a result get which pattern was recognized. Training the Neural Network requires a dataset that is predetermined which the Network can use to learn to recognize. Deep neural networks are becoming more and more popular as they can be applied to image pattern recognition and image classification.

Few other derivative methods emerged, such as, template matching, Support Vector Machine, Deep Restricted Boltzmann, Stacked Auto-encoders and Deep Convolutional Networks, [1]. In [2], they are using modified Alex-Net model, where instead of using back propagation, they are using unsupervised sparse auto-encoder machine. By using this auto-encoder, they are accelerating the learning feature success of the Deep Neural Networks to 90.1%. They are testing this feature on Synthetic Aperture Radar (SAR) images, where the algorithm classifies these images into predetermined classes. Properly trained Deep Neural Network usually requires large data set and adjustment of many parameters to get border line results, assuming that the algorithm does not over-fit. Since, large amounts of medical images is hard to be obtained, other methods are to be used to train the DNN. In [3], they are using active learning to help with the data set, that is to help with selecting and classifying the images before training. They use multistage training scheme to overcome the overfitting problem, which in term means that they start off with a smaller data set, and reduce it up to the point where there is no overfitting. For each next step they predict the amount of data they need to send the DNN and measure if and when overfitting happens.

II. METHODOLOGY FOR LUNG CANCER DETECTION

The methodology adopted in this project was carried out in five steps which are shown with the help of a flow chart in Fig.1. Each step of the flow chart is explained below.

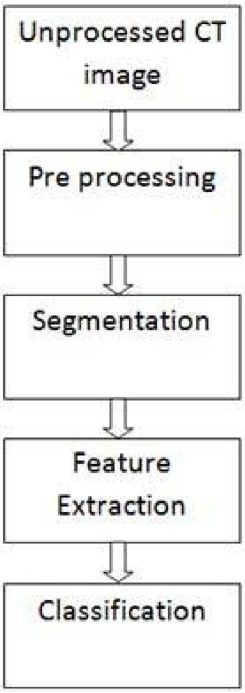


Fig.1 Methodology Block Diagram

1) Data collection

The CT images of lungs acquired from the hospital database are shown in Fig.2. We will analyze how this algorithm helps us to distinguish between cancerous and non-cancerous images.

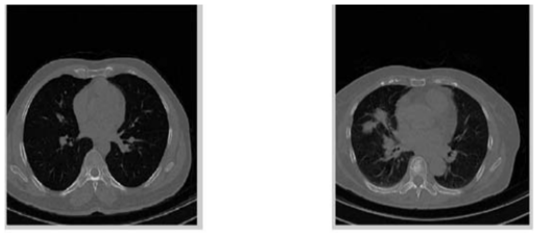


Fig.2 .a. Non- cancerous image b. Cancerous image

2) Pre-processing

Preprocessing involved the steps shown in Fig.2.

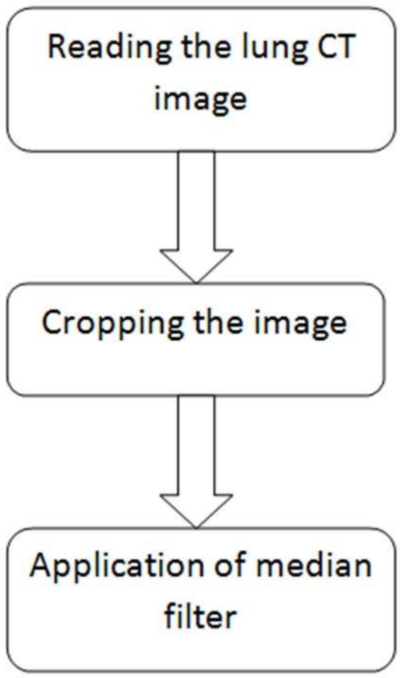


Fig.2 Pre-processing flow diagram

Cropping of the image in first step is done to eliminate the unwanted portions from the image. Next, median filters are applied to the images, which are basically used to get rid of the salt and pepper noise present in the images. A median filter of size 3*3 was used and its contribution towards enhancement of the images is shown in Fig.3.

