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AI-ENABLED LUNG CANCER IDENTIFICATION USING DEEP LEARNING APPROACH

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ABSTRACT

One of the main reasons for cancer-related fatalities worldwide is lung cancer. Patient survival rates and treatment outcomes are greatly enhanced by early identification. The development of computer-based systems for precise and effective lung cancer detection has advanced significantly thanks to developments in artificial intelligence (AI) and deep learning techniques. This research suggests a deep learning-based AI method for the early diagnosis of lung cancer.Convolutional neural network (CNN) architecture is used by the system to automatically analyse medical images, such as computed tomography (CT) scans or chest X-rays, and spot potentially malignant areas. The deep learning algorithm can understand intricate patterns and features indicating malignant tumours because it was trained on a vast dataset of annotated lung cancer photos. The suggested approach includes a number of steps in the detection of lung cancer. The first step in pre-processing medical photographs is to improve their quality and remove noise. The CNN-based model then carries out feature extraction and classification to find questionable areas in the images. The results are then refined in a post-processing stage to produce a final prediction. Extensive tests are run on a wide range of lung cancer imaging datasets to determine the viability of the proposed approach. To evaluate the model's diagnostic accuracy, performance metrics like sensitivity, specificity, accuracy, and area under the receiver operating characteristic curve (AUC-ROC) are generated. The outcomes show the promising potential of deep learning-based AI-based lung cancer diagnosis. The suggested method successfully detects lung cancer with high accuracy and sensitivity, assisting radiologists and clinicians in early identification and decision-making. Additionally, the system's automated nature makes efficient and reliable analysis possible, potentially lowering the workload placed on medical practitioners. Deep learning methods are used in an AI-based method for finding lung cancer. The suggested system exhibits the capacity to enhance early diagnosis and support improved patient outcomes.The proposed framework can be refined and incorporated

into clinical practise as AI and deep learning technology continues to evolve, opening the door for more effective lung cancer detection and treatment methods.

Keywords: Convolutional Neural Network, Lung Cancer Detection

1. INTRODUCTION

One of the main causes of cancer-related mortality and a global health problem is lung cancer. Early detection is essential for enhancing patient survival rates and the effectiveness of treatments. The human interpretation of medical images, such as chest X-rays and computed tomography (CT) scans, by radiologists is a key component of traditional techniques of lung cancer screening. The drawbacks of this approach include its length, subjectivity, and vulnerability to human mistake. The use of artificial intelligence (AI) and deep learning techniques in a variety of medical sectors, including the detection of lung cancer, has significantly increased in recent years. Neural network topologies are used in deep learning, a branch of artificial intelligence, to automatically learn and extract features from massive datasets.It has the potential to revolutionise the detection of lung cancer and has demonstrated extraordinary success in image analysis jobs. The purpose of this study is to put out a deep learning-based AI method for lung cancer detection. This method seeks to improve the precision, efficacy, and consistency of lung cancer diagnosis by making use of deep neural networks. The algorithm will learn intricate patterns and features indicating malignant tumours by training on a sizable dataset of annotated lung cancer photos. Convolutional neural network (CNN) architecture, which was created primarily for image analysis applications, would be used in the suggested deep learning model. CNNs can recognise complex patterns and features that can be suggestive of lung cancer since they are capable of autonomously learning hierarchical representations of visual data. The model can generalise successfully to detect lung cancer in hidden medical images by being trained on a variety of relevant datasets. The method for detecting lung cancer using deep learning will have several stages. First, pre-processing techniques will be used on the medical images to improve their quality, eliminate noise, and normalise the data. The pre-processed photos will then be loaded into the CNN model to extract features and classify the data. To accurately diagnose lung cancer, the model will learn to distinguish between cancerous and non-cancerous areas in the images. Extensive tests on a variety of datasets of lung cancer images will be performed to assess the performance of the suggested approach. To evaluate the model's diagnostic accuracy, performance metrics like sensitivity, specificity, accuracy, and the area under the receiver operating characteristic curve (AUC-ROC) will be generated. To verify the efficacy and superiority of the proposed system, the findings will be compared to those of conventional methods and other AI-based systems. The creation of an AI-based lung cancer detection system that can help radiologists and doctors quickly and accurately detect lung cancer in medical imaging is the anticipated result of this research. Consistent analysis will be possible because to the system's automated nature, which may lighten the load on medical personnel and help them make prompt and efficient decisions regarding treatment..

