COVID-19-CNN-Image-Detection-from-Lung-X-Rays

This project aims to take a chest X-Ray image and detect if the patient has the COVID-19 infection. It uses a CNN to train on a large dataset of both normal and COVID lung images to learn how to process the difference in both images. COVID-19 or novel Coronavirus originated in Wuhan, China in 2019 and spread around the world. it has so far infected millions of people across the world.

As the number of cases are rapidly increasing, most of the countries are facing shortage of testing kits and resources. AI is already transforming many different fields. One such field is the area of Medical Diagnosis through accurate clinical computer-aided diagnosis (CAD) systems.

The limited quantity of testing kits and increasing number of daily cases encouraged us to come up with a deep learning model that can aid radiologists and clinicians in detecting COVID-19 cases using chest X-rays. This project aims to take a chest X-Ray image and detect if the patient has the COVID-19 infection. It uses a CNN to train on a large dataset of both normal and COVID lung images to learn how to process the difference in both images.

We applied a CNN Model, which we trained on a COVID-19 Radiography dataset containing Chest X-Rays, for detecting COVID-19 & achieved ~98% accuracy on the validation set with respective to Radiologist's clinical findings.

Literature Survey

[1]COVID-19 is creating havoc on the lives of human beings all around the world. It continues to affect the normal lives of people. As number of cases are high, a cost effective and fast system is required to detect COVID-19 at appropriate time to provide the necessary healthcare. Chest X-rays have emerged as an easiest way to detect COVID-19 in no time as RT-PCR takes time to detect the infection. In this paper we propose a concatenation-based CNN model that will detect COVID-19 from chest X-rays. We have developed a multiclass classification problem which can detect and classify a chest X-ray image as either COVID + ve, or viral pneumonia, or normal. We have used chest X-rays collected from different open sources. To maintain class balancing, we took 500 images of COVID, 500 normal images, and 500 pneumonia images. We divided our dataset in training, validation, and test set in 70:10:20 ratio respectively. We used four CNNs as feature extractors from the images and concatenated their feature maps to get better efficiency of the network. After training our model for 5 folds, we have obtained around 96.31% accuracy, 95.8% precision, 92.99% recall, and 98.02% AUC. We have compared our work with state-of-the-art pretrained transfer learning algorithms and other state-of-the-art CNN models referred in different research papers. The proposed model (Concat_CNN) exhibits better accuracy than the state-of-the-art models. We hope our proposed model will help to classify chest X-rays effectively and help medical professionals with their treatment.

2 A team of researchers from Qatar University, Doha, Qatar, and the University of Dhaka, Bangladesh along with their collaborators from Pakistan and Malaysia in collaboration with medical doctors have created a database of chest X-ray images for COVID-19 positive cases along with Normal and Viral Pneumonia images. This COVID-19, normal, and other lung infection dataset is released in stages. In the first release, we have released 219 COVID-19, 1341 normal, and 1345 viral pneumonia chest X-ray (CXR) images. In the first update, we have increased the COVID-19 class to 1200 CXR images. In the 2nd update, we have increased the database to 3616 COVID-19 positive cases along with 10,192 Normal, 6012 Lung Opacity (Non-COVID lung infection), and 1345 Viral Pneumonia images and corresponding lung masks.

3 The whole world is facing a health crisis, that is unique in its kind, due to the COVID-19 pandemic. As the coronavirus continues spreading, researchers are concerned by providing or help provide solutions to save lives and to stop the pandemic outbreak. Among others, artificial intelligence (AI) has been adapted to address the challenges caused by pandemic. In this article, we design a deep learning system to extract features and detect COVID-19 from chest X-ray images. Three powerful networks, namely ResNet50, InceptionV3, and VGG16, have been fine-tuned on an enhanced dataset, which was constructed by collecting COVID-19 and normal chest X-ray images from different public databases. We applied data augmentation techniques to artificially generate a large number of chest X-ray images: Random Rotation with an angle between -10 and 10 degrees, random noise, and horizontal flips. Experimental results are encouraging: the proposed models reached an accuracy of 97.20 % for Resnet50, 98.10 % for InceptionV3, and 98.30 % for VGG16 in classifying chest X-ray images as Normal or COVID-19. The results show that transfer learning is proven to be effective, showing strong performance and easy-to-deploy COVID-19 detection methods. This enables automatizing the process of analyzing X-ray images with high accuracy and it can also be used in cases where the materials and RT-PCR tests are limited.

References

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