A Deep Learning based Dual Encoder-Decoder Framework for Anatomical Structure Segmentation in Chest Fluoroscopic Images

Babar Shah
College of Technological Innovation (CTI), Zayed University, Dubai, UAE

Babar.Shah@zu.ac.ae

Summary

In this study, we presented a deep learning-based framework that can effectively identify anatomical structures, which include the lungs, heart, and clavicles, in chest x-ray images. A dual encoder-decoder network is notably employed, which can iteratively refine the output of the first network by fusing it with the input image and passing it through the second network to identify the anatomical structures in the x-ray images. Furthermore, the first encoder-decoder incorporates the use of a pre-trained VGG19 network, which allows the proposed framework to be efficiently trained using limited datasets. In addition, it also allows the proposed model to extract essential features to enhance the anatomical structure segmentation. In the second encoder-decoder, we integrated the input image with a segmentation mask to guide the network and focus on the essential features and avoid the outliers, which permit the proposed network to effectively segment the anatomical structures. Furthermore, instead of the standard convolutional layers, we employed the R2CL and AGMs, which enable the proposed framework to focus on the regions of interest simultaneously and improve the feature maps. The proposed method accurately extracts information from the first encoder-decoder network and integrates it with the second encoder-decoder network to provide precise segmentation of the anatomical structures, which will assist physicians with diagnosing various pulmonary and cardiac diseases. In the future, the performance of the anatomical structure's segmentation framework will be enhanced by utilizing synthetically generated samples by using generative adversarial networks. Additionally, downstream tasks, such as pneumonia and covid classification will be included to provide a more comprehensive approach for the CADs of chest radiographs. Finally, a more sophisticated segmentation and classification method will be investigated for more accurate and reliable anatomical structure segmentation and diseases classification.