

The Detection and Prevention of Lung Cancer using Convolution Neural Networks - A Review

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Abstract—Lung cancer is one among malignancies with high risk of morbidity and mortality ration. In each phase of lung cancer detection imaging plays as vital role to develop imaging based AI models which plays potential key role in detection and customized cancer treatment for the patients. Lung nodule detection by computer aided techniques has recast early detection of lung disease. The feasible use of AI approaches has limitations and more screening program required to detect and identify lung cancer patients with high risk factor. The promising results can be obtained by combining clinical laboratory data and image features using AI models to predict patient's outcomes, specific therapy responses, risk factor computation and toxic reaction developments etc. In the research review, which provides an overall overview of AI based imaging tools, an automated lesion detection and its characterization, segmentation process, predictions of the outcomes, to provide exact and on time treatment by radiologist and clinicians with the foundations of specific applications in the medical era.

Index Terms— Lung Disease Diagnosis (LDD), X-rays, lung cancer; convolution neural network, medical images artificial intelligence.

I. INTRODUCTION

The major challenge with early detection and prevention of the lung cancer is the persistent clinical problems which reflect the desire behavior of the malignancy. According to Indian statistics out of which 20-25% will be susceptible to an accurate cure with 5 years of survival rate. The recent- technical era development study focused more on the CT image screening to detect small lung tumors includes availability of MDCT and computer aided diagnosis to analyse the images. To improve the ability detect peripheral lesions the technological development provides new challenges and opportunities initiate innovative technology adaptations. Filtering can be normally used in noise reduction and smooth edges. To extract needed region segmentation process can be carried out so that results in less space requirement. In the second stage of this work features from the spliced and authentic image are checked by applying hybrid Kerke discrete cosine transforms. All the use of CT images is well documented to be enhanced method to detect pulmonary nodules lesions with small size remains difficult in identification using one detector CT scanner. Nodule detection factors include morphological appearance of the small nodules variability caused by intra and inter observers. Technical factors which affect the detection of nodules slice thickness reconstruction interval, differences in viewing method, pitch and dose etc.

Lung Nodule Characterization To differentiate malignant from non-malignant nodule which is the major issues

in the current medical field because nodule growth changes with respect to time which leads to change in accuracy [1].

II. LITERATURE REVIEW

The related work on LDD is a in depth study of various research articles relate to the lung cancer diseases normally which uses image- processing concept and techniques on the CT , X-ray images. The authors of this research paper, considered ATA (adaptive-threshold algorithm) watershed algorithm, mathematical morphology [2].The researchers of the present article have applied some steps to segment an images, during first step they have targeted to enhance the quality of the images with the help of Gaussian filter and noise reduction using gradient enhancement technique to extract the noise of the CT images. And in the second step they extracted and removed bronchus, trachea from the CT lung image finally segmented with the watershed transform method .The testing process was carried out by using of CT lung images in series to segment the cancerenecic area .Finally the research of this article concluded how lung parenchyma can be segmented successfully.

This author stated that the CAD model designed is helpful to detect cancer in the early stage using CT lung images. This author has adapted four steps to detect cancer cells in the CT images taking in to account of medical professionals challenges to diagnose the lung cancer nodules from CT images .The first step filters the noisy contents by applying filtering concepts either by using Weiner Filter, Median, Gabor filter, Min and Max filter etc. In the preceding step thresholding like multiple and optical thresholding, active contour method, shape based method etc were used. Segmentation was introduced to segment suspected nodules .The third step is the feature extraction like geometric features, shape –size features, gray scale features and statistical features need to be extracted from the CT lung images to detect malignant or non-malignant .To extract the features various classifiers like vector machine, generic algorithm, ANN. Rule based classifier, Linear Discriminate Analysis methods were adapted. As concluded by the research author still there is more of improvements required with respect to sensitivity, accuracy and specificity in the existing deionisation system. [3]

T Aggrawal et al. (2015) [4], in the proposed research paper the classification of cancer nodules, the author has introduced a model which uses gray scale characteristics and valuable thresholding values to perform segmentation process of lung nodules by threshold values ,gray scale characteristics to perform segmentation process. The proposed system achieved accuracy, sensitivity, Specificity of 84% , 97.14% and 53.33%.

