BVRIT HYDERABAD College of Engineering for Women
Department of Information Technology

LUNG NODULE DETECTION

USING DEEP LEARNING TECHNIQUES

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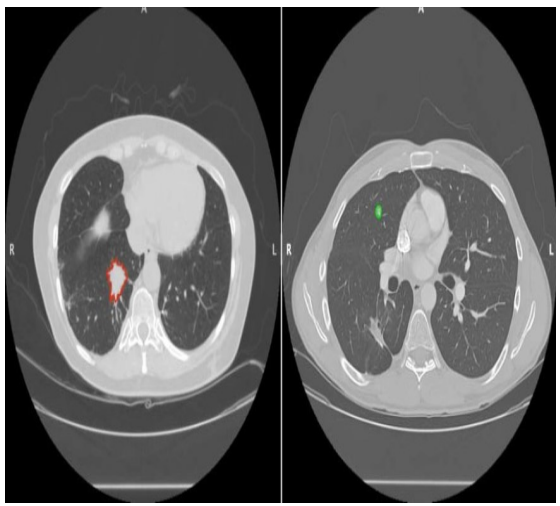
Abstract

- Lung nodules are small, rounded or oval growths within the lungs which are typically detectable through chest X-rays or CT scans. They can arise from various causes, encompassing both benign and malignant origins.
- Malignant nodules could signal the presence of lung cancer.
- The objective is to develop an machine learning model to automate lung nodule identification, aiding early lung cancer detection.
- The approach includes data collection, model development, training, and evaluation.
- Results, insights, and their potential impact on healthcare and research contribute to the enhancement of medical diagnostics.

Introduction

- Lung nodule detection is essential for the early identification and assessment of lung abnormalities, particularly those related to lung cancer.
- Timely identification allows for effective treatment and significantly improves patient outcomes, especially in high-risk populations.



World Statistics

Estimated New Cases

Males			Females		
Prostate	248,530	26%	Breast	281,550	30%
Lung & bronchus	119,100	12%	Lung & bronchus	116,660	13%
Colon & rectum	79,520	8%	Colon & rectum	69,980	8%
Urinary bladder	64,280	7%	Uterine corpus	66,570	7%
Melanoma of the skin	62,260	6%	Melanoma of the skin	43,850	5%
Kidney & renal pelvis	48,780	5%	Non-Hodgkin lymphoma	35,930	4%
Non-Hodgkin lymphoma	45,630	5%	Thyroid	32,130	3%
Oral cavity & pharynx	38,800	4%	Pancreas	28,480	3%
Leukemia	35,530	4%	Kidney & renal pelvis	27,300	3%
Pancreas	31,950	3%	Leukemia	25,560	3%
All Sites	**970,250**	**100%**	**All Sites**	**927,910**	**100%**

Estimated Deaths

Males			Females		
Lung & bronchus	69,410	22%	Lung & bronchus	62,470	22%
Prostate	34,130	11%	Breast	43,600	15%
Colon & rectum	28,520	9%	Colon & rectum	24,460	8%
Pancreas	25,270	8%	Pancreas	22,950	8%
Liver & intrahepatic bile duct	20,300	6%	Ovary	22,950	5%
Leukemia	13,900	4%	Uterine corpus	12,940	4%
Esophagus	12,410	4%	Liver & intrahepatic bile duct	9,930	3%
Urinary bladder	12,260	4%	Leukemia	9,760	3%
Non-Hodgkin lymphoma	12,170	4%	Non-Hodgkin lymphoma	8,550	3%
Brain & other nervous system	10,500	3%	Brain & other nervous system	8,100	3%
All Sites	**319,420**	**100%**	**All Sites**	**289,150**	**100%**

Courtesy By : Cancer Statistics, 2021

Problem Statement

- The detection of lung cancer cases involving 0-3mm pulmonary nodules is impeded by the substantial number of CT slices generated during thoracic scans.
- To address this issue, we introduce an innovative deep learning framework for medical imaging.
- Our primary aim is to heighten the sensitivity in identifying small nodules while effectively mitigating false positive outcomes, thus advancing early diagnosis and improving patient care in lung cancer cases.

