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An Implementation of Deep Neural Network for Lung Cancer Detection

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Abstract: *Lung cancer varies from region to region due to a variety of medical factors. Early detection of lung cancer is paramount to reducing high mortality. The global lung screening program focuses on performing PET / CT scans in the most vulnerable groups to increase early detection rates. Despite the use of cumbersome procedures, side effects rarely occur until the infection progresses, making it difficult for a radiologist to detect the wound. Each year, the American Cancer Society estimates the number of new growth cases and deaths worldwide this year and collects the latest information on tumor incidence, mortality, and survival. Realistic and accurate information is the basis of the disease management initiative. Over 3/4 of illnesses have been confirmed with tobacco use. In addition, hereditary components, exposure to environmental toxins, and second-hand smoke can rapidly amplify the disease. Cycles such as chemotherapy, radiation therapy, surgery, and skin-opening drugs increase survival and personal well-being. This strategy concerns the basic idea of digital image processing, the early and critical stages of diagnosis with a segmentation strategy and a sharp computational method with various computational noise reductions. Use MATLAB to examine the location of CT images obtained from cancer research institutes.*

Keywords: CT, PET, MATLAB, Lung Cancer Detection CNN (Convolutional Neural Network).

I. INTRODUCTION

Lung cancer is one of the leading causes of death and is the most frequently diagnosed in the world. For both men and women. Of the 222,500 new cases in the United States, an estimated 155,870 Americans died of lung cancer in 2017, according to the American Cancer Society. [4] The 5-year survival rate for lung cancer is 17.8%, which is lower than 65.4% for the colon, 90.35% for the breast, and 99.6% for the prostate [5]. The presence of lung nodules can be a sign of lung cancer. Only 16%

It is diagnosed at an early stage of the cases. If these nodules are found at the localized stage, the chances of survival can increase from 10-15% to 65-80% [6]. Diagnostic imaging methods such as multi-detector x-ray computer tomography (MDCT) are widely used in the diagnosis and treatment of lung cancer. Advanced CT scanners generate large amounts of CT data, making interpretation and manual segmentation of all CT data extremely difficult and time consuming. It burdens the radiologist and increases his workload. However, a visual examination of this vast set of images increases the likelihood that some important pathological details, especially abnormalities, will be overlooked.

To address this issue, computer-aided diagnosis (CADx) and computer-aided detection (CADe) are being studied to help radiologists evaluate CT images, helping to improve diagnostic accuracy. Over the last 20 years, researchers around the world have been studying CAD methods [7–10] to improve the accuracy of lung nodule detection. Recently, statistical methods based on machine learning (support vector machines, decision trees, etc.) and CADx / CADe systems have been proposed. Several commercial CAD (Image Checker, SyngoLungCARE, Visia CT Lung CAD, iCADQuickCue, LMS-Lung / CAD) and CADx (Lung VCAR, Brilliance Workspace, detection of lung cancer detection from chest CT and distinction from lung disease) There is also. Recently, several researchers have reported on the use of AI-based tools to solve medical imaging problems based on training using CT images, CT scans, and histopathological images. ,Such. Deep learning is a very powerful tool for learning complex cognitive problems [6, 7] and its use and reputation in a variety of problems is increasing [8]. In this study, we used a deep learning algorithm using a convolutional neural network (CNN). This makes it possible to efficiently detect lung cancer from chest CT images and make a quick diagnosis.

II. LITERATURE REVIEW

1. Priyanka Kamra et al [1], compares different lung nodulesegmentation methods. The paper compares iterativethresholding and Fuzzy region-based level set methods. A dataset of 52 patients was used and 82.7 % of True positiveratio was achieved.
2. Negar Mirderikvand et al [2], proposed an automaticlocalization of lung nodules. It uses Graph cut and snakealgorithm on the 27 CT scans from the LIDC database and achieved a 100 % true positive rate.
3. Qui Shi et al [3] proposed a lung nodule detection methodusingGesalt based algorithm. The method segments the lungregion from the CT image first. Then, local three-dimensionaldatawere incorporated to the maximum intensity projection image taken from sagittal, axial and coronal planes. 50 scansfrom the ELCAP public database is used and an accuracy of91.29 % was achieved.
4. Sara Soltaninejad et al. [4] proposed a robust lungsegmentation by combining active contours with adaptiveconcave hulls. It used CT scans from the TABA medicalimagining center of Shiraz medical school and fromANODE09. It gave an accuracy of 95.9 %, sensitivity of90.1% and specificity of 97.6 %. In the proposed method,adaptive thresholding and watershed segmentation techniqueare used to detect lung nodules in the 50 CT scan images.
5. Shukla et al (2009) proposed a novel technique to simulate aKnowledge Based System for diagnosis of Breast Cancer using Soft Computing tools like Artificial Neural Networks(ANNs) and Neuro Fuzzy31Systems. The feed-forward neural network has been trained using three ANNalgorithms namely Back Propagation Algorithm, Radial Basis Function(RBF) Networks and the Learning Vector Quantization (LVQ) Networks, Adaptive Neuro Fuzzy Inference System (ANFIS). The simulation was done using MATLAB and performance was evaluated by considering the metrics like accuracy of diagnosis, training time, number of neurons, number of epochs etc., and these parameters can be very effective for early detection of Lung Cancer.

III. PROPOSED SYSTEM

3.1 Background for Lung Cancer

Carcinoma causes abnormal cells to grow out of control in the body. In the human body, normal cells follow an organized pathway of growth, division, and death. The malignant cells of the carcinoma are not killed, instead it develops and spreads enormously. Abnormal accumulation cells that spread out of control develop. Cancer is a major sign of death worldwide. The World Health Organization (WHO) reported 7.4 million deaths from cancer (13% of all deaths) in 2015. Deaths from this disease will reach 13.1 million by 2030. By 2017, the National Cancer Institute states that there are an estimated 222,500 new lung cancer diagnoses and 155,870 lung cancer-related deaths. A group of abnormal cells is called a tumor. Tumorsare either benign or malignant. Benign tumors are tumors that are not cancerous. The tumor does not flood nearby tissue, but stays in one place. Malignant tumors are dangerous cancerous tumors. They easily invade surrounding tissues and spread the cancer to other parts of the body through the blood or lymph nodes. Cancers are named after the organs in which they begin. The most common types of cancer are lung cancer, breast cancer, prostate cancer, ovarian cancer, and bone cancer.

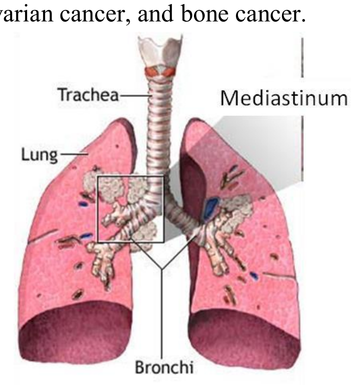


Figure 3.1 Different parts of a lung

3.2 Lung Cancer Types and Stages

Lung cancers are broadly classified into two main categories. They're Small Cell Lung Cancer (SCLC) and Non-Small Cell Lung Cancer (NSCLC).NSCLC reports85-90% of lung cancers, while SCLC accounts for the remaining 10-15%. While the growth and spread of NSCLC is slow, SCLC is a fast-growing cancer and spreads. rapidly to other body parts. Smoking is the main cause in all cases of SCLC, NSCLC will be treated with surgery, chemotherapy, radiotherapy, depending on the stages of cancer is diagnosed. SCLC cancer is mostly treated with chemotherapy. Differencebetween SCLC and NSCLC are listed in Table 1. There are 4 different types of NSCLC, each having different treatment options:

A. Epidermoid / Squamous Cell Carcinoma

The cancer forms in the lining of the bronchial tubes and is most common in men.

B. Adenocarcinoma

The cancer formsin the mucus glands of the lungs and is most common in women and non-smokers.

C. Bronchioalveolar Carcinoma

The cancer forms near the air sacs of the lungs and is a rare type of adenocarcinoma.

3.3 Identification of Lung Cancer

Identification of lung cancer are made in the following ways:

A. History and Physical Examination

Medical history of the patient and physical examination for the symptoms are done initially. Once the results suggest that there might be lung cancer, then the following diagnosis tests are carried out.