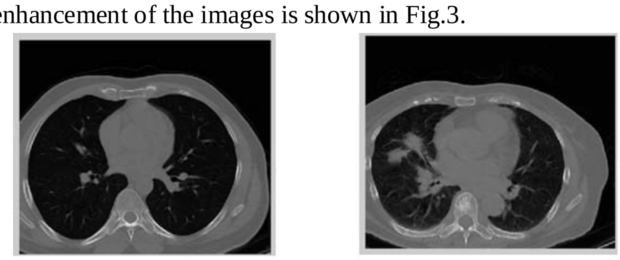


Fig. 3 Median filtered images

3) Segmentation

Segmentation steps are depicted in flow diagram, shown in Fig.4. and each step is discussed in detail. Converting the images to binary reduces computational complexity and storage issues and also is a pre-requisite for morphological segmentation of lungs. The opening operation using the periodicline structuring element tends to remove some of the foreground pixels from the edges of the region of foreground pixels.

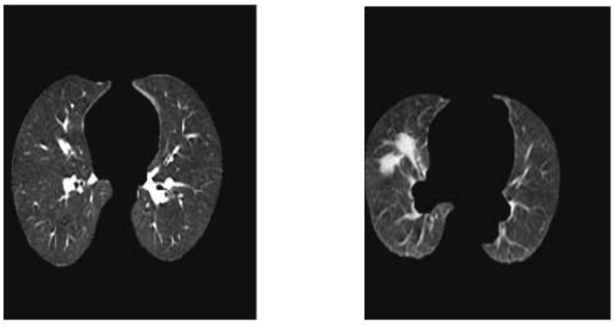
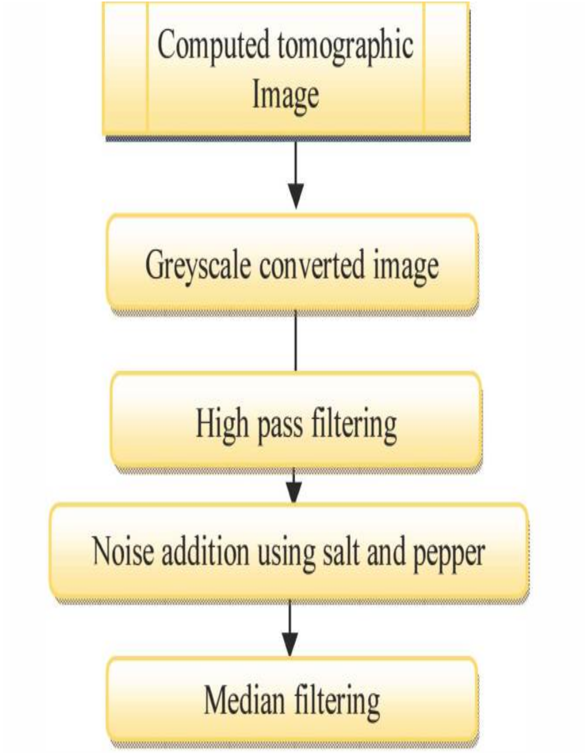


Fig. 4 Segmented Lungs

III. FACILITIS REQUIRED FOR PROPOSED WORK

After segmentation, a circular mask is applied to the output of watershed to remove any regions outside the lung parenchyma. The resulting image shown in Fig. 2(d) contains the lesions present in the CT scan. The normal and abnormal lesions are identified by calculating diameter of lesions using connected components algorithm. Any lesions which have more than 3 mm in diameter or 11.3385 pixels is considered as an abnormal case.



