COVID-19 Classification Detection System Based on Dense Convolutional Network with SENet Module

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Abstract:
Coronavirus known as Covid-19 starts from Wuhan city of China and affects rapidly around all over the world. In March 2021, According to the Statistic of WHO approximately 120M cases reports and deaths are 2.66M which is extremely frightened. It has caused a devastating effect on both community health and the worldwide economy. After lots of struggle developed countries almost overcome the disease due to good infrastructure in Hospitals and proper lab instruments. But the problem is currently for Developing Countries they have poor health sectors and lack proper equipment as well as other accessories due to this reason no accurate method to detect the corona patients. So, in the current scenario, need an intelligent system to detect Coronavirus patients without the help of any instruments. For this purpose, we will use the Dense Convolutional Neural Network (DenseNet) as the basic building block and with the squeeze-and-excitation (SENet) module for the classification of COVID-19 Computed Tomography (CT) Chest Images.

Introduction:
COVID-19 is a type of virus. It is called Novell because it is a new strain of the virus and its combination with the number 19 since it appeared in 2019. COVID-19 is a transferable virus caused by SARS-CoV-2. The most common symptoms of the virus are fever, dry cough, tiredness, difficulty breathing, and Chest Pain.
Coronavirus first case reports in November 2019 in Wuhan city of China and affected thousands of peoples. Then rapidly spread around all over the world. Now currently 2.66M cases Reports and Death around 2.6M.
The Coronavirus is first and foremost reach between people during close contact through sneezing, handshaking, eating, etc. The virus approaches the cell membrane which very dangerous for the human body. For this disease currently, there is no vaccine available but many Countries have working for the Vaccination of COVID-19.

Literature Review:

In this paper [1] author's proposed a model for classification of Coronavirus. They have used Machine Learning Method. This work performs a COVID-19 classification in two steps. In the first step, they have used Support Vector Machine (SVM) and without Extraction, Features classify the result. And In the second step, they have used five Feature Extraction methods such as Grey Level Cooccurrence Matrix, Local Directional Patterns, Grey Level Run Length Matrix, Grey Level Size Zone Matrix, and Discrete Wavelet Transform and then classify the result through Support Vector Machine.

In this paper [2] author's used the DeTraC-ResNet18 model to detect the Chest X-ray image of Coronavirus patients. For Feature Extraction they have used the PCA model to project the high dimensional to low dimensional and then apply shallow-tuning mode for training. For this purpose, they used 70% data for training and 30% for testing. And the result that they obtained is 95.12% accuracy and 91.87% specificity.

In this Paper [3] author's proposed a study develops a model for the detection of Coronavirus disease. They used three models of Deep Learning named ResNet50, InceptionV3, and Inception-ResNetV2 and dataset that they used Chest X-ray image. They split the dataset they used a 5-fold cross-validation Technique. In this study, ResNet50 gave a better result as compare to InceptionV3 and Inception-ResNetV2.

The main problem in the above research is that they have used limited patient's datasets.

Research Objective:

1. To build an intelligent system for Coronavirus patients.
2. To implement a robust computer vision technique for detection.
3. To determine the most efficient extract features for CT Chest images.

Significance of Study:

1. Patients don't need to go to a special Medical Laboratory for the corona test.
2. Patients can check their own corona test through the mobile application.
3. An accurate method to detect Coronavirus patients.
4. Hospitals don't need to invest in producing test kit.
5. Quick result and time saving.
6. Cost efficient method.

Methodology:

In this study, we will use the Dense Convolutional Neural Network (DenseNet) as the basic building block and with the squeeze-and-excitation (SENet) module. It's relatively a new technique. DenseNet consists of the block and there in several layers, each layer obtains extra inputs from all preceding layers and passes on its own feature-maps to all following layers.

In this technique, we will use four Dense Bock which extracts the feature from the Chest X-Ray image and fed into the squeeze-and-excitation (SENet) module. Then all the information that fed

into the SENet module will concatenate and goes into a fully connected layer. In a fully connected layer we will apply the sigmoid function to predict the result (why sigmoid? because we have two class datasets Corona Positive and Corona Negative. For this purpose, we will use 100k Chest X-Ray images (both corona patients and Normal) to train and test the model.
Here you can see the Structure of DenseNet with the SENet module and how the system will work.