B. Diagnostic Tests

Diagnostic tests include:

- **Sputum cytology:** In sputum cytology the sputum samples are collected and examined using amicroscope to search for the cancer cells presence.
- **Biopsy (bronchoscopy, needle biopsy, surgery):** The removal of a small part of the tissue from a suspicious area for study and analysis under a microscope is called biopsy. It is an invasive technique. Further test will results the type of cancer and how fast it has been spread, once the biopsy test confirms lung cancer.
- **Chest CT:** It is the first imaging test carried out for identification of lung cancer. XRay images usually identified nodules usually greater than 1 cm. If there is any abnormality in the chest CT then the patients may be suggested toundergo staging tests. If a lung tumour is small or hidden behind a rib, breast or collar bone, a chest CT can miss it.
- **MRI (Magnetic Resonance Imaging):** scans uses a large magnet to produce 3d images. MRI can be used to study any region in particular that couldn't be decisively interpreted on a CT scan. MRI is useful in looking at Cancer cell involvement.

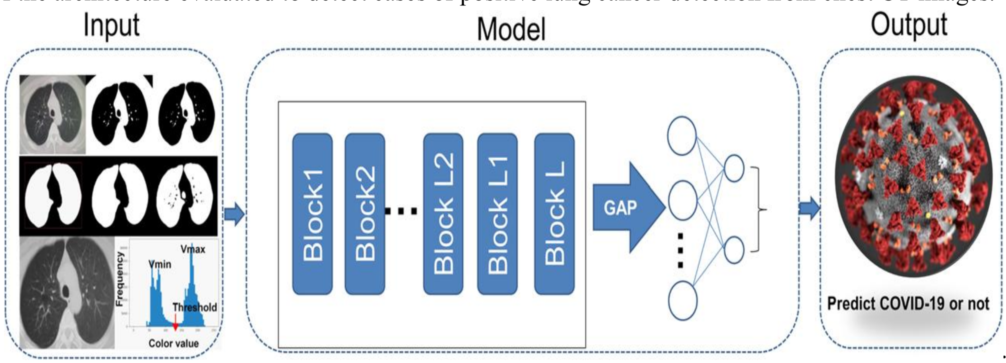
IV. FACILITIS REQUIRED FOR PROPOSED WORK

4.1 Introduction

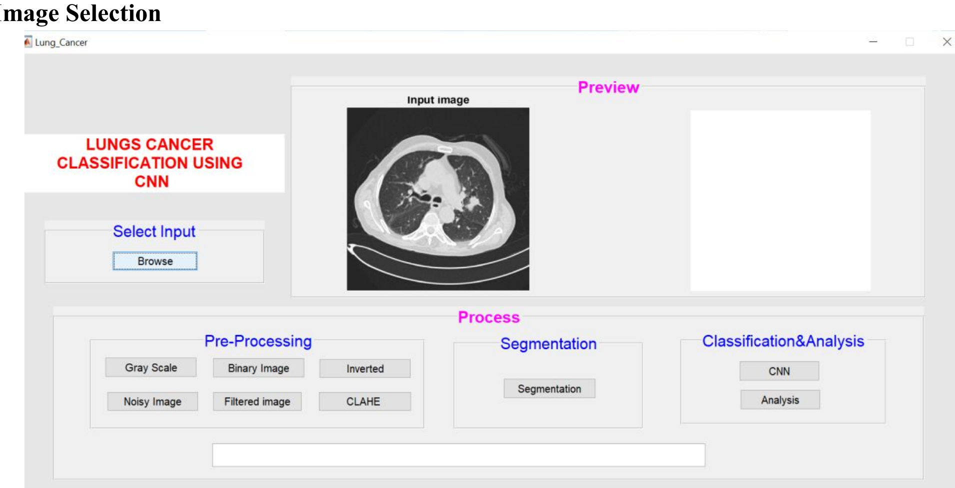
Detection of positive cases in the detection of lung cancer is performed using a convolutional neural network. Specifically, we use the well-known deep CNN model to classify images, pre-train them from a large image database, and retrain them to learn positive and negative cases of lung cancer detection.

Chest x-rays clinically diagnosed as COVID-19 positive are pretreated and used to retrain existing deep CNN models for imaging classification. The CT image preprocessing consists of image resizing and pixel value normalization to meet the input specifications of each newly trained deep CNN model. The CNN model is retrained as a binary classifier to identify positive lung cancer detections compared to lung cancer detection chest CT images. The newly trained

DeepCNN model used in the test receives a new chest x-ray with an unknown clinical diagnosis as input and automatically flags it as a positive or negative case of lung cancer. H. Provides binary decisions via chest scan. Block diagram of the architecture evaluated to detect cases of positive lung cancer detection from chest CT images.



