

Lung Nodule Detection Using Deep Learning Techniques

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Overview

- 1 Introduction
- 2 Literature Survey
- 3 Problem Statement
- 4 Proposed Method
- 5 Modules
- 6 Implementation status
- 7 References

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.
- About 40 percent of pulmonary nodules turn out to be cancerous.

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.

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.

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.

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.

Modules and Functionalities of modules

- Convolutional Neural Network (CNN):
 - This module responsible for automatically learning relevant features and localizing potential nodules in lung CT scans.
 - CNN's will take input images, assign importance to various aspects/objects in the image.
- Post-processing and Visualization:
 - In this module, it primarily focuses on refining lung nodule detection results by reducing false positives and integrating accurate detection.

Implementation

Module	Description	Status
Module 1	Convolutional Neural Network (CNN)	In progress.
Module 2	Post-processing and Visualization	Information Gathering and Algorithm Justification.

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
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Thank you