

# COVID-19 Detection from Lung CT imagery using AI

--Deep Learning Approach

## Introduction:

Novel Corona virus has took large attention of all the globe. Every one joined the battle to fight the Corona virus. As a part of society we develop the software for Corona detection using AI; specially designed for front-line use to help doctors to detect and monitor the disease efficiently and effectively. Patients with confirmed COVID-19 pneumonia have typical imaging features that can be helpful in early screening of highly suspected cases and in evaluation of the severity and extent of disease. Most patients with COVID-19 pneumonia have ground-glass opacities or mixed ground-glass opacities and consolidation and vascular enlargement in the lesion. Lesions are more likely to have peripheral distribution and bilateral involvement and be lower lung predominant and multifocal. CT involvement score can help in evaluation of the severity and extent of the disease[1].

Some survey [2] analyzed that the sensitivity of RT-PCR testing at various tissue sites, bronchoalveolar lavage fluid specimens demonstrated the highest positive rates of at 93% (n = 14). This was followed by sputum at 72% (n = 75), nasal swabs at 63% (n = 5), fibrobronchoscope brush biopsy at 46% (6/13), pharyngeal swabs at 32% (n = 126), feces at 29% (n = 44) and blood at 1% (n = 3). The authors of that study pointed out that testing of specimens from multiple sites may improve the sensitivity and reduce false-negative test results. The letter examined 1070 specimens that were collected from 205 hospitalized patients with confirmed COVID-19 in China. In another study published in *Radiology*, [3] investigators found chest CT achieved higher sensitivity for diagnosis of COVID-19 as compared with initial RT-PCR from pharyngeal swab samples. This retrospective study analyzed 1014 hospitalized patients with suspected COVID-19 in Wuhan, China with patients undergoing both serial RT-PCR testing and chest CT. Using RT-PCR results as reference standard, the sensitivity, specificity, and accuracy of chest CT in diagnosing COVID-19 were 97% (n = 580), 25% (n = 105), and 68% (n = 685), respectively.

## Motivation:

The Corona outbreak has put significant pressure on imaging departments, to test hundreds of peoples per day. Patients and doctors typically have to wait a few hours to get the CT results, but our system is improving the CT diagnosis speed for each case; and each minute saved is critical to decrease the chance of cross-contamination at the hospital.

The shortage of strict laboratory requirements for the use of the RT-PCR detection kit, to confirm the 2019-nCoV diagnosis, is a major problem. Proposed system can help with limited medical resources to immediately screen out suspected Coronavirus-infected patients for further diagnosis and treatment.

The battle against this epidemic is one being fought by all clinicians and countries, and We as a part of society is fully committed to support these efforts, wherever needed, and aspires to "Use the most advanced AI technology to serve the most fundamental needs."

## Challenge:

*"To develop a system that detect Novel corona symptoms with maximum precision and with minimum processing time."*

For NOVEL CORONA Patients CT scan have some symptoms such as, Reticulation, Ground Glass Opacities and Consolidation of lung tissue. To detect such symptoms is challenging. Traditional methods such as segmenting the Region of interest t, then extracting features of those part and then

classify using some pretrained classifier is time consuming process. Recent studies on Deep learning change the process of detection by Providing the image to this second generation neural networks which are capable of extracting features and classifying itself. Also CORONA is spreading fast, so this overall development should be completed within few duration.

Block diagram:

Proposed method takes Lung CT scan as input. It process on input image using median filter. After that it extract the region of interest. Then our deep dense network will look for any symptoms for corona such as glass opacity. If it found any of the trained symptom then it will gives result for COVID costiveness. The accuracy of any Deep Network depends on the training dataset. For our model we used normal Lung CT scan from LIDC Dataset[4] and Corona image are taken from web. As there is privacy issues of corona images. Also in this situation no one is ready to make those dataset public.

