ISSN 2395-1621

Detection of pulmonary nodule in CT images Reduction of false positive using multi-view convolutional network

#1Kanchan Ingle, #2Ashvini Walunj, #3Kalpana Hankare

3hankarekalpana@gmail.com

123Student, Dept. of Electronics& Telecommunication Engineering,
4Professor, Dept. of Electronics& Telecommunication Engineering,

JSPM's ICOER, Pune, Maharashtra, India.

ABSTRACT

A novel Computer-Aided Detection (CAD) system is proposed for pulmonary nodules using multi-view convolutional networks (ConvNets), for which discriminative features are automatically learnt from the training data. The network is fed with nodule candidates obtained by combining three candidate detectors specifically designed for solid, subsolid, and large nodules. For each candidate, a set of 2-D patches from differently oriented planes is extracted. The proposed architecture comprises multiple streams of 2-D ConvNets, for which the outputs are combined using a dedicated fusion method to get the final classification. Data augmentation and dropout are applied to avoid overfitting. On 888 scans of the publicly available LIDC-IDRI dataset, our method reaches high detection sensitivities of 85.4% and 90.1% at 1 and 4 false positives per scan, respectively. An additional evaluation on independent datasets from the ANODE09 challenge and DLCST is performed. We showed that the proposed multi-view ConvNets is highly suited to be used for false positive reduction of a CAD system

Key Words: Computed tomography, computer-aided detection, convolutional networks, deep learning, lung cancer, pulmonary nodule.

ARTICLE INFO

Article History

Received: 29th April 2017

Received in revised form :

30th April 2017

Accepted: 4th May 2017

Published online :

4th May 2017

I. INTRODUCTION

A pulmonary nodule is a small round or oval-shaped growth in the lung. It may also be called a "spot on the lung" or a "coin lesion." Pulmonary nodules are smaller than three centimeters (around 1.2 inches) in diameter. If the growth is larger than that, it is called a pulmonary mass and is more likely to represent a cancer than a nodule.

Lung cancer is the world's deadliest type of cancer with a 5-year overall survival rate of only 10 to15%. According to the agency for search on cancer, in 2012, approximately 1.8 million new cases and 1.6 million related deaths, were accounted all over world. This represents approximately 20% of all medical cases with lung nodules, as a relatively poor early stages diagnosis is the main cause of dead when defining the odds for the success of the patient survival rate and the primary reason for this lies on the difficulty in the diagnosis process, where for early detecting and characterizing these pathologies, the radiologists must be capable of performing an exhaustive search throughout the scans. This procedure is very time consuming and often physically demanding, that may lead to errors. The biomedical engineers have, therefore, the objective of providing computer-aided diagnosis (CAD) system in order to aid and assist radiologists in diagnostic

Cancer is a leading cause of death worldwide and accounted for 7.6 million deaths (around 13% of all deaths) in 2008. Lung cancer is the most common cause of cancer-related death in men and women and accounted for 1.4 million deaths in 2008 and accounts for more annual deaths than breast, colon and prostate cancers combined. A major risk factor for lung cancer is tobacco use, but also harmful alcohol use, poor diet and physical inactivity are main risk factors. Prevention of lung cancer is difficult since symptoms usually arise when the cancer is already in a very late stage. 5-Year survival rates for stage IV lung cancers are reported to be as low as 10%. However, cancer mortality is expected to be reduced when lung cancer is detected in an early stage. 5-year survival rates for stage I lung cancers are reported to be between 60-80%. Therefore, efforts are under

way to start low-dose CT screening of high-risk subjects to detect lung cancers in an early stage.

Identification of lung cancer in its initial stage is the only way to limit the death rate. However, fining out the lung cancer in its initial stage is difficult and for which physician requests the patients to undergo several Computed Tomography (CT) images at regular intervals . Even though CT imaging precisely captures the lung images; physician still finds it complicated to identify the cancerous nodules. The reason for this is due to the continuous cross- sectional images produced by the CT scanner and required to analyze the every cross-section. This demand for extra effort put by the radiologist to detecting the lung cancer and therefore high probability of error. The development of computer-aided diagnostic (CAD) system may help the physician and radiologist to accurately analyze the CT images to increase the accuracy of the cancerous nodule detection.

