SURVEY ON LUNG CANCER DETECTION USING CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT

The deaths caused by cancer is increasing day by day one of the major reasons is lung cancer. Detecting lung cancer at initial stages greatly lessens the number of patients die and dramatically increases the likelihood that the patient will be saved. This paper aims to classify malignant and non-malignant development in the lung using the Convolutional Neural Network (CNN) algorithm. As a progressively mechanized methodology, the CNN technique uses picture information as input information and can be straightforwardly classified as yield. The machine will detect the image of the lung nodule participant in characteristics with various targets and dimensions when observing the disruption in the standard representation of the lung nodule due to its radiological complexity and fluctuation of sizes and shapes, thereby doing the constructive side of the classification function and enhancing the precision of classification steps. Many different methods of detecting lung cancer nodules exist but we will be focusing on Convolutional neural networks that utilizes deep learning techniques.

Keyword: *Key word1Lung Cancer Detection, CNN, Convolutional neural networks, Deep CNN, Detection.*

I. INTRODUCTION

Nearly 1.8 million deaths are attributed to the cancer known as lung cancer [1]. Even though many methods to cure cancer are available such as chemotherapy and target therapeutics and these have been proven to be effective, poor prognosis persisting in the detection of advanced lung cancer nodules results in a survival time of less than 1year. Therefore, to increase the lifespan of a patient with a lung lesion it is important to detect it in an early stage. CT (Chest tomography) scan, is broadly used in medical field to detect tumors of the lungs [2]. Diameter of 15/16 mm in the lung a protuberance is a small round shaped protuberance(nodule). Chest tomography scanner takes images that give detailed idea about the internal organs that forms a nodule. This also takes into the consideration of round shaped protuberance structure and not all of these are cancerous. Radiologists find these tasks tedious as they have to analyze many small protuberances as more time is consumed. Computer aided diagnosis (CAD) system makes this task simpler. Sections that are evidently affected by lung cancer are highlighted by the Computer aided diagnosis system after processing the digital image. Perception and interpretation of medical images is improved which helps radiologists and doctors [3]. In the approach we are proposing a method using CNN and deep learning aptly called Deep CNN.

II. SURVEY STUDY

Sayana Sharma et cetera all [4], presented a method in which a CAD system is used along with CNN to detect the presence of lung nodules. The Proposed technique uses CT images as input. Equalization, segmentation, and morphological operations are some image processing techniques applied for the feature extraction. A Convolutional Neural Network classifier is well trained to predict the lumps as malignant or benign.

Balachandar et cetera all [5], presented a method to detect lung cancer. This method has only three steps. The first step is pre-processing and segmentation of 3D CT images. After segmentation linear scaling is applied to normalize the 3D image to produce the values between 0 and 1. To filter the noise, Marker-driven watershed segmentation is used. The second phase is to detect the nodule(s), this is done by selecting small boxes containing top cancerous nodule candidates. The third phase is to predict the nodules as malignant or benign using the softmax layer of the U-Net layer.

Yashaswini et cetera all [6], proposed a method that uses both SVM and CNN. Support Vector Machine is an approach of machine learning used for classifying the system. SVM builds a hyper plane in a very high dimensional area, that can be utilized for classification, regression, or outlier's detection. A CNN uses 2D convolutional layers for pre-processing of CT images. This method uses very little pre-processing. Output is obtained using SVM classifier. CNN classifier is used to detect whether the nodule is cancerous or not.

Fuqiang Zhou et cetera all [7], presented M-RCNN to categorize the nodule candidates. This step is done by drawing out various features and resolutions. The Knowledge-transfer method classifies the detection process in 3 steps. First step is knowledge-transfer that has come from source CNN. This can be used for edge detection. Second step is knowledge- transformation that has come from training progress. Each output is used for the calculation. Data enhancement & sample production are the final step in the process that are accomplished for testing & training. Finally, output is predicted by using classifier, that is the nodule is cancerous or not.