4.2 Input Image Selection




```
global image img path
[filename,filepath] = uigetfile({'* .jpg;*.png'},'File selector');
path = strcat(filepath,filename);
image = imread(path);
img=image;
axes(handles.axes1);
imshow(image);title('Input image');
set(handles.pushbutton6,'Enable','off');
set(handles.pushbutton10,'Enable','off');
```

4.3 Preprocessing

4.3.1 Gray Scaled Image

```
global image IMG
IMG=rgb2gray(image);
axes(handles.axes2);
imshow(IMG); title('Gray Scaled image');
```

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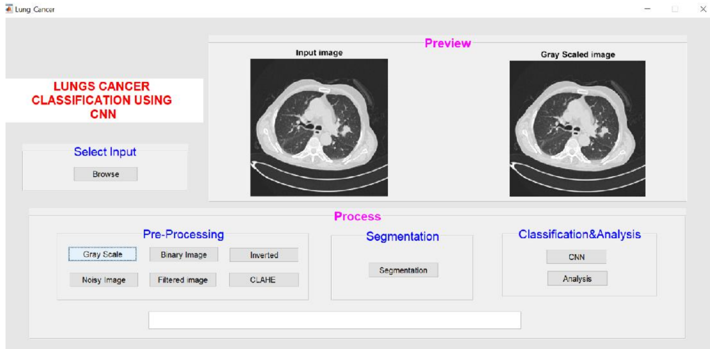
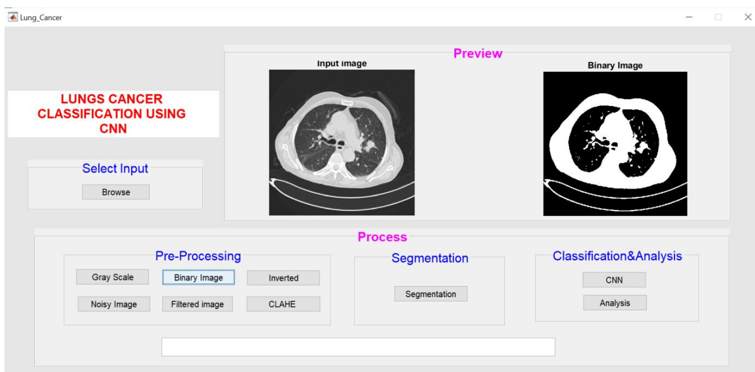


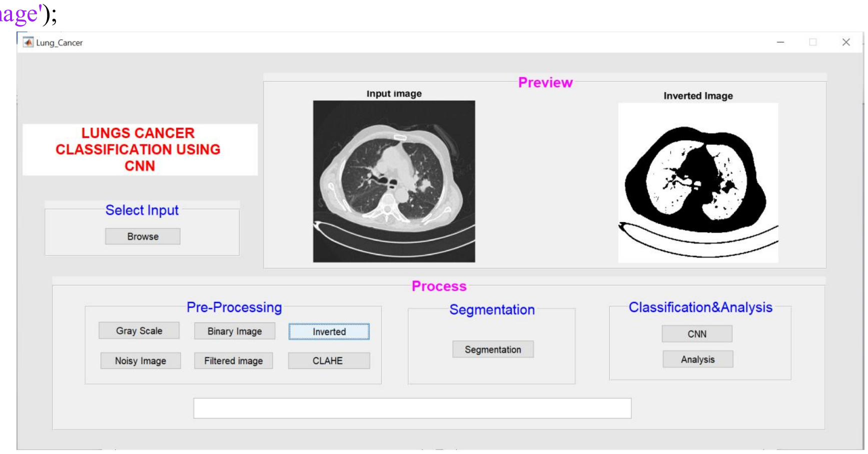
4.3.2 Binary Image

```
global IMG binary
binary=im2bw(IMG,0.5);
axes(handles.axes2);
imshow(binary);
title('Binary Image');
global binary
```

