Smartphone Capable Lightweight Convolutional Neural Network Model for Detecting COVID-19 in Chest X-rays: Addressing the Need of Resource-strapped Locations

Nair, Ayan (School: Okemos High School)

COVID-19 has been a global health crisis for the past year. One way of testing COVID-19 is with the use of chest X-rays. Radiologists read an X-ray and provide results within 24 hours. However, many hospitals do not have a radiologist on hand, making it harder for hospitals to give accurate and timely results to patients. This project aims to use a lightweight convolutional neural network to accurately detect COVID-19 from standard chest X-rays, one that can potentially be used on a smartphone. My project uses a ResNet model and a lightweight mobile neural network. A ResNet is a convolutional neural network that can classify an input image into 1000 object categories. The lightweight mobile neural network, on the other hand, is a highly stripped-down version containing less than 15 layers. I examine if a lightweight neural network tool can accurately detect COVID-19 pathologies from chest radiographs. To answer the research question, I first gathered 1345 viral pneumonia chest radiographs provided by Chowdhury et. al. (2020) & Rahman et. al. (2020), 1070 images of COVID-19 radiographs from GitHub provided by Cohen et. Al. (2020), and 1358 images of normal chest radiographs obtained from CheXpert (Irvin et. al. 2019), a large public radiograph dataset. Using this data, I first trained the ResNet model and used the weights from the training model to test 800 radiographs. The performance of this model (accuracy, sensitivity, specificity) was compared with the performance attained from the lightweight model. The results show that the lightweight model provided very high accuracies, sensitivities, and specificities, which are 98.4%, 97.7%, and 98.7% respectively. This offers potential for using such a smart phone capable lightweight model in resource strapped locations.

Awards Won: