Transcript of 2021 3MT® presentation by Jenita Manokaran, PhD Engineering at the University of Guelph

What were your thoughts when you heard about COVID-19 for the very first time? Fear? Anxiety? Anger? You are not alone. I had to sail through the same phase too. And to add fuel to the fire, my very first project was on COVID-19. Looking into the x-ray images every single day did not help me overcome my fear. So, I had to change my focus from fear to how to contribute to the human society fighting against COVID-19.

Currently, we have swab test available for diagnosis, but it takes 24-48 hours to get the results, where the affected patient might spread the disease. Even worse when the new variants are taken into consideration. So, we are in need for a fast and accurate tool to control the disease spread and potentially save lives.

So, the main goal of my research is to develop a fast, accurate, and automated tool to detect COVID-19 from healthy and other pneumonia cases using deep learning. So, what is deep learning? It is an AI, which behaves like a human brain and learns complicated patterns through a larger data set.

But collecting this larger data set was challenging in my case as COVID-19 was fairly new and not many images were available for public access. So, I used state-of-the-art method called transfer learning. It is a deep learning technique where the knowledge gained by training the model on large public data set can be reused for my own small medical data set.

By implementing this technique, I was able to predict COVID-19 with an accuracy of more than 90%. But I need to wishfully prove that my model looked into the right features in the lungs and not on the other artifacts present. Because if you take any x-ray images, there are many artifacts like probes, pacemakers, labels that are unique to different hospitals, which may affect my classification result.

So, I used Grad-CAM, a visual indicator that produces a heat map highlighting the area in red used by the model for classification. As shown in the slide, the model looked into the right features in the lungs and not the other artifacts like label in this case.

Currently, I am working towards finding the severity of the disease to identify high risk patients who are in need of ventilators. Once my model is fully developed, it will become a game-changer. As it is not only accurate, it is much faster. It can be used a rapid screening tool to relieve high volume of patients in the testing centers. And at the airports, for screening travellers to avoid long hotel quarantine, and to prevent super spreader events. Most importantly, it can be implemented in the developing countries as X-rays are available even in remote parts of the world.

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