4.3.3 Inverterd Image

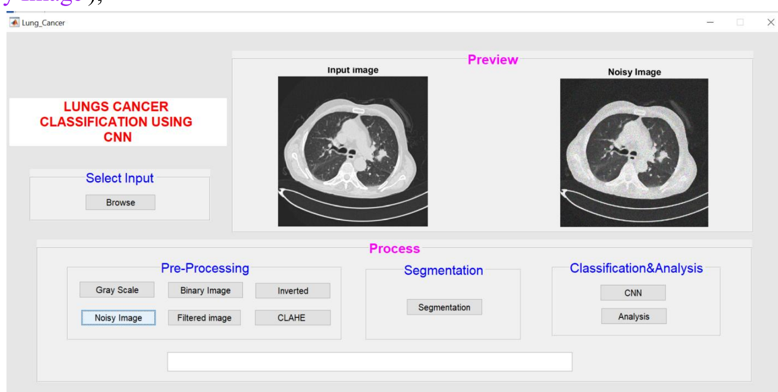



```
inverted=~binary;
axes(handles.axes2);
imshow(inverted);
title('Inverted Image');
```



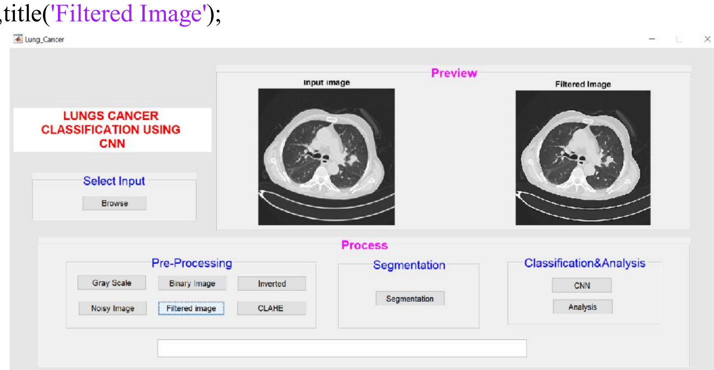
4.3.4 Noisy Image

```
global path
global Input_Image1 Input_Image
Input_Image = double(imread(path))/255;
Input_Image = Input_Image+0.01*randn(size(Input_Image));
Input_Image(Input_Image<0) = 0; Input_Image(Input_Image>1) = 1;
D = 2;
SIG = [7 0.4];
Input_Image1 = DATA(Input_Image,D,SIG);
scale = 1e10;
J = scale * imnoise(Input_Image1/scale, 'poisson');
axes(handles.axes2);
imshow(J),title('Noisy Image');
```



4.3.5 Filtered Image

```
global Input_Image1
h = fspecial('unsharp');
Input_Image1 = imfilter(Input_Image1,h);
axes(handles.axes2);
imshow(Input_Image1),title('Filtered Image');
```



V. CONCLUSION

Several Computer Aided Diagnosis (CAD) systems were developed for detecting lung cancer in its early stage using CT images. The CAD systems mainly concentrate on identifying and detecting the lung nodules. There exist no CAD systems for identifying the stage of the lung cancer. Staging the lung cancer at its detection need to be focused as the treatment is based on the stage of the cancer. The major drawbacks of existing CAD systems are the accuracy in segmenting the nodule and staging the lung cancer. This research concentrated on developing CAD methods for segmenting the nodules and detecting the various stages of the lung cancer, thereby aiding the radiologists for analyzing the disease. Staging of cancer at its investigation is the major predictor of survival, and it determines the treatment.

The segmentation process is largely implemented automatically. Yet automatic segmentation technique will always not yield accurate results due to the fact that the tumorsize and location can be diverse with different pixels range. Interactive segmentation methods are assisted by the radiologist and hence expecting more accurate results in medical image processing. The major dispute in nodule segmentation is extracting the nodules with irregular shapes. This research focused on the development of a hybrid method of using the random walk algorithm with 100 weights modified and watershed algorithm for interactively segmenting the nodules with irregular shapes. The following are the rewards of proposed method Nodules with irregular shapes are segmented precisely. • Free parameter is replaced by a constant β. With small amount of seed points accuracy is improved. The proposed method is tested with 23 CT images. Accuracy of segmentation is devised based on the parameters of the nodules such as its area, major axis, minor axis, eccentricity and perimeter.

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