The research author has proposed a model in which CT images were pre-processed to remove the noise. In the next step fuzzy k-mean algorithm was used to perform segmentation process ,later on the result was improved by k mean approach .In the third step feature extraction was carried out from the CT lung images like correlation ,entropy SSIM,PSNR,homogeneity using statistics GLCM feature extraction method. Finally categorization is carried out using supervised NN like BPNN for the detection of lung cancer. This author has achieved 90.7% of accuracy but this accuracy can be enhanced using improvised classification technique like support vector machine. [5]

This author has proposed CNN model as the classification approach in the CAD system and achieved 84.6%, 82.5% of accuracy and sensitivity and specificity of 86.7% [6].

The author has proposed data mining methods, lung cancer patient database includes images of human upper half body X-rays that classifies like normal or malignant, benign. CAD system uses pattern recognition, feature extraction also classification process. The proposed model used X-ray images and accuracy gained is less comparing with CT images .This study elaborates that to achieve better accuracy implementation work can be enhanced and extended to apply the CT images in superiorised diagnosis of detection of lung cancer in the human body.[7]. The author has developed an enhanced model for segmenting the lung CT images by combining kernel graph cut algorithm and proposed a mathematical model .In the next stage the proposed algorithm was compared with K –mean algorithm, cluster variance algorithm and concluded with the comparative studies between two approaches [8].

In the proposed research article author has developed a CAD based system to detect cancer from lung CT images. This research has adapted four steps like pre-processing, segmentation, classification, and the validation. In the first step filtering process was carried out to enhance the input CT lung image followed by segmentation of blood vessels and pulmonary nodules by applying double level thresholding, morphological operations. In the next step features can be extracted from the segmented lung images which are HOG feature VH features, statistical features of first, second order GLCM etc. Fourth step is to get the better accuracy using MFFNN ,radial basis NN,SVM.The validation process was carried out and the results obtained was CAR is -99.06%, S is -100% and SP is -99.2%.As per this article still there is a scope in improvements in early detection and classification of benign and non-benign tumor. [9]

The proposed article focused on how lung nodules can be diagnosed using skeletonization and Gini coefficient techniques which produces lung images as class malignant or class benign from the Data set .The Gini coefficient technique helps to identify the nodule distribution and the skeletonization helps to analyze the shape of the lung nodules .By considering these two parameters research author has proposed a prototype which performs discriminate analysis malignant or else benign. The results validation was depending on classification methodology and ROC curve. [10].

In the present medical era lung cancer has become the major health challenge in human body. Early stage detection and diagnosis of lung cancer is quite difficult with less rate of survival, risk factor is high if it is not early detected and diagnosed. Different levels of cancer treatments are available in the medical and hospital science like chemotherapy, radiography, surgery depending upon the stages of the lung cancer. The survival rate is 14% for 5 years since cancer develops within the respiratory system epithelium and bronchial trees of the lung and which spread across the human body. [11]

Early stage detection of lung cancer required a powerful technology to assist experts provide a desirable treatment. The techniques like ML techniques , artificial intelligence techniques and image processing can process the lung cancer images, if necessary pre-processing and training of medical CT and X Ray images by adapting NN ,ML techniques.[12]

The researcher has developed a prototype to improvise lung cancer detection using Computed-Tomography lung images, are mainly best suited for detection of pulmonary the nodules in the Lung cancer. [13, 14].

In the present era lung cancer is the major cause which reflects modern lifestyle and contamination and colossally expansion of lungs issue.The lung illness treatments corresponding to the image processing techniques using CAD frameworks implementations. In this prototype initially pre-processing was carried out by highlighting the features from CT lung images .This researcher has adapted advanced image processing, machine learning technologies in the implementation step, later on comparison analysis of diverse classification mechanisms was carried out which will helps to improve % accuracy while detecting lung cancer and suggest the use of advanced classification and segmentation technologies.

To achieve the set objectives the researcher has used an effective segmentation technique like thresholding, ANN, SVM classification techniques. But the obtained results can be further enhanced by improving the accuracy while detecting lung cancer to avoid false positive results because cancer in lung may be treat-able only it is detected in the initial stages. As per the cancer study lung cancer doesn't exhibits early stage and initial symptoms and noise CT images doesn't give exact results in CAD system. The proposed system eliminates the risk and challenges by using filtering techniques like Auto encoder system, segmentation and classification techniques like OTSU algorithm, decision tree, CNN.The researcher has clearly discussed the LDD and how progressing can fulfill the medical filed using R-CAD (Robust) system to overcome the challenges of future work. [15].

