Background

The coronavirus infection, COVID-19 has surprised the world with its rapid spread, potential virulence.

You can see spread of Coronavirus around the world and in India through following websites:

1. https://www.covid19india.org/
2. https://www.worldometers.info/coronavirus/

Challenge in current system:

A critical step in the fight against COVID-19 is effective screening of infected patients

RTPCR is by far the best method to test COVID19 for initial confirmation on diagnosis, while after some days CT scan and chest Xray's are done to measure progression of pneumonia inside body The imaging is basically done to measure progression of lesions to formation of Ground granular opacities (GGOs) or consolidation of GGOs. CT scans are generally more accurate in visualising GGOs [Ref]

While RT-PCR testing is the gold standard as it is highly specific, it is a very time-consuming, laborious, and complicated manual process that is in short supply

An alternative screening method that has also been utilized for COVID-19 screening has been radiography examination, where chest radiography imaging (e.g., chest X-ray (CXR) or computed tomography (CT) imaging) is conducted and analysed by radiologists to look for visual indicators associated with SARS-CoV-2 viral infection (particularly searching for progression of Pneumonia)

Following challenges are proposed:

1. Doctors and radiologists in hospitals have to process above than normal scans a day. Device a method which can empower Doctors and radiologists to increase the efficiency of scanning
2. CT scans machines take longer time for sanitation, Device a method through which usage of CT scans can be limited and done only case of emergencies

**Scans refer to human analysis of medical images produced by CT or X-Ray*
**CT findings were positive in all 140 laboratory-confirmed COVID-19 patients, even in the early stage. In the fifth version of 78 diagnostic manual of COVID-19 launched by the National Health and Health Commission of 79 China, the radiographic characteristics of pneumonia was included the clinical diagnostic standard*

Proposed Solution point wise as listed above

1. Computer system which takes medical image (all formats) as an input and