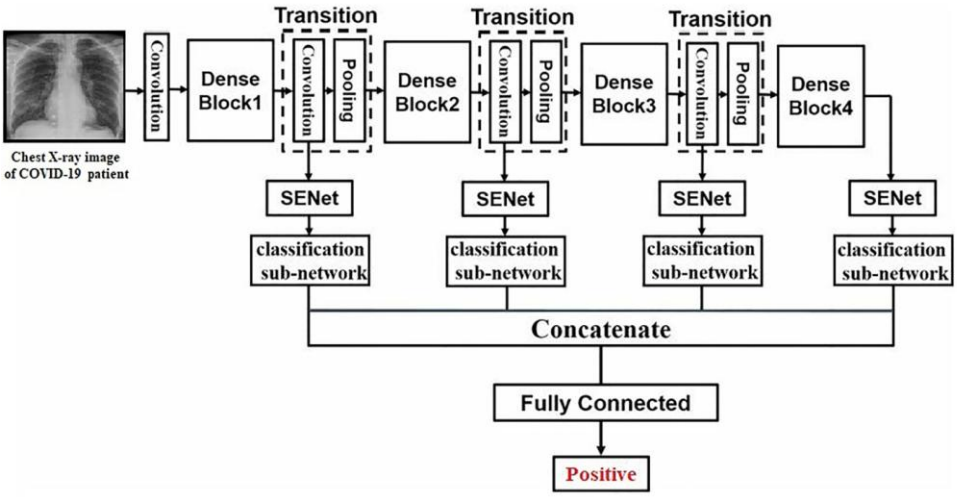

Figure 1: Corona Positive Case Detection

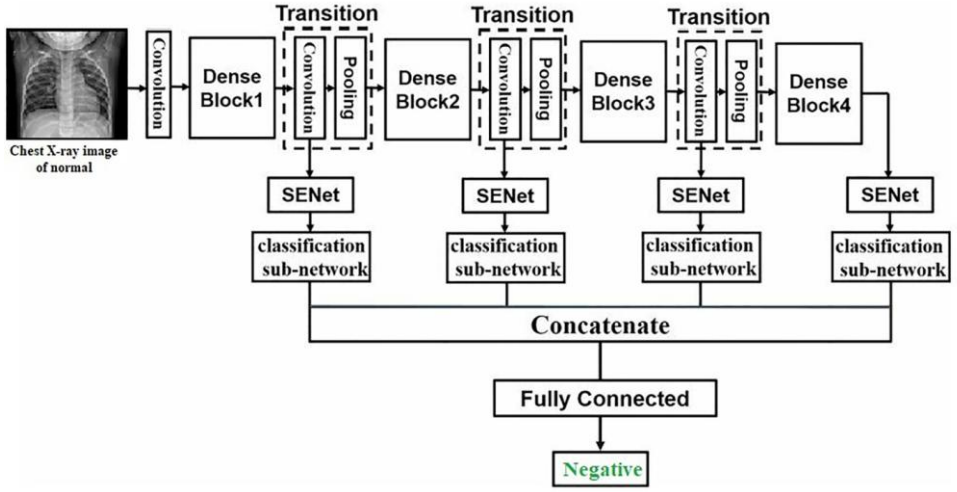

Figure 2: Corona Negative Case Detection

Research Plan:

The timeline for the research plan in this Course is as the following:

Outline	Mar 2021	Apr 2021	May 2021	Jun 2021
Literature Review	?			
Introduction	?			
Data Collection		?		
System architecture		?		
Testing and Training			?	
Result Evaluation			?	
Final report				?
Presentation				?

Reference:

[1] Barstuğan, Mücahid & Özkaya, Umut & Öztürk, Şaban. (2020). Coronavirus (COVID-19) Classification using CT Images by Machine Learning Methods.

[2] Abbas, Asmaa & Abdelsamea, Mohammed & Gaber, Mohamed. (2020). Classification of COVID-19 in chest X-ray images using DeTraC deep convolutional neural network. 10.1101/2020.03.30.20047456.

[3] Narin, Ali & Kaya, Ceren & Pamuk, Ziynet. (2020). Automatic Detection of Coronavirus Disease (COVID-19) Using X-ray Images and Deep Convolutional Neural Networks.

[4] Li, Kunwei & Fang, Yijie & Li, Wenjuan & Pan, Cunxue & Qin, Peixin & Zhong, Yinghua & Liu, Xueguo & Huang, Mingqian & Liao, Yuting & Li, Shaolin. (2020). CT image visual quantitative evaluation and clinical classification of coronavirus disease (COVID-19). European Radiology. 30. 10.1007/s00330-020-06817-6.

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