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Covid 19 Detection from Chest X-Ray Images Using Deep Learning

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***Abstract*- The Covid-19 first occurs in Wuhan, China in December 2019. After that the virus spread all around the world and at the time of writing this paper the total number of confirmed cases are above 170 million with over 3.8 million deaths. Machine learning algorithms built on radiography images can be used as a decision support mechanism to aid radiologists to speed up the diagnostic process. CNN is a Deep Learning algorithm, we are using Convolution Neural Network(CNN) to identify the different features of the x ray images or we can say to visualize the most discriminating regions of the input images. We are taking images of chest x-rays from github. The application of deep learning in the field of COVID-19 radiologic image processing reduces false-positive and negative errors in the detection and diagnosis of this disease and offers a unique opportunity to provide fast, cheap, and safe diagnostic services to patients.**

***Keywords*- Covid-19, Convolution Neural Network (CNN), Deep Learning, X-ray images.**

I. INTRODUCTION

With the outbreak of an unknown disease in late 2019 in China, some people became infected with the disease in a local market. The disease was completely unknown at first, but specialists diagnosed its symptoms as similar to those of coronavirus infection and flu [1–4].

The specific cause of this widespread disease was initially unknown, but after the laboratory examination and analysis of positive sputum by real-time polymerase chain reaction (PCR) test, the viral infection was confirmed and eventually named “COVID-19” upon the recommendation of the World Health Organization (WHO).

TheThe American College of Radiology recommends that CT scans should not be used as the first line of diagnosis. Problems such as the risk of transmission of the disease while using a CT scan device and its high cost can cause serious complications for the patient and healthcare systems, so it is recommended that if medical imaging is needed, the CT scan be replaced with CXR radiography [22].

X-ray imaging is much more extensive and cost-effective than conventional diagnostic tests. Transmission of an X-ray digital image does not require transferring from the access point to the analysis point, so the diagnostic process is performed very quickly.

Chest radiography is convenient and fast for medical triaging of patients. Various studies have indicated the failure of CXR imaging in diagnosing COVID-19 and differentiating it from other types of pneumonia. The radiologist cannot use X-rays to detect pleural effusion and determine the volume involved. However, regardless of the low accuracy of X-ray diagnosis of COVID-19, it has some strong points [25, 26].

To overcome the limitations of COVID-19 diagnostic tests using radiological images, various studies have been conducted on the use of deep learning (DL) in the analysis of radiological images.

II. DATASET DESCRIPTION

We are using X-ray images collected from different publicly available sources. Our dataset is a collection of 100 chest x ray images. 50 images are of Covid 19 and 50 are normal.

(a)Covid (b) Normal
Fig 1. Examples of x-ray images used in project.

We are creating three folders:

- Testing,
- Training and
- Validation.

As folders name suggests testing folder images will be use to test our model and training folders images will be used to train our model and validation folder images would be used for calculating the efficacy of our model. Example of dataset images shown below.

III. METHODS

1. Basic Flow of Model:

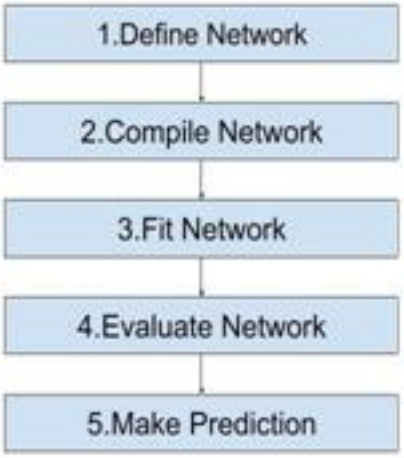

Fig 2. Flow Model.

2. Deep Learning:

In 2006, Hinton and Salakhutdinov published an article in the Science journal that was a gateway to the age of DL. They showed that a neural network with hidden layers played a key role in increasing the learning power of features. These algorithms can enhance the accuracy of classifying different types of data.

One of the major applications of DL in radiology practices was the detection of tissue-skeletal abnormalities and the classification of diseases. The convolutional neural network has proven to be one of the most important DL algorithms and the most effective technique in detecting abnormalities and pathologies in chest radiographs. Since the outbreak of COVID-19, much research has been conducted on processing the data related to DL algorithms, especially CNN. Using different algorithms and DL architectures, these studies have embarked on the identification and differential diagnosis of COVID-19.