Jenuwine et cetera all [8], Presented a method which uses candidate selection. The system recognizes objects that are resembling candidate nodules. A filter consisting of algorithms based on machine learning is applied to separate false positives and true nodules. A computer aided diagnosis system with 3D CNN to detect cancerous nodules present in CT images without the help of candidate selection. A 3D CNN is trained with the data from LIDC database, the CNN is trained well so that it researches sub volumes from anywhere in the given CT image and output the probability of that sub volume containing a nodule. These are inputted to the CNN to get the corresponding probabilities. The probability ranges from 0-1, zero denotes benign and one denotes malignant.

Lin et cetera all [9], proposed a method that uses 2D CNN with Taguchi parametric optimization to boost the efficiency of classification and CAD system structure. First step is to apply Taguchi Method to evaluate the optimal parameter combinations for the 2D CNN. Second step is to extract the input CT images to the 2D CNN model. Third step is to set the optimization parameters of the 2D CNN model to train and achieve the result.

Dongbao et cetera all [10], presented a framework which uses 2D CNN for pulmonary nodule recognition. The first step is pre-processing the data from CT images. F(Faster)R-CNN is altered using de-convolutional layer and 2 region proposal networks to detect of candidate nodules. FP is reduced by training 3 different models of different slices. Boosting architecture stationed on 2-Dimensional CNN is used to detect true protuberances from candidate protuberances. Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work.

III. METHODOLOGY

In this method, we are proposing, we detect cancerous nodules supported by Chest tomography images of the lungs by the use of Convolutional Neural Network. In the first step, we extract lung regions from the Chest tomography image, and in this region, each of the slices is segmented to urge tumors. Convolutional Neural Network architecture is trained by inputting the segment in the previous step. After which, CNN is employed to check the patient scans

then the softmax layer determines the ultimate outcome. The ultimate aim of the study is to find malignancy or benignity of the patient's lung nodule.

3.1 DATASET

LIDC-IDRI is where we get our dataset, from which we train our model. LIDC-IDRI contains 1000s of CT scans that consists of large and small tumors saved in DICOM format.

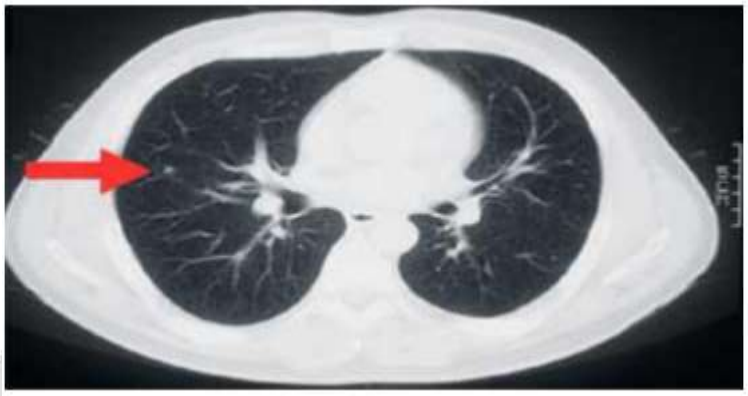

Fig -1: CT Scan slice at an early-stage of lung cancer

3.2 FLOW DIAGRAM

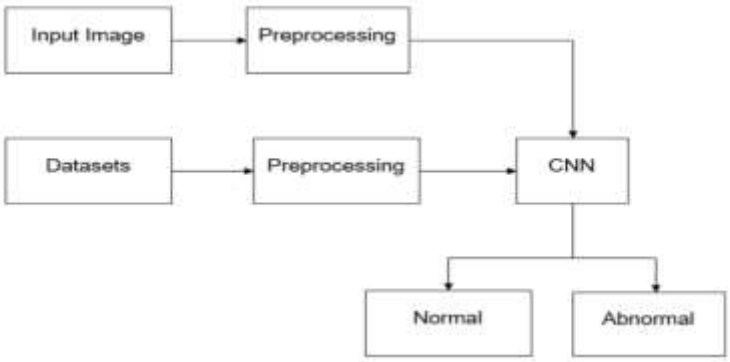

Fig -2: Flow diagram for the CNN architecture

3.3 PRE-PROCESSING

within the pre-processing stage, a median filter is utilized to revive test beneath test by minimizing the results of degradations throughout acquisition. The median filter just exchanges every pixel value with the norm of its adjacent pixels and this includes itself. Hence, pixel values that contrast from their adjacent pixels will get removed during this process [11].