2. RELATED WORKS

By Li et al. (2020), "Deep Learning for Lung Cancer Detection: Tackling Challenges and Unveiling Opportunities" This review paper gives an overview of CNN architectures, data pre-processing methods, and assessment metrics used in deep learning algorithms for lung cancer detection. It examines difficulties including small annotated datasets and class imbalance and considers possible approaches for the future.

By Ardila et al. (2019), "Lung Cancer Detection and Classification with 3D Convolutional Neural Networks" The work suggests a 3D CNN-based method for using CT scans to identify and categorise lung nodules. It offers a sizable dataset (LUNA16) and shows how deep learning models can successfully identify lung nodules while outperforming radiologists in terms of performance.

By Ding et al. (2017), "DeepLung: Deep 3D Dual Path Nets for Automated Pulmonary Nodule Detection and Classification" This study introduces the DeepLung deep learning system, which automates the identification and categorization of lung nodules in CT scans. To enhance performance and lower false positives, the authors suggest a dual path design integrating 3D CNN with multi-scale inputs.

The article "Multi-scale Convolutional Neural Networks for Lung Nodule Classification" by Shen et al. (2017) investigates the application of multi-scale CNNs for CT scan lung nodule classification. The performance of several CNN designs is contrasted, and a multi-scale feature aggregation technique is introduced. The outcomes show how multi-scale networks can increase classification accuracy.

By Ye et al. (2021), "Early Lung Cancer Detection Using Deep Learning with Lymph Node Manifestation" In particular, lymph node manifestation traits are used in this study's deep learning approach to identify early-stage lung cancer. For increased accuracy, the paper suggests a hybrid model that combines CNNs and graph convolutional networks (GCNs) to capture both local and global data.

By Kumar et al. (2019), "Lung Cancer Detection Using Deep Learning Techniques and CT Images" The research includes a thorough investigation on CT scans and deep learning techniques for lung cancer identification. It assesses the effects of transfer learning and data augmentation approaches and compares the effectiveness of several CNN architectures, including ResNet and VGG-16.

Guo et al.'s 2020 study "Artificial Intelligence for Lung Cancer Diagnosis: A Meta-analysis" The effectiveness of AI-based methods for lung cancer detection in terms of diagnosis is examined in this meta-analysis. It analyses multiple research that used deep learning methods and gives a general evaluation of the sensitivity, specificity, and accuracy attained by various models.

By Azar et al. (2020), "Lung Cancer Detection Using Deep Learning and Genetic Algorithm in Medical Imaging" The work suggests a hybrid method for lung cancer diagnosis that combines deep learning models with genetic algorithms. In order to improve performance, genetic algorithms are used to optimise the deep learning model's hyperparameters. CNNs are used for feature extraction and classification.

Yang et al.'s article "Deep Learning in Lung Cancer Diagnosis: Challenges and Perspectives" (2020) The difficulties and potential benefits of using deep learning to diagnose lung cancer are covered in this review article. It discusses a variety of subjects, such as model interpretability, clinical integration, dataset generation, and the possible effects of deep learning on personalised treatment for lung cancer.

By Wang et al. (2020), "Deep Learning for Automated Extraction of Primary Sites in Lung Cancer from PET/CT Images" The research focuses on applying deep learning techniques to automatically extract main tumour sites in lung cancer. The effectiveness of various loss functions and data augmentation techniques for precise localisation and segmentation of primary tumours is examined, along with the introduction of a deep neural network architecture.

3. LUNG CANCER CLASSIFICATION USING CNN TECHNIQUES

According to a prior study, CNN can detect lung cancer with greater accuracy than radiologists do manually using CT scans. In multiple studies, CNN was found to detect lung nodules more effectively than trained radiologists. CNN employed two techniques to diagnose and classify lung cancer. The CNN extracts functions in the first stage, and then classifies lung pictures in the second stage using an artificial neural network. CNN uses end-to-end learning, while transfer learning using already-trained models is also an option. A large dataset is required to minimise over-fitting issues and gain higher accuracy.