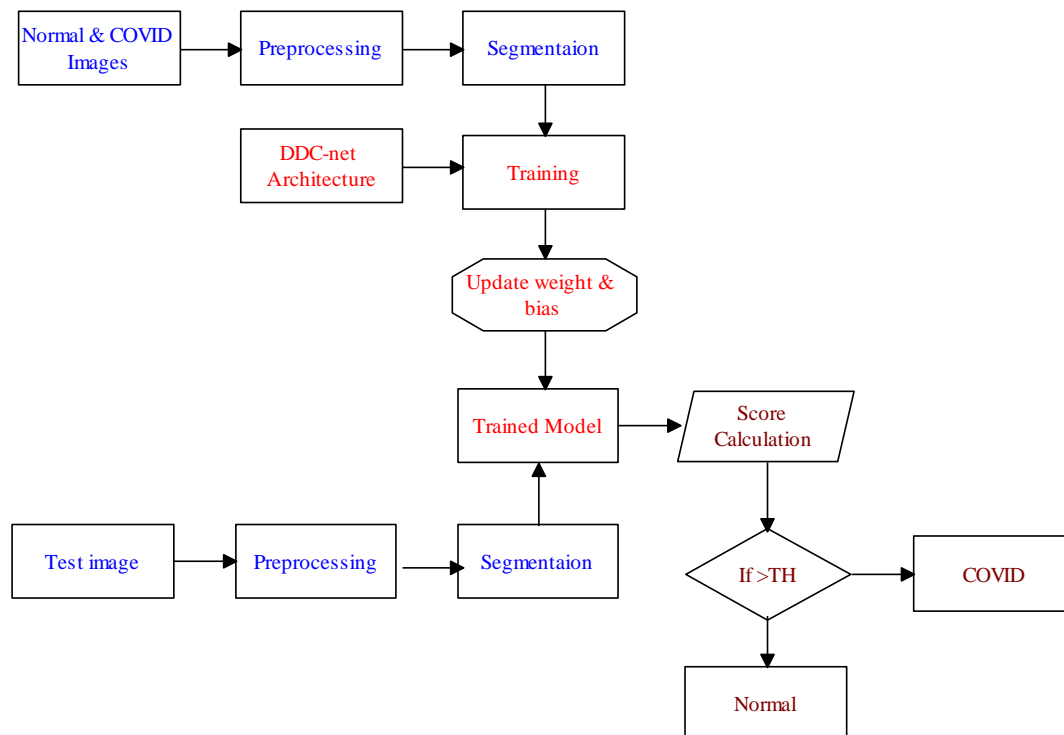


Figure 1: Proposed Architecture

A new artificial intelligence-powered deep learning model will help radiologists to distinguish COVID-19 from community-acquired pneumonia and other lung diseases in chest CT imaging

Experiments and results:

Proposed model will help with a growing workload to be able to focus on complex clinical cases. With its deep learning algorithms, it automatically highlights abnormalities, segments anatomies. Proposed model gives better accuracy for Dataset. For real time imagery large dataset is needed.

Execution Time:

Execution time required for overall test is 10.14 seconds.

Demo:

Necessary Hardware:

- 1] Laptop or PC or
- 2] Raspberry Pi

Necessary software:

- 1] Python or
- 2] MATLAB

Platform Flexibility:

- It can be implement on a single kit using raspberry pi.

Implementation in MATLAB:



*Figure 2: Main Front Panel (MATLAB)*

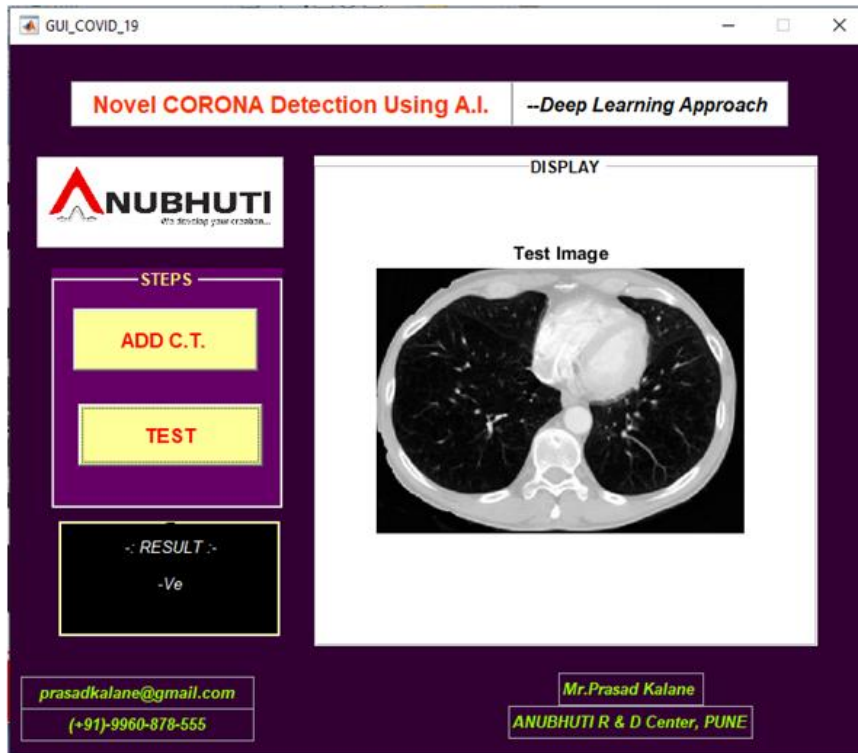


Figure 3: Normal Patient (MATLAB)

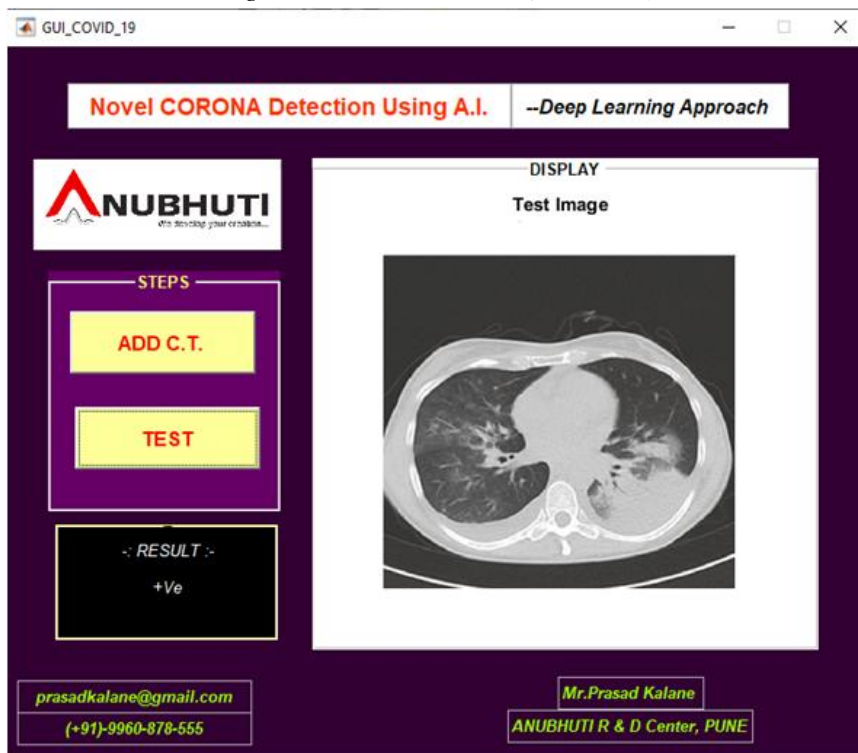


Figure 4: Corona Patient (MATLAB)

Implementation in MATLAB:

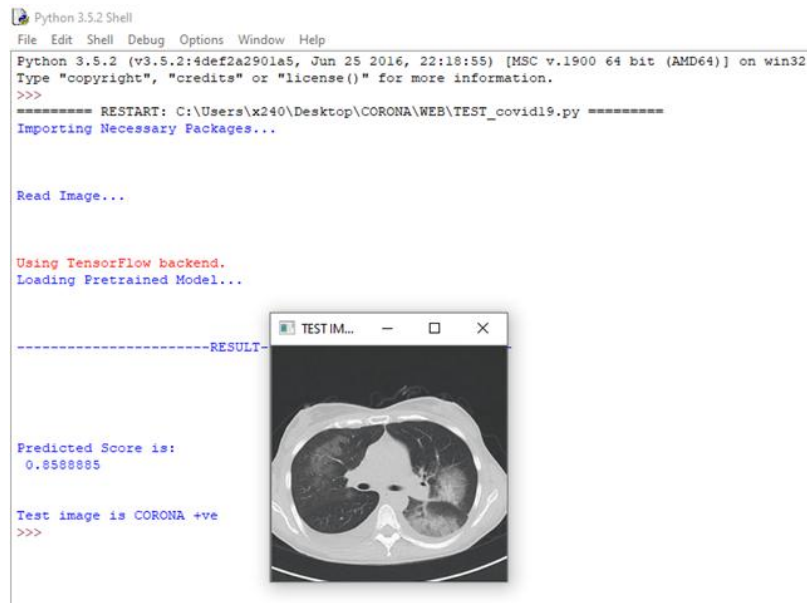


Figure 5: Corona Patient (Python)

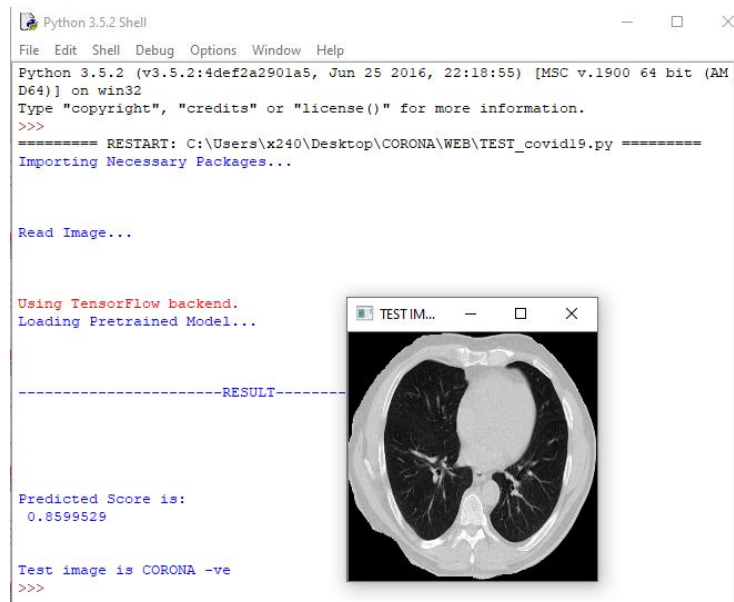


Figure 6: Normal Patient (Python)

## Conclusion:

- Faster, more informative CT scans:  
Proposed method not only detects the availability of NOVEL CORONA but also it tracks the treatment progress.
- Ability to experiment with new deep learning architects:  
In Second generation, number of architectures or algorithms is present for classification problem. In other languages we have to start from scratch, but for MATLAB and Python this is another case., simply calling those function and changing the input argument, you test.
- Highly reduced programming time:

Due to available built in commands, design and development time get reduced. With minimal Mathematics behind deep learning, We can design and test various architectures of neural network.

#### References:

- [1] Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study Wei Zhao, Zheng Zhong, Xingzhi Xie, Qizhi Yu and Jun Liu, American Journal of Roentgenology: 1-6. 10.2214/AJR.20.22976
- [2] Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in Different Types of Clinical Specimens. JAMA. Published online March 11, 2020. doi:10.1001/jama.2020.3786
- [3] Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases, Tao Ai, Zhenlu Yang, Hongyan Hou, Chenao Zhan, Chong Chen, Wenzhi Lv, Qian Tao, Ziyong Sun, Liming Xia , Feb 26 2020<https://doi.org/10.1148/radiol.2020200642>
- [4] <https://omictools.com/lidc-idri-tool>