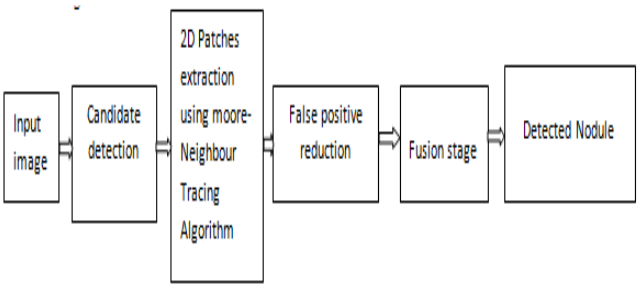
II. CT IMAGE

In order to obtain a CT scan patients lie in a CT scanner . The X-ray tube and the detectors are opposite to each other. Both of these rotate around the patient and information is obtained, usually in slices. The data are constructed by a computer and provide, most commonly, cross-sectional images in a single plane..The pictures are obtained by differences in X-ray absorption - compared with conventional radiology these differences are very small, allowing different shades of grey and distinction between different tissues - eg, between fat and soft tissues and between brain and cerebrospinal fluid.

Fig 1. CT image of Lung

We take an input image of lung for the detection of the nodule. The input image is Computerised tomography (CT) scanned lung image which is used commonly in medicine today

Block Diagram:



It is similar to conventional radiology as it uses X-rays.The input image undergoes the candidate detection process in which the nodule from in the input image is divided into three nodules that is solid nodule ,sub solid nodule ,and large nodule .The 2D patches are extracted in which it is check whether another nodule is present neighbouring to the actual nodule. It undergoes the process of False positive reduction and fusion stage and finally the nodule is detected.

III. ALGORITHM AND RESULT

Algorithm:

1. Segment Thorax from Background in Each Section
2. Segment Lungs within Thorax
3. Apply Rolling Ball Algorithm to Lung Segmentation Contours
4. Apply Multiple Gray-Level Thresholding to Lung Regions
5. Group Voxels of Individual Structures within Lung Volume
6. Identify Nodule Candidates Based on Volume Criterion
7. Compute Features of Nodule Candidates
8. Apply Automated Classifier
9. To Detect The Nodules

IV. CONCLUSION

We have presented a CAD system for pulmonary nodule detection in CT scans based on multi-view convolutional network. We have shown that the proposed convents-CAD achieves good result for the nodule detection task the ConvNets -CAD highly suited to be used as decision Aid in lung cancer screening scenario. Given the deadliness of lung cancer, it is important to be able to identify lung nodules - masses of tissue that can become cancerous. While CAD systems exist for this task, they often produce too many false positives to be of use to oncologists. However, we found that CNNs can successfully be used to classify candidate nodules, with relatively high sensitivity and very high specificity.

The pulmonary nodules can be detected highly frequently in patients with high grade because of improved CT technologies .Carefully follow –up needed if nodules are detected after initial treated are during the clinical course of disease.

V. ACKNOWLEDGEMENT

We would like to express our deepest appreciation to all those who provided us the possibility to complete this project. A special gratitude we give to our final year project guide, Ms.P.Arora whose contribution in stimulating suggestions and encouragement, helped us to coordinate our project, especially in writing this paper.

REFERENCES

[1] S-C. Lo et.al "Artificial convolution neural network for medical image pattern recognition" 1995.

[2] M. Aoyama and et al. Automated computerized scheme for distinction between benign and malignant solitary pulmonary nodules on chest images, Med Physic, 701(8), 2002.

[3] Durai Iyengar and et al. Computer-aided diagnosis systems for lung cancer: Challenges and methodologies, International Journal of Biomedical Imaging, 2010.

[4] C. Jacobs and etss al. Automatic detection of sub solid pulmonary nodules in thoracic computed tomography images, Medical Image Analysis, 18:374–384, 2014.

[5] S. Lo and et al. Artificial convolution neural network for medical image pattern recognition, Neural Networks, 8(7), 1995.

[6] B.C. Lowe amp and et al. the design of simple it. Frontiers in Neuroinformatics, 7(45), 2013.

[7] K. Murphy and et al. A large scale evaluation of automatic pulmonary nodule detection in chest CT using local image features and k-nearest neighbour classification. Medical Image Analysis, 13:757–770, 2009.

[8] Abinav Vishwa and et al. with spiral CT and maximum intensity projection. Radiology, 185:607–610.

[9] A. J. R. Siegel, D.Naishadham. Cancer statistics. CA: a cancer j ournal for clinicians, 62(1):10–29.

[10] H. R. Roth and et al. Improving computer-aided detection using convolutional neural networks and random view aggregation. IEEE Trans. on Medical Imaging, 2015.

[11]S. Diederich and et al. Detection of pulmonary nodules at spiral CT: comparison of maximum intensity projection sliding slabs and single-image reporting. European Radiology, 11, 2001.

