CoronaXNet: Using Convolutional Neural Networks to Automate the Detection COVID-19 from Chest X-Ray Images

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With major outbreaks in over 150 countries, the COVID-19 pandemic has had a devastating effect on public health, daily life, and the global economy. Absent a vaccine or therapeutic treatment for the novel virus, early diagnosis of infected persons has become critical to allow for targeted isolation, limiting the probability of the spread into healthy populations. This study evaluates the ability of deep learning models to identify the abnormalities in COVID-19 radiographs with the goal of diagnosing infected patients efficiently and effectively. To do this, transfer learning was used to train various popular convolutional neural networks on a collected multiclass dataset that contained chest X-ray images of COVID-19, pneumonia, and normal patients. After 100 epochs of training, the proposed hybrid VGG19-LSTM model architecture, CoronaXNet, achieved the highest total validation accuracy (95.59%) out of all the models and exhibited minimal overfitting. In contrast, the deeper network architectures tended to be less accurate as they easily overshot the relatively small dataset. Grad-CAM heatmaps, which were generated using the gradient information flowing into the last layer of each head network, showed no irregularities in the evaluation behavior of the models. Although the achieved performance of CoronaXNet is promising, further research with a larger sample of COVID-19 radiographs is required to get a more robust estimate of accuracy rates.