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Pre-Trained Convolutional Neural Networks as Feature Extractors for Tuberculosis Detection

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Abstract

It is estimated that in 2015, approximately 1.8 million people infected by tuberculosis died, most of them in developing countries. Many of those deaths could have been prevented if the disease had been detected at an earlier stage, but the most advanced diagnosis methods are still cost prohibitive for mass adoption. One of the most popular tuberculosis diagnosis methods is the analysis of frontal thoracic radiographs; however, the impact of this method is diminished by the need for individual analysis of each radiography by properly trained radiologists. Significant research can be found on automating diagnosis by applying computational techniques to medical images, thereby eliminating the need for individual image analysis and greatly diminishing overall costs. In addition, recent improvements on deep learning accomplished excellent results classifying images on diverse domains, but its application for tuberculosis diagnosis remains limited. Thus, the focus of this work is to produce an investigation that will advance the research in the area, presenting three proposals to the application of pre-trained convolutional neural networks as feature extractors to detect the disease. The proposals presented in this work are implemented and compared to the current literature. The obtained results are competitive with published works demonstrating the potential of pre-trained convolutional networks as medical image feature extractors.

Keywords: Deep Learning, Convolutional Neural Networks, Tuberculosis, Computer Assisted Diagnosis, Multiple Instance Learning, Ensemble

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