Medical cancer detection tools are more essential in initial stage diagnosis and to monitor lung cancer while treatment. For lung cancer detection different medical image modalities like MR images ,X-Ray images ,computed and position emission tomography etc. have been extensively used. The medical techniques adapted have some major limitations like automatic classification of lung cancer nodules is the major challenge. Deep learning technique is the quick growing concept in medical imaging area by considering emerging applications like textual and image based modalities. The author has proposed a deep learning image based system for advance detection of the lung nodules. The recent achievements in the deep learning approaches for lung cancer detection segmentation and classification has proven a wide variety of techniques to achieve enhanced accuracy. Most of the system uses CT image datasets to train the networks and clinical and experimental results demonstrates deep learning technique may be superiorly used by the radiologists which enhances the effectively of the segmentation, classification and detection. Deep learning approach is a potential technique which solves many of the medical challenges in spite of limitations like clinical verifications, privacy protection, legal accountability etc. [16].

Lung cancer detection is the challenging task for clinical and medical professionals to identify the true cause for cancer with in the human body and treatment is the risky and challenging task because exact treatment have not been invented so far . If cancer is detected in the initial stage that can be partially treated. In the medical image processing system involves reduction of noise, feature extraction, detection of damaged segments and comparison with the of medical history which used to locate exact region where lung cancer is located .This research has shown an accurate detection and prediction of lung cancer with the help of image processing techniques and Machine learning techniques. The image filtration steps initiated by the researcher using K-mean method and in the next step images were segmented .For classification ML Techniques like KNN, RF and ANN were used. Among these ML techniques ANN model produces better accuracy for prediction of Lung Nodules.

Approximately one –million lung cancer patients claiming the lives because of lung cancer disease since it is a deadliest type of cancer disease. According to current affairs in medical challenges it is difficult that lung nodule detection using CT scanned images. Even CAD system is also a crucial for the detection, hence image processing techniques is basic activity that is to be carried out in a wide range of medical scenario. This method proposed and demonstrated accurate prediction and classification technique which enables enhanced results with the help of image processing and machine learning techniques. Lung images were collected and pre-processed using geometric mean filter to increase the quality of the images. K mean approach was used to segment the enhanced images, in the next step ML based categorization algorithms were used for classification purpose [17]. Lung cancer staging and its investigation in the initial stage is the basic and major predictor of survival since it determines the treatment options. Using CT images there are much computer-aided diagnostics were developed and this majorly concentrates on CNN-based technology to detect various stages of lung cancer. The proposed work focused on the development of a model by which an improved rate of accuracy classifications of lung nodules and their analysis can be achieved.

III. PROPOSED SYSTEM

The detection of lung cancer adapts filtering segmentation process and quantum machine learning for splicing detection of the medical image. Filtering is normally used to reduce noise and smooth edges. Segmentation is used to extract the needed region so that results can be stored in less space. In the second stage of this work features from the spliced and authentic image are checked by applying hybrid Kerke discrete cosine transforms. In real-time data sets, feed-forward neural network (FFNN) is applied for classification and detection of cancer. Feature extraction is done through gray level and co-occurrence matrix (GLCM).this results helps in differentiating the lung cancer as malignant tumors, benign tumors. Artificial neural network is trained to differentiate the cancer stages by analyzing accuracy, area, correlation, entropy, and contrast and similarity index.

Objectives of the proposed work:

- To Design and develop a mathematical CNN model for lung cancer detection as well as classifies it into various classes through the convolution neural network using EDA tool.
- To design and develop a customized App for lung cancer detection using transfer learning.
- To design and develop a CNN model for lung cancer detection on AI –Edge device.

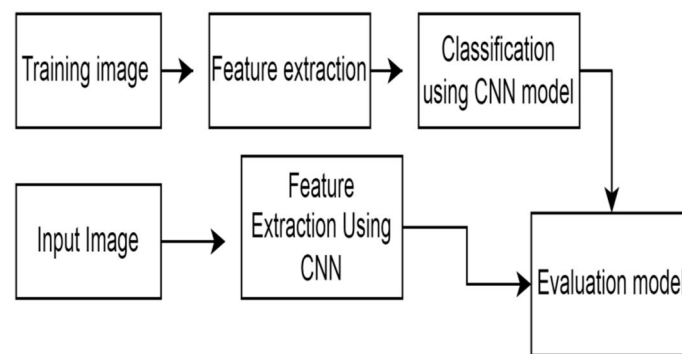


Figure 1. proposed system for lung cancer detection and classification

Steps:

1. Collection of data from hospitals (creating a repository in GitHub and copy righting it) and preprocessing of data.
2. Mathematically develop a CNN model.
3. Develop a CNN model using EDA tool.
4. Train and test the data.
5. Result comparison with the available CNN model.
6. Evaluation verification and performance analysis with the existing results.

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