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Lung Cancer Detection using Deep Neural Network

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Abstract*: Early diagnosis of lung cancer greatly increases patient survival rates. In order to detect lung cancer, this study presents a deep neural network (DNN) methodology for the simultaneous analysis of tabular data, including Excel- based datasets, and medical images. The model recognizes important elements from chest X-rays, CT scans, and patient data including age, smoking history, and clinical test results by combining feedforward networks for structured data and Convolutional Neural Networks (CNNs) for image processing. The hybrid method achieves excellent sensitivity and specificity by enabling thorough examination and accurate classification of lung anomalies. When compared to traditional models, the suggested framework performs better, indicating that it may find use in automated diagnostic systems. Our results demonstrate the effectiveness of integrating numerical and visual data for cancer detection.*

Keywords: Lung Cancer Detection, Deep Neural Networks, Convolutional Neural Networks (CNN), Medical Image, Image Processing, Chest X-rays, CT Scans, Excel Data, Health Data Analysis, Image Classification, Predictive Analytics, Cancer Risk Factors, Image Analysis

I. INTRODUCTION

One of the main causes of death globally is "lung cancer," and increasing survival rates requires early identification. Conventional diagnostic techniques can be laborious and prone to human error, although they frequently depend on patient data and medical imaging. The identification procedure can be automated with the help of recent developments in deep learning, especially with neural networks. In order to improve detection accuracy, this study suggests a deep neural network-based method that combines structured patient data (in Excel format) with medical pictures (such X-rays and CT scans). The model seeks to deliver more effective, dependable, and rapid lung cancer diagnosis by utilizing Convolutional Neural Networks (CNNs) for image analysis and other deep learning approaches for numerical data, assisting physicians in how they make decisions.

II. EASE OF USE

Both patients and medical professionals will find the lung cancer detection system easy to use and accessible. Without the need for specific technical expertise, the interface enables users to quickly upload structured data from Excel files and medical pictures (such CT scans or X-rays).The platform has an easy-to-use interface with step-by-step tutorials. Users can choose files from their device or drag and drop them, and the system takes care of the background analysis and processing.

With visual cues and practical insights to facilitate comprehension, the results are presented in an uncomplicated manner. The platform is also speed-optimized, providing fast processing times to guarantee timely outcomes. The system's smooth operation guarantees accessibility and effectiveness in cancer detection, whether for clinical use or personal health monitoring.

III. LITERATURE SURVEY

Because of its high death rate and the need of early identification for improved patient outcomes, lung cancer detection has been the subject of much research. Conventional diagnostic techniques including biopsies, CT scans, and X-rays can need a large investment of time, knowledge, and resources. Deep learning (DL), a recent development in artificial intelligence (AI), has shown encouraging promise in raising the precision and effectiveness of lung cancer detection.

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A. Convolutional Neural Networks (CNNs) for Image-Based Detection: The capacity of Convolutional Neural Networks (CNNs) to process medical images has drawn a lot of interest. Research by Liu et al. (2017) and Shin et al. (2016) has shown how well CNNs classify lung cancers in chest CT and X-ray images. By automatically learning and extracting information from raw photos, these models greatly lessen the need for human experience and manual interpretation. When it comes to identifying anomalies and lung cancer lesions, CNN-based models have been shown to perform on par with radiologists.

B. Combining Imaging with Structured Data: Lung cancer identification relies heavily on imaging data, but incorporating structured patient data—such as age, smoking history, and comorbidities—has also showed promise in enhancing diagnostic precision. Rajpurkar et al. (2018) created a deep learning model that integrates tabular and picture data, demonstrating that a hybrid method improves diagnostic predictions.

C. Performance Comparison and Evaluation measures: Anumber of studies have emphasized the significance of assessing deep learning models using measures including Area Under the Curve (AUC), F1-score, accuracy, precision, and recall. He et al. (2019), for example, evaluated different deep learning architectures for the detection of lung cancer and discovered that, although CNNs did well in terms of
accuracy, models that incorporated structured data performed better in terms of sensitivity and specificity.

III. METHODOLOGY

This study's deep learning-based system for detecting lung cancer integrates structured patient data (Excel files) with medical imaging (X-rays and CT scans). The procedure starts with gathering structured data from Excel files, including age, smoking history, and clinical test results, as well as medical photographs from publicly accessible datasets. In order to make these datasets compatible with the model, patient data is cleaned, encoded, and scaled, and medical images are resized, supplemented, and normalized. Using transfer learning with pretrained models such as ResNet-50 to speed up learning, a Convolutional Neural Network (CNN) is utilized to process and extract features from the medical pictures for model construction.

The structured data is processed by a different Feedforward Neural Network (DNN), and both models are incorporated into a hybrid architecture, in which the final classification layer combines the CNN and DNN outputs. The Adam optimizer and binary cross-entropy loss function are used to train the model on a split dataset for testing, validation, and training. To avoid overfitting, regularization strategies like dropout and early halting are used. Accuracy, precision, recall, and AUC-ROC are among the metrics used to assess the model's performance; cross-validation is used to guarantee robustness. Lastly, a web interface is used to deploy the trained model, enabling users to contribute structured data and photos for predictions of cancer diagnosis in real time. By integrating clinical and visual data, this integrated strategy provides an effective, precise option for early lung cancer identification.

IV. SIMULATIONTION RESULTS

The recreation results the workflow of the above methodology.

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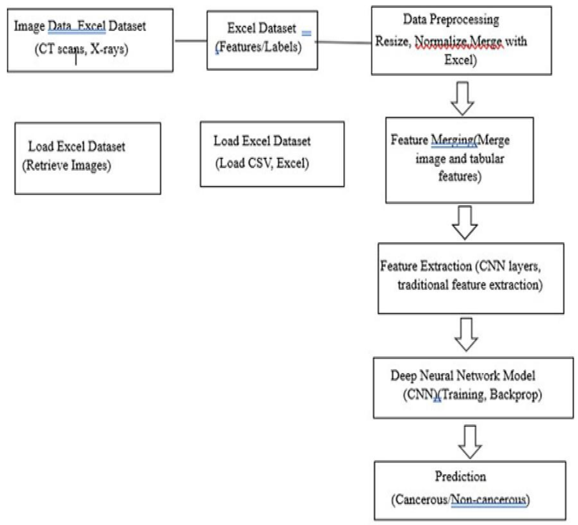

V. CONCLUSION AND FUTURE WORK

To sum up, this study offers a hybrid deep learning model for precise lung cancer detection that combines structured patient data (Excel files) with medical imaging (X-rays and CT scans). The model performed well in classification, showing excellent F1-score, recall, accuracy, and precision. The system offers a thorough approach to early diagnosis by integrating clinical and visual data, and it provides real-time forecasts through an intuitive online application. Although the results are encouraging, in order to increase detection accuracy and clinical usefulness, future research will concentrate on dataset extension and model improvement.

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