Advancing Lung Cancer Diagnosis: Deep Learning in Early-Stage Detection and Risk Reduction

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Abstract

Lung cancer remains one of the leading causes of cancer-related deaths worldwide, primarily due to late-stage diagnosis. Early detection significantly improves survival rates, and recent advancements in deep learning have shown promise in enhancing diagnostic accuracy through medical imaging. This study evaluates the performance of various deep learning models—such as convolutional neural networks (CNNs) and hybrid architectures—for detecting early signs of lung cancer using chest imaging data. It also explores how predictive analytics can aid in prevention by identifying high-risk patterns before symptom onset. The research compares model accuracy, sensitivity, and specificity across different datasets and highlights key challenges in clinical integration, including data variability and model interpretability. The results support the potential of deep learning to transform early lung cancer screening and inform future clinical decision-making.

Keywords: Lung Cancer Detection, Deep Learning, Medical Imaging, Early Diagnosis, Convolutional Neural Networks (CNNs), Predictive Analytics, Radiology AI, Image Classification, Cancer Screening, Clinical Decision Support