Literature Survey

S. No	Title of the paper	Author(s) & Journal Details	Description
1	Pulmonary Nodule Classification Based on Heterogeneous Features Learning	Tong, C, Liang, B, Su, Q, Yu, M, Hu, J, Bashir, AK & Zheng, Z, in IEEE Journal on Selected Areas in Communications, vol. 39, no. 2, pp. 574-581 - 2021	The proposed model in this paper is a deep automated lung nodule diagnosis system based on 3D-CNN algorithm with an accuracy of 84.70%.
2	Two-Stage Convolutional Neural Network Architecture for Lung Nodule Detection	Haichao Cao, Hong Liu, Enmin Song, Guangzhi Ma, Xiangyang Xu, Renchao Jin, Tengying Lu, Chih-Cheng Hung,Cao, H., Liu, H., Song, E., Ma, G., Xu, X., Jin, R., Liu, T., ArXiv, abs/1905.03445. - 2020	The 2-stage CNN architecture have been designed to better detect lung nodules with 84.8% accuracy score.

Literature Survey

S. No	Title of the paper	Author(s) & Journal Details	Description
3	Efficient Lung Nodule Classification Using Transferable Texture Convolutional Neural Network	Imdad Ali, Muhammad Muzammil, Ihsan Ul Haq, Amir A. Khaliq, Suheel Abdullah, National Center for Physics, Pakistan. Faculty of Engineering and Technology, International Islamic University, Islamabad, Pakistan. - 2020	In this paper, the model is training using transferable texture CNN algorithms to improve the classification performance of pulmonary nodules in CT scans. On LUNGx dataset, the model scored 85.86% accuracy.

Existing Method

- Current methods in lung nodule detection primarily involve the extraction of relevant image features from medical scans, followed by the application of machine learning techniques for classification.

- These techniques rely on established principles of image analysis to identify key characteristics associated with lung nodules, particularly those larger than 3 millimeters (mm) in size.

- Machine learning classifiers, such as Support Vector Machines (SVM) and Convolutional Neural Network (CNN), are then applied to make informed decisions based on these extracted features with accuracy of below 90%.

Proposed Method

- Recognizing the critical importance of early detection in lung cancer cases involving 0 - 3mm pulmonary nodules is a formidable challenge due to the sheer volume of CT slices produced in thoracic scans.
- To address this issue, we present a comprehensive approach that leverages advanced techniques in medical imaging.
- Our work emphasizes the need for sensitivity in detecting small nodules while effectively managing the common issue of false positives.
- Extensive experiments underscore the potential of our approach in enhancing early diagnosis and patient care in lung cancer cases.

References

- Chao Tong; Baoyu Liang; Qiang Su; Mengbo Yu; Jiexuan Hu; Ali Kashif Bashir; Zhigao Zheng, "Pulmonary Nodule Classification Based on Heterogeneous Features Learning", in IEEE Journal on Selected Areas in Communications, vol. 39, no. 2, pp. 574-581, Feb. 2021, doi: 10.1109/JSAC, 2020 https://ieeexplore.ieee.org/document/9181623

- Haichao Cao, Hong Liu*, Enmin Song, Guangzhi Ma, Xiangyang Xu, Renchao Jin, Tengying Liu, Chih-Cheng Hung , "Two-Stage Convolutional Neural Network Architecture for Lung Nodule Detection", Computer Vision and Pattern Recognition (cs.CV); Image and Video Processing (eess.IV) arXiv:1905.03445 [cs.CV] (or arXiv:1905.03445v1 [cs.CV] for this version) , 2020 https://arxiv.org/abs/1905.03445

- Imdad Ali, Muhammad Muzammil, Ihsan Ul Haq, Amir A. Khaliq, Suheel Abdullah. "Efficient Lung Nodule Classification Using Transferable Texture Convolutional Neural Network" , 1 National Center for Physics, Islamabad 44000, Pakistan. 2 Faculty of Engineering and Technology, International Islamic University, Islamabad, Islamabad 44000, Pakistan , 2020 https://ieeexplore.ieee.org/document/9204580

THANK YOU!!