The CT scanned Image with cancer infected lung as seen a spot in left lung from patient's point of view is obtained from the cancer institute is in fig. 3

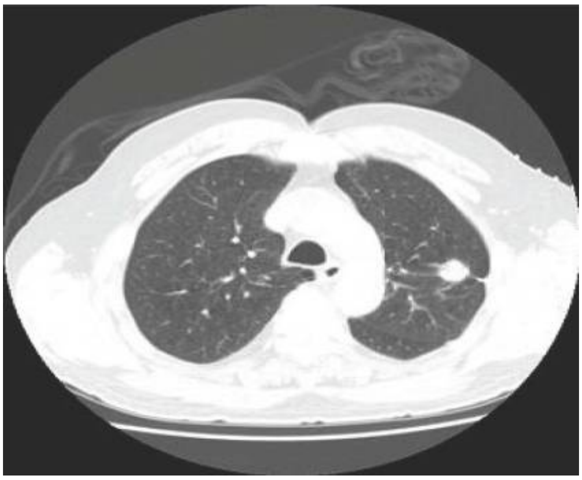


Fig.5 CT image of Cancer Infected Lungs

The CT image is converted to grayscale image to perform mathematical operations shown in figure 4. In terms of digital, greyscale is a unique, reflexive and unit distance code. Changing from bit to bit is only of unit distance so probability of error is minimum.

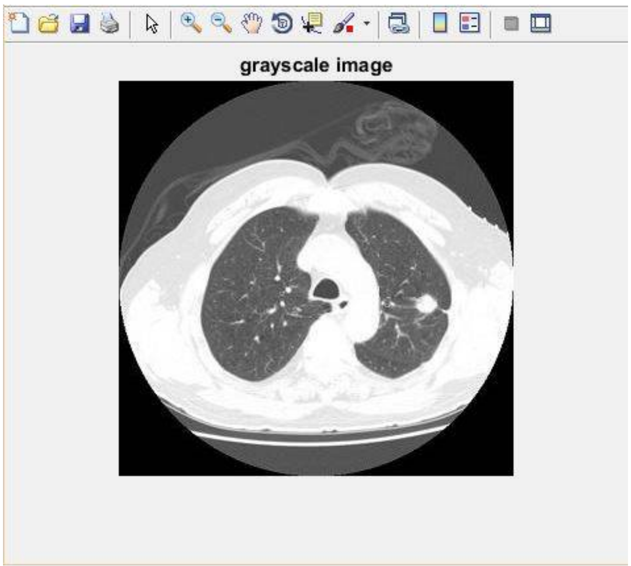


Fig.6 Greyscaled Image

Now it is ready to carry out further mathematical operations, the image is passed through a high pass filter to enhance the information needed shown in figure 5 but there is problem of edge preserving.

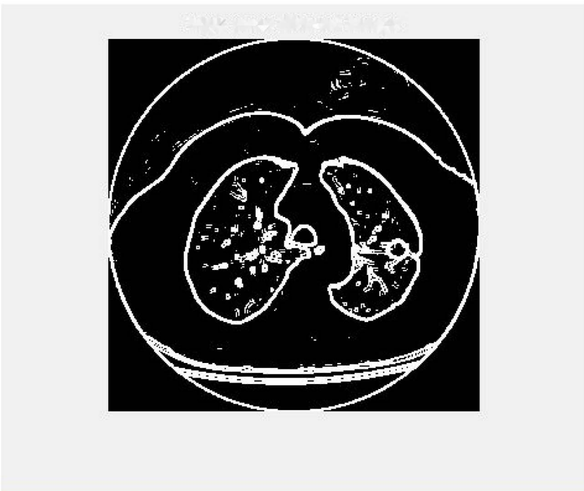


Fig.7 High Pass Filtering

The segmented image is shown as follows in figure 9. There are various threshold detection methods like P- tile thresholding, optimal thresholding, mixture modelling, and adaptive thresholding. All the above methods are automated. For cancer cell detection Ptilethresholding is used because in this process object is with lesser/greater intensity as compared to background and subjugates a definite known percentile lip from the total image area (example: printed text sheet). We set the threshold by finding the intensity level such that lip image pixels are below this value

Fig.8 Watershed Segmentation

The output of the watershed image contains pixels of infected lung tissues which are not labeled. These pixels are in the form of watershed lines. Figure 9 shows the output image after successful Morphological operations. This figure clearly represents left lung being more infected by cancer with background stating the cancer region as compared to right lung of the given CT scan image. Also pink marks with the help of binary morphology indicating cancer region affected in both the lungs can be seen in following image.