3.4 DEEP LEARNING

It consists of multiple layers that are non-linear nodes, coupled with computer file, a collection of weights so that assigning importance to inputs for the interrelated task the algorithm is attempting to be told in supervised and/or unsupervised behaviour. The sum of the product of that input and weights is passed through the activation function of nodes. Every layer of the output is given concurrently as input to the next layer ranging from the input layer. Learning is often performed in numerous levels of forms that correspond to numerous levels of abstraction [12].

3.5 CONVOLUTION NEURAL NETWORKS (CNN)

CNN is a kind of a Deep-NN that consists of many concealed layers such as the convolutional layer, rectified linear unit layer, pooling layer and a completely connected normalized layer. To reduce the memory CNN largely shares its weights in the convolutional layer and thereby improving the performance. we use a deep learning methodology to detect candidate nodules present in Chest tomography scans. The ultimate aim is to train DCNN to detect lung protuberance in sub-quantity of Chest tomography images. This can be used to determine the boundary and location of candidate nodules in unprocessed Chest tomography images. The Convolutional Neural Network is formed of a total of twenty layers, these twenty layers are partitioned into 2 parts. In the first part valuable volumetric information of the input data is extracted using Convolutional Neural Network. The network further consists of numerous convolution layers, Rectified linear unit, & max pooling layers. Classifier is the next part of the Convolutional Neural Network.

A Deep CNN consists of many hidden layers such as fully-connected layer, thresholding layer. Finally, softmax layer is used to determine the result [13].

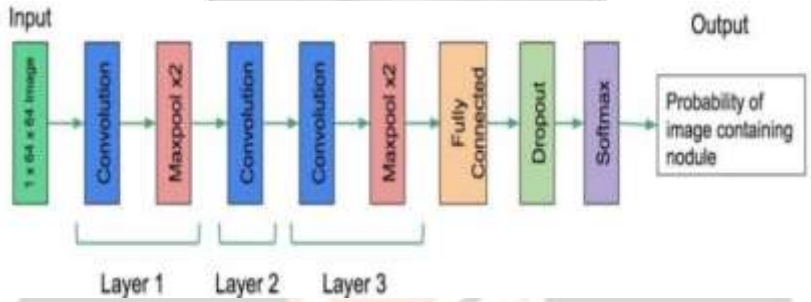

Fig -3: Architecture of CNN

IV. RESULT COMPARISION

Result Comparison of different methods on lung cancer detection.

Table -1: Comparison of the results of the papers.

Authors	**Model**	**Results**
Sharma et al	CNN	Accuracy=0.9733precision=0.9673 AUC = 0.9954
Chon et al	Deep CNN	Sensitivity=0.652 ACC=0.665 AUC=0.663
Yashas-wini et al	CNN & SVM	Wt. average =.90 Precision=0.80 Recall=0.80
W.Zuo et al	CNN with knowledge Transfer	CPM=0.787
Jenuwine et al	3D CNN	AUC=0.722

Lin et al	Taguchi Parametric optimization	Accuracy=94.68
Hongtao et al	2D CNN with faster R-CNN	Sensitivity=86.42

V. CONCLUSION

From the above all paper, it is evident that diagnosing the lung cancer at initial stages is still challenging. To overcome all these challenges, we are proposing an optimized Deep CNN method [8]. The reason to choose CNN is that it can extract the spatial from the data using kernels, which other networks are not capable of. The proposed method uses D-CNN to detect lung cancer based on the CT images. A Deep CNN consists of many hidden layers such as fully-connected layer, thresholding layer. Finally, softmax layer is used to determine the result.

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