Abstract

Lung parenchyma segmentation is a very important stage in every CAD system for lung cancer detection. In this paper, we propose a new method for CT lung Parenchyma segmentation using the deep SegNet neural network with VGG-16 model. Firstly, 120 CT lung images were collected for the training phase and their ground truth maps were obtained using manual segmentation. Secondly, the training images alongside their corresponding ground truth label images were used as input to the VGG-16 based SegNet model. Finally, 60 CT lung images were collected to validate the performance of the model. The experimental results showed that an accurate segmentation with an average dice similarity index equal to 0.9586 is achieved.

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A, “Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries”. CA Cancer J Clin, vol.6, pp.394-424, 2018.
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2. Müller, Pavel; De Chiffre, Leonardo; Hansen, Hans Nørgaard; Cantatore, Angela., “Coordinate Metrology by Traceable Computed Tomography”, Technical University of Denmark (DTU), 2013.

3. P. Hua, Q. Song, M. Sonka, E. A. Hoffman, and J. M. Reinhardt, “Segmentation of pathological and diseased lung tissue in CT images using a graph-search algorithm.” Proceedings of the International Symposium on Biomedical Imaging (ISBI ‘11), pp. 2072–2075, 2011.

4. Guimei Cui, Liang Wu, Tao Zhou, Yu Gu, Baohua Zhang, Ying Zhao, Dahua Yu, Xiaoqi Lu, and Lixin Gao, “Automatic lung nodule detection using multi-scale dot nodule-enhancement filter and weighted support vector machines in chest computed tomography,” PLoS ONE, vol. 14, no. 1, 2019.

5. Brahim AIT SKOURT*, Abdelhamid EL HASSANI, Aicha MAJDA, “Lung CT Image Segmentation Using Deep Neural Networks”, Procedia Computer Science, vol.127, pp.109-113, 2018.

6. Lin-Yu Tseng, Li-Chin Huang, “An adaptive thresholding method for automatic lung segmentation in CT images”, AFRICON, pp.1-5, 2009.

7. Ying Wei, Guo Shen, and Juan-juan Li, “A Fully Automatic Method for Lung Parenchyma Segmentation and Repairing”, Journal of digital imaging, vol.26, no.3

8. Juanjuan ZHAO, Guohua JI, Xiaohong HAN, Yan QIANG, Xiaolei LIAO, “An automated pulmonary parenchyma segmentation method based on an improved region growing algorithm in PET-CT imaging”, vol.10, pp. 189–200, 2016.

9. Ali Mayya, Mariam Saii, “Lung Detection and Segmentation Using Marker Watershed and Laplacian Filtering”, vol.1, pp.29-42.

10. Yongqiang Tan, Lawrence H. Schwartz, Binsheng Zhaoa, “Segmentation of lung lesions on CT scans using watershed, active contours, and Markov random field”, Medical Physics, vol.40, no.4, 2013.

11. V. Badrinarayanan, A. Kendall and R. Cipolla, "SegNet: A Deep Convolutional Encoder-Decoder Architecture for Image Segmentation," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 12, pp. 2481-2495, 1 Dec. 2017.

12. Lung Image Database Consortium (LIDC): https://imaging.nci.nih.gov/ncia/login.jsf.

13. X. Zhang, J. Zou, K. He and J. Sun, "Accelerating Very Deep Convolutional Networks for Classification and Detection," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 38, no. 10, pp. 1943-1955, 1 Oct. 2016.

14. Abdel, A. T. & Allan, H., “Metrics for evaluating 3D medical image segmentation: analysis, selection, and tool. BMC Medical Imaging”, Volume 15, pp. 1-29, 2015.

Index Terms

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Lung CT, Parenchyma, Semantic Segmentation, Deep learning, SegNet, Vgg16.