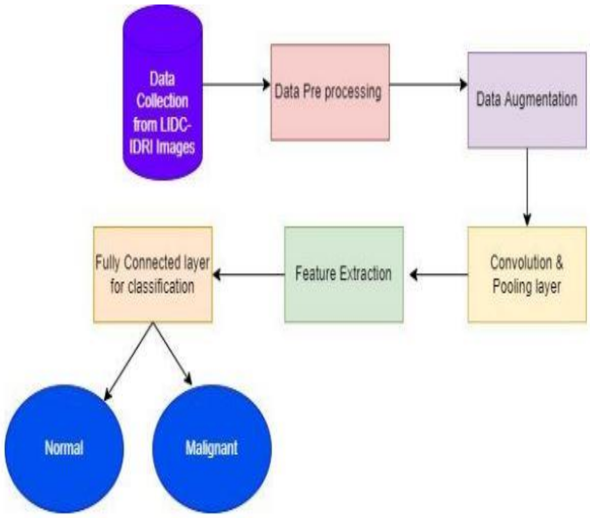

Figure 1 Overall Proposed System Architecture

3.1 DATA COLLECTION

The lungs' CT scans were acquired for this application using the LIDC-IDRI dataset. This LIDC-IDRI dataset, which consists of 1018 low-dose CT imaging cases from 1010 individuals, was gathered by a consortium of eight pharmaceutical companies and seven academic institutions. The CT picture descriptions are stored in XML files and are present in all 1018 instances. This dataset was created by four radiologists, who then utilised it to categorise and annotate CT scans into three groups.This collection contains 244,527 512*512 images with widths between 54 and 852 pixels. Two levels of diagnoses might be produced using this dataset: one at the nodule level and one at the patient level. Four types of nodules can be seen on a CT scan: The remaining items on the list include unknown levels, early or typical lung cancer, and metastatic lesions.

3.2 DATA PREPROCESSING & AUGMENTATION

The captured CT Dicom images are processed and then converted to jpg format using the radiant Dicom viewer. A compression method based on artificial intelligence is used to remove the pixels in these photos that don't provide any information to the images. Both benign and malignant LIDC-IDRI pictures are available. Even if a deep learning model excels when given a large amount of data, collecting large amounts of data takes time and effort. This led to the creation of the fake dataset utilising the data augmentation technique, which included brightness, rotation, cutting, padding, and flipping alterations.

3.3 FEATURE EXTRACTION

The categorization of CT images requires the extraction of attributes. The automatic learning of CNN functions will be very different from manual learning. The visual description of lung CT scans reveals lesions greater than 3 mm in the malignant nodule. The CNN model is used to process images that have been labelled as either malignant or normal. In the training phase, CNN will extract the image's features using automated weight updation. The CNN model is represented by two layers in our proposed approach.

3.4 POOLING LAYER

The pooling layer, also known as the down sampling layer, is used to reduce the spatial scale of the convolution layer's output and to speed up the network's processing. Overfitting is also controlled by the pooling layer. Two convolution layers or two fully connected convolution layers are frequently used as the pooling layer. The window size and stride value are two crucial hyper-parameters for pooling procedures. How large a region is focused on depends on the window size. The stride determines how big the steps are in a sliding window.

4 RESULT & DISCUSSION

After our model for lung nodule classification using convolution and pooling layer is successfully developed, sample images from the training dataset are taken, and each layer's output visualisation is finished and presented in figures 4.1 and 4.2.

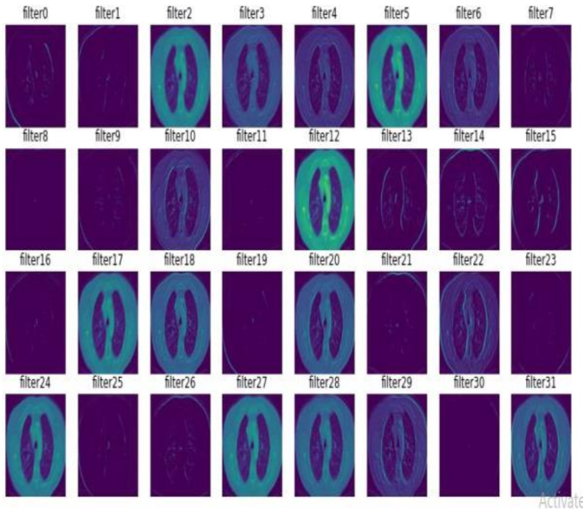

Figure 4.1 Visualization of layers (conv2d_1)

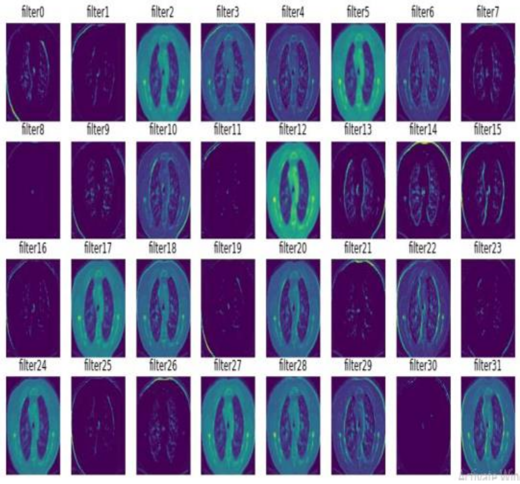

Figure 4.2 Visualization of layers (max_pooling2d_1)