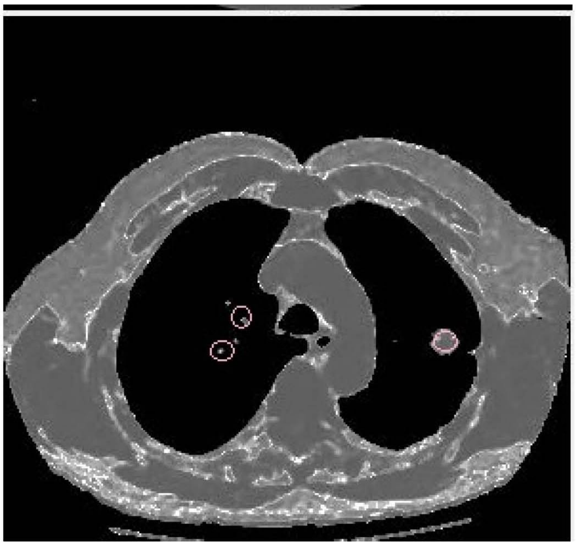


Fig.9 Output Image with Input Image after Morphological Operations

REFERENCES

[1] PriyankaKamra, RashmiVishraj, Kanica and Savita Gupta, “Performance Comparison of Image Segmentation Techniques for Lung Nodule Detectionin CT Images”, IEEE International Conference on Signal Processing, Computing and Control, 24-26, Sept 2015.

[2] NegarMirderikvand, MarjanNaderan and Amir Jamshidnezhad, “Accurate Automatic Localisation of Lung Nodules using Graph Cut and Snake Algorithms”, IEEE 6th International Conference on Computer and Knowledge Engineering, Oct 2016.

[3] Qiu Shi, Wen Desheng, Cui Ying, and Feng Jun, “Lung Nodules Detection in CT Images Using Gesalt-Based algorithm”, Chinese Journal of Electronics, Vol. 25, No. 4, July 2016.

[4] Sara Soltaninejad, Irene Cheng and AnupBasu, “Robust Lung Segmentation Combining Adaptive Concave Hulls with Active Contours”, IEEE International Conference on Systems, Man and Cybemetics, Oct 2016.

[5] Lung Imaging Database Consortium www.wiki.cancerimagingarchive.net

[6] SayaliSatishKanitkar, N.D. Thomare and S.S. Lokhande, “Detection of Lung Cancer Using Marker-Controlled Watershed Transform” IEEE International Conference on Pervasive Computing, 8-10 Jan 2015.

[7] Tong Jia, Hao Zhang and HaixiuMeng, “A novel lung nodules detection scheme based on vessel segmentation on CT images”, Bio-Medical Materials and Engineering 24 (2014) 3179 3186.

[8] Nisar Ahmed Memon, Anwar MajidMirza, 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

[9] R. Gonzalez and R. Woods, Digital Imaging Processing (NJ, Prentice Hall, 2002).

[10] Ivanov, A., Zhilenkov, A., The prospects of use of deep learning neural networks in problems of dynamic images recognition, Russian Young Researchers in Electrical and Electronic Engineering (EIConRus), Russia, 2018

[11] Huang, T., Gao, F., Wang, J., Combining Deep Convolutional Neural Network and SVM to SAR Image Target Recognition, International Conference on Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData), United Kingdom, 2017

[12] Stanitsas, P., Cherian, A., Truskinovsky, A., Active convolutional neural networks for cancerous tissue recognition, International Conference on Image Processing (ICIP), 2017, China

[13] Cruz-Roa AA., ArevaloOvalle JE., Madabhushi A., González Osorio FA., A deep learning architecture for image representation, visual interpretability and automated basal-cell carcinoma cancer detection, Medical Image Computing and Computer-Assisted Intervention – MICCAI 2013, Japan

[14] Sarraf, S., Tofinghi, G., Deep learning-based pipeline to recognize Alzheimer's disease using fMRI data, Future Technologies Conference, USA, 2016