Pneumothorax Radiograph Diagnosis Utilizing Deep Convolutional Neural Network

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Abstract

Pneumothorax is a life-threatening respiratory disease caused by physical trauma to the chest or as a complication of medical or surgical intervention (Zarogoulidis, 2014). Despite many available methods, a chest radiograph remains a primary method used for diagnosis. Although this technique is commonly used, it is challenging to diagnose based upon chest radiographs. Highly trained specialists are needed to review the chest radiographs which tends to create a large amount of additional work. Hence, in this study, our goal is to develop an algorithm using Deep Convolutional Neural Networks (DCNNs) to detect visual signs for pneumothorax in medical images and conduct a diagnosis. The deep learning network called ResNet-101 was utilized through transfer learning. A chest radiograph database named "ChestX-ray8" comprised of 108,948 front-view radiographs containing 32,717 unique patients was used. This database contained eight unique, text-mined, disease image labels and was provided by the National Institute of Health (NIH) in 2017 (Wang, Sun, & Jin, 2017). Out of the original database from NIH, a database consisting of 5302 images of pneumothorax was used for training, and a preliminary diagnosis accuracy of 86.26% was achieved. The area under the probability curve (AUC) is 92.13%, which implies that the algorithm can strongly distinguish between patients with pneumothorax and no pneumothorax. This being the case, along with pneumothorax radiographs doctors' expertise, the algorithm will be able to automatically detect physical signs of pneumothorax much faster and with higher accuracy. More patients with pneumothorax symptoms can be detected at a relatively earlier stage. Overall, this project has the potential to revolutionize the field of pneumothorax detection in hospitals and medical imaging institutes.

Keywords: Artificial Intelligence, Deep Learning, Deep Convolutional Neural Network, Medical Imaging, Image Processing, Pneumothorax, Radiograph Processing.

References

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