Lung Cancer Detection & stages Identification using CNN and ResNet algorithm

[1] T. Venu, [2] P. Sridevi, [3] R. Sirisha, [4] S. Niharika, [5] T. Shyam

[1]Associate Professor, [2]Student, [3]Student, [4]Stuent, [5]Student[1]Computer Science and Engineering
[1]Lendi Institute of Engineering and Technology, Vizianagaram, India

Abstract - Identification of lung cancer is an efficient way to minimize the death rate and maximize survival rate of patients. It is an essential step to screen out the computed tomography (CT) images for pulmonary nodules towards the efficient treatment of lung cancer. However, robust nodule identification and detection is a most critical task due the complexity of the surrounding environment and heterogeneity of the lung nodules. The use of machine learning to detect, predict, and classify disease has grown exponentially in the past few years, especially for complex tasks such as lung cancer detection and recognition. Convolutional neural networks (CNN) and Resnet have exploded in popularity for transforming the field of computer vision research. In this paper, we are using Deep Convolutional Neural Network for lung cancer classification using CT images based lung cancer image dataset consortium (LIDC) for detecting cancerous and noncancerous lung nodules for measuring the accuracy of classification better than existing methods.

Index Terms - Lung Cancer, CNN, ResNet, Computed Tomography, computer vision

I. INTRODUCTION

Lung cancer stands as a significant contributor to global mortality, necessitating early detection and precise staging for improved patient outcomes. Despite its prevalence affecting both genders, current diagnostic and treatment methods are often lengthy, costly, and burdensome for patients. Leveraging machine learning techniques, particularly convolutional neural networks (CNNs) like ResNet, presents a promising avenue for enhancing accuracy and efficiency in lung cancer detection and staging from medical imaging data. Challenges in lung cancer detection stem from the complexities of lung anatomy and variations in tumor appearance. The proposed approach aims to address these challenges by utilizing ResNet's depth and residual connections to accurately detect cancer and categorize its stages, facilitating tailored treatment strategies and prognosis assessment.

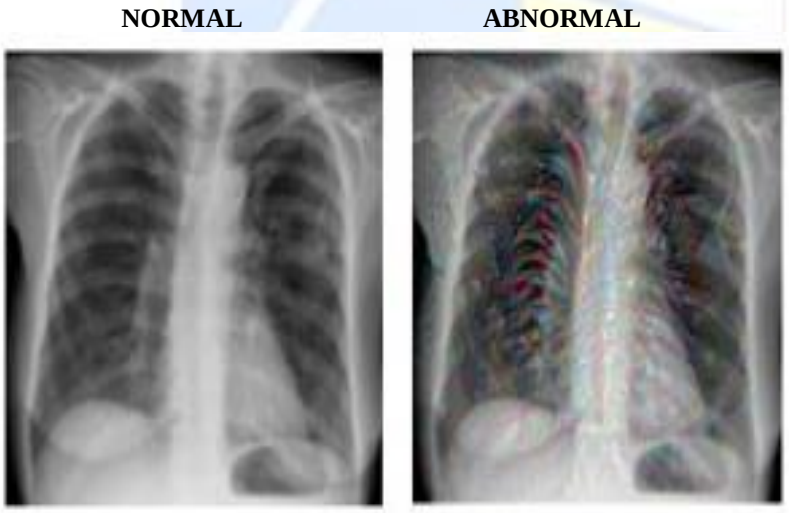

Fig.1 Chest CT scan images for lung cancer detection.

II. LITERATURE SURVEY

2.1. Jiang et al., IEEE Journal of Biomedical and Health Informatics, 2019 Efficient lung nodule detection is crucial for lung cancer risk assessment, yet existing CADe schemes are complex and time-consuming. This study presents a patch-based deep learning approach utilizing Frangi filter-enhanced lung images, achieving high sensitivity with low false positives.

2.2. Sharma & Jindal, International Conference on Computational Techniques and Artificial Intelligence, 2011 Early identification of lung cancer is vital for reducing mortality. This paper proposes a deep learning-based system utilizing VGG-16 and Improved VGG-16 models to classify CT images with high accuracy, providing a promising method for diagnosis.

2.3. Farahani, IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology, 2015 Early cancer detection is crucial for survival. This paper introduces an ensemble learning approach using morphological features and multiple classifiers, demonstrating improved lung nodule diagnosis accuracy.

2.4. Teramoto et al., Informatics in Medicine Unlocked, 2019 Accurate histological classification of lung cancer is essential for effective treatment. This study compares deep CNN models and additional classifiers, highlighting the potential of combining fine-tuned CNNs with machine learning classifiers for improved diagnosis.

2.5. Jin et al., International Symposium on Computational Intelligence and Design, 2016 Computer-aided detection can enhance lung nodule diagnosis efficiency. This paper proposes a segmentation method based on morphology and ROI extraction using convolutional neural networks, offering a reliable approach for pulmonary nodule detection on CT images.

III. ARCHITECTURE AND WORK FLOW

The architecture of the CNN and ResNet models for lung cancer detection is meticulously designed to effectively analyze CT scan images and accurately predict the presence of cancerous lesions. Commencing with the input layer, the models can seamlessly process and analyze both grayscale and RGB CT scan images, ensuring adaptability to various image types. Numerous convolutional layers are strategically arranged within the network, employing filter sizes optimized for capturing intricate visual patterns indicative of lung cancer. ResNet's residual connections and Inception modules in CNN facilitate parallel convolutional operations, enabling the models to extract features at different spatial scales, thus enhancing their ability to detect subtle signs of cancer. Max-pooling layers interspersed throughout aid in downsampling feature maps and refining spatial dimensions, contributing to effective feature abstraction. Subsequently, fully connected layers enable the models to learn high-level representations of features crucial for accurate classification. Ultimately, the output layer provides predictions regarding the presence of lung cancer, furnishing clinicians with vital diagnostic insights to guide patient care and treatment decisions based on the analyzed CT scan images.

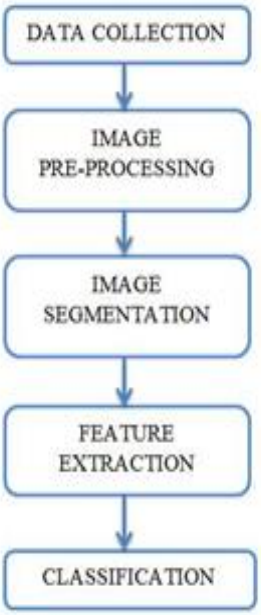

Fig.2 block diagram

IV. CONCLUSIONS

In our research work, we have used deep Convolutional neural networks for classifying the CT images of lung nodules into cancerous (malignant) and non-cancerous (benign). Thus preprocessing has been done before applying input CT images to network model to make equal sizes and format of the images. The dataset used in our research work belongs to LIDC dataset. Hence we achieved an accuracy of 100% which is the better results comparable to previous research papers as mentioned. As a future work, the experiments could be performed by using Deep CNN and ResNet architecture for other types of cancer.

V. REFERENCES

[1]. Jiang, H., Qian, W., Gao, M., & Li, Y. (Year). An automatic detection system of lung nodule based on multigroup patch-based deep learning network. "IEEE Journal of Biomedical and Health Informatics", 22(4), 1227-1237.
[2]. Sharma, D., & Jindal, G. (Year). Identifying Lung Cancer Using Image Processing Techniques. In "Proceedings of the International Conference on Computational Techniques and Artificial Intelligence" (pp. 116-120).
[3]. Farahani, F. V. (Year). Lung Nodule diagnosis from CT images Based on Ensemble Learning. In "Proceedings of the IEEE Conference on Computational Intelligence in Bioinformatics and Computational Biology".
[4]. Teramoto, A., et al. (Year). Automated classification of benign and malignant cells from lung cytological images using deep convolutional neural network. "Informatics in Medicine Unlocked", 16, 100205.
[5]. Jin, X. Y., Zhang, Y. C., & Jin, Q. L. (Year). Pulmonary Nodule Detection Based on CT Images Using Convolution Neural Network. In "Proceedings of the 9th International Symposium on Computational Intelligence and Design".
[6]. Shimizu, R., et al. (Year). Deep Learning Application Trial to Lung Cancer Diagnosis for Medical Sensor Systems. In "Proceedings of the International Symposium on Computers and Communications".
[7]. Huang, P. W., Lin, P. L., Lee, C. H., & Kuo, C. H. (Year). A Classification System of Lung Nodules in CT Images Based on Fractional Brownian Motion Model. In "Proceedings of the IEEE International Conference on System Science and Engineering".
[8]. Patil, V. C., & Dhotre, S. R. (Year). Lung Cancer Detection from Images of Computer Tomography Scan. "International Journal of Advanced Research in Computer and Communication Engineering", 5(7).
[9]. Felix, A., Oliveira, M., Machado, A., & Raniery, J. (Year). Using 3D Texture and Margin Sharpness Features on Classification of Small Pulmonary Nodules. In "Proceedings of the 29th SIBGRAPI Conference on Graphics, Patterns and Images".
[10]. Golan, R., Jacob, C., & Denzinger, J. (Year). Lung nodule detection in CT images using deep convolutional neural networks. In "Proceedings of the International Joint Conference on Neural Networks".