3. CNN:

We Humans are the master at determining objects quickly. When you enter a grocery store, you can separate bananas from other goods such as shoes. Yet to teach those classifications with a computer is very hard. In the past, image classification models used raw pixels to classify the images. You can classify cats by color histogram and edge detection which allows you to classify cats by color and ear shape. This method has been successful but until the method encounters more complex variants. That's where the classical image recognition fails because the model does not account for other features. But what are these other features? Do you need to tell the model one by one? You will find it a great hassle if not impossible. That's where we can use CNN.

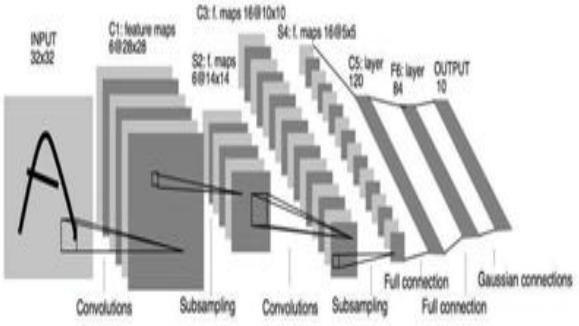

Fig 3. CNN Architecture.

CNN is a type of neural network model which allows us to extract higher representations for the image content. Unlike the classical image recognition where you define the image features yourself, CNN takes the image's raw pixel data, trains the model, then extracts the features automatically for better classification.

Because the human brain is designed to capture patterns in order to classify an object, changing the points where you focus your observation also changes your interpretation of the overall image. Similar to how the human brain works, CNN distinguishes meaningful features in an image in order to classify the image as a whole. Even though we do not use the test set to train the model, the model could adjust the loss function with the test dataset. This will base the training with the test dataset and is a common cause of overfitting. Therefore during the training we need to use validation datasets then ultimately test the model with the unseen test set.

4. Keras and Tensorflow

TensorFlow 2 is an end-to-end, open-source machine learning platform. You can think of it as an infrastructure layer for differentiable programming. It combines four key abilities:

- Efficiently executing low-level tensor operations on CPU, GPU, or TPU.
- Computing the gradient of arbitrary differentiable expressions.
- Scaling computation to many devices
- Exporting programs ("graphs") to external runtimes such as servers, browsers, mobile and embedded devices.

Keras is the high-level API of TensorFlow 2: an approachable, highly-productive interface for solving machine learning problems, with a focus on modern deep learning. It provides essential abstractions and building blocks for developing and shipping machine learning solutions with high iteration velocity.

Keras empowers engineers and researchers to take full advantage of the scalability and cross-platform capabilities of TensorFlow 2: you can run Keras on TPU or on large clusters of GPUs, and you can export your Keras models to run in the browser or on a mobile device.

IV. CONCLUSION

This paper presented a critical analysis for CNN architectures, proposed originally for natural image analysis, for the purpose of aiding radiologists to discriminate COVID-19 disease based on chest X-ray images. We also proposed a simple CNN architecture that can outperform architectures such as Xception and

Dense net when trained on a small dataset of images. The use of these techniques in rapid diagnostic decision-making of COVID-19 can be a powerful tool for radiologists to reduce human error and can assist them to make decisions in critical conditions and at the peak of the disease.

This research supports the idea that DL algorithms are a promising way for optimizing healthcare and improving the results of diagnostic and therapeutic procedures. Although DL is one of the most powerful computing tools in diagnosis of pneumonia, especially COVID-19, developers should be careful to avoid overfitting and to maximize the generalizability and usefulness of COVID-19 DL diagnostic models; these models must be trained on large, heterogeneous datasets to cover all the available data space.

REFERENCES

[1] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems book by aurleion geron.
[2] C. M. A. De O. Lima, “Information about the new coronavirus disease (COVID-19),” Radiologia Brasileira, vol. 53, no. 2, 2020.
[3] Automated detection of Covid-19 cases using deep neural network by muhammedtalo.
[4] I. D. Apostolopoulos and T. Bessiana, “Covid-19: Automatic detection from X-Ray images utilizing Transfer Learning with Convolutional Neural Networks,” Phys. Eng. Sci. Med., Mar. 2020.
[5] Mustafa Ghaderzadeh, Deep Learning in the Detection and Diagnosis of COVID-19 Using Radiology Modalities: A Systematic Review.
[6] Vincent tatan, Understanding Convolution neural network, Dec 26, 2019.