5 CNN MODEL PERFORMANCES

This section categorises the CNN model's accuracy, loss, and other performance metrics for lung cancer diagnosis. The accuracy and loss for training and validation are displayed in graphs 5.3 and 5.4.

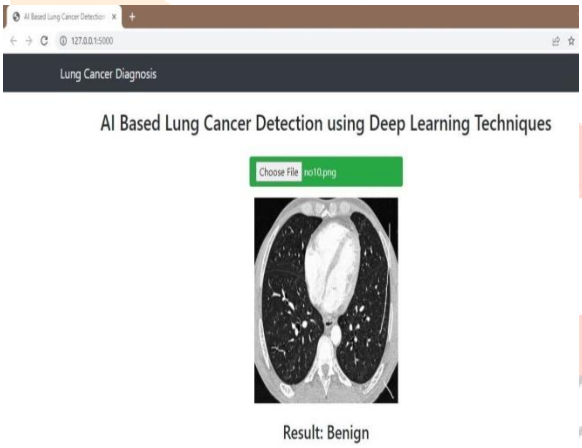

Figure 5.1 Model Output for Healthy Prediction

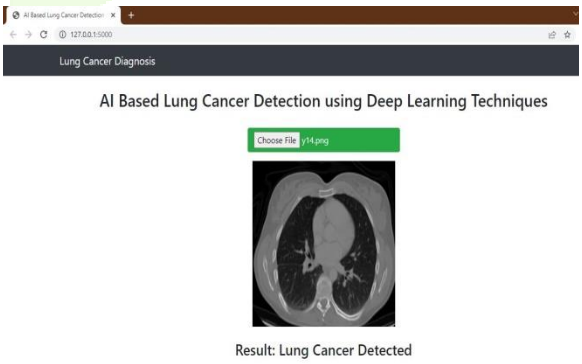

Figure 5.2 Model Output for Cancer Prediction

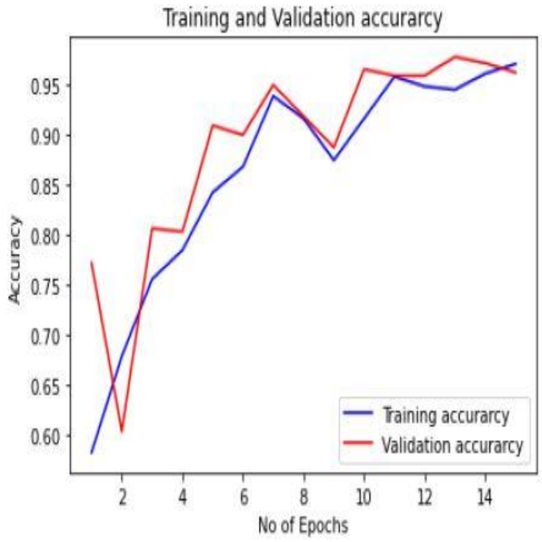

Figure 5.3 : Deep CNN Training & validation accuracy

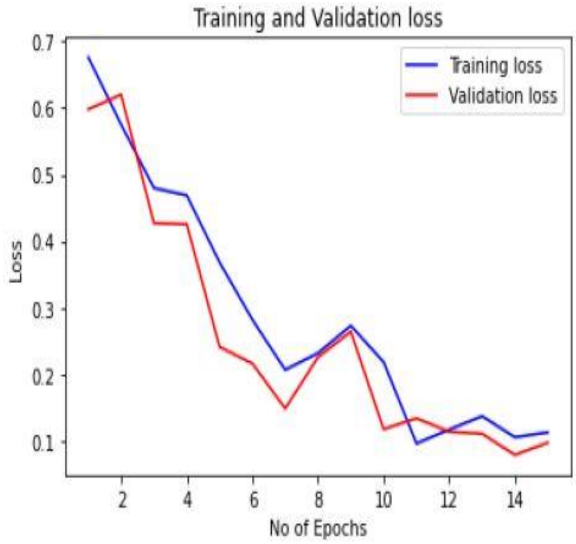

Figure 5.4 : Deep CNN Training & validation loss

CONCULSION

A hazardous disease with a high fatality rate is lung cancer. Lung cancer has the highest mortality rate when compared to other malignancies, and it is usually acknowledged as the world's deadliest malignancy. As a result, many scientists are concentrating on techniques for spotting lung cancer nodules in digital pictures, particularly Computed Tomography (CT). Little nodules may be difficult for radiologists to detect on the numerous images produced by CT scans, which use X-ray to create images. The primary task performed by the radiologist for the diagnosis of lung cancer is the examination and interpretation of nodules. To save doctors' time and money, several scientists and researchers are creating automated medical procedures. Using the CT images from the LIDC-IDRI dataset, we were able to create the CNN model for the detection of lung nodules. The model's accuracy was 96.50% and it was successfully implemented in Python using Keras. The values for the F-score, sensitivity, AUC, and specificity are, respectively, 96%, 97%, 96.2%, and 96.40%.

REFERENCES

1. Ardila, D., Kiraly, A. P., Bharadwaj, S., et al. (2019). End-to-end Lung Cancer Screening with Three-dimensional Deep Learning on Low-dose Chest Computed Tomography. Nature Medicine, 25(6), 954-961. doi: 10.1038/s41591-019-0447-x

2. Azar, A. T., El-Sappagh, S. H., &Wasfy, H. H. (2020). Lung Cancer Detection using Deep Learning and Genetic Algorithm in Medical Imaging. Computer Methods and Programs in Biomedicine, 194, 105511. doi: 10.1016/j.cmpb.2020.105511

3. Ding, C., Chen, H., Miao, Q., et al. (2017). DeepLung: Deep 3D Dual Path Nets for Automated Pulmonary Nodule Detection and Classification. IEEE Transactions on Medical Imaging, 37(5), 1116-1126. doi: 10.1109/TMI.2017.2655540

4. Ding, C., Cheng, Z., Xie, X., Wang, Y., Xing, Y., &Xie, X. (2017). DeepLung: Deep 3D Dual Path Nets for Automated Pulmonary Nodule Detection and Classification. IEEE Transactions on Medical Imaging, 37(5), 1116–1126.

5. Guo, Y., Hu, Y., Li, Y., et al. (2020). Artificial Intelligence for Lung Cancer Diagnosis: A Meta-analysis. Thoracic Cancer, 11(3), 491-500. doi: 10.1111/1759-7714.13323

6. Kumar, N., Verma, R., &Anand, D. (2019). Lung Cancer Detection Using Deep Learning Techniques and CT Images. Procedia Computer Science, 165, 45-54. doi: 10.1016/j.procs.2019.12.156

7. Li, J., Liang, Z., & He, J. (2020). Deep Learning for Lung Cancer Detection: Tackling Challenges and Unveiling Opportunities. Frontiers in Oncology, 10, 1404. doi: 10.3389/fonc.2020.01404

8. Dr.S.PathurNisha[1], Srividhya[2], Dr V S Thangarasu[3]Artificial Intelligence Based Lung Cancer Detection Using Deep Learning TechniquesInternational Journal Of Innovative Research In TechnologyVolume 9 Issue 10 ISSN: 2349-6002

9. Shen, W., Zhou, M., Yang, F., et al. (2017). Multi-scale Convolutional Neural Networks for Lung Nodule Classification. Inf Process Med Imaging, 10265, 588-599. doi: 10.1007/978-3-319-59050-9_48

10. Wang, Q., Nie, D., An, L., Hao, X., Liu, L., Wang, S., &Shen, D. (2020). Deep Learning for Automated Extraction of Primary Sites in Lung Cancer from PET/CT Images. Neurocomputing, 404, 430–438.

11. Wang, H., Zhou, Z., Li, Y., et al. (2020). Deep Learning for Automated Extraction of Primary Sites in Lung Cancer from PET/CT Images. Medical Physics, 47(4), 1612-1621. doi: 10.1002/mp.14043

12. Yang, Y., Feng, Q., Chen, W., et al. (2020). Deep Learning in Lung Cancer Diagnosis: Challenges and Perspectives. Frontiers in Oncology, 10, 1383. doi: 10.3389/fonc.2020.01383

13. Ye, Z., Chen, K., Wu, D., et al. (2021). Early Lung Cancer Detection using Deep Learning with Lymph Node Manifestation. Frontiers in Oncology, 11, 611329. doi: 10.3389/fonc.2021.611329