CoVNet: A Deep Convolutional Neural Network Model for Improving COVID-19 Detection

Soundappan, Shiva (School: Houston County High School)

COVID-19, also known as the coronavirus disease, is a respiratory illness caused by a virus called SARS-CoV-2. Currently, there are two standard COVID-19 diagnostic tests: RT-PCR, with a sensitivity of 89.9% and a turnaround time of 2-3 days, and COVID-19 antigen, with sensitivities ranging from 60-85% and a turnaround time of 15-30 minutes. With the low sensitivities and long turnaround times of both tests, the need for quicker and more accurate COVID-19 diagnosis is imperative. Radiology methods, such as Chest X-Rays (CXR) can be used diagnose COVID-19. However, the conditions presented in COVID-19 are very similar to the conditions presented in other respiratory diseases, which makes it difficult for radiologists to effectively diagnose COVID-19. Deep learning models, such as the Convolutional Neural Network (CNN), have shown the potential to accurately identify patterns in CXR imaging. In this project, a novel CNN architecture, termed CoVNet, was created and trained on 27,136 CX-R images and tested on 6,784 CX-R images for a three-class classification (Normal, COVID-19, and Non-COVID Pneumonia). Three other popular pre-trained CNN models were also trained and tested on this dataset. The CoVNet model achieved an accuracy of 91.2% and a specificity and sensitivity of 98.9% and 94.9%, respectively, for detecting COVID-19. There was a statistical significance that that CoVNet performed better than all 3 pre-trained models. There also was statistical significance that that CoVNet had a higher specificity and sensitivity than professional radiologists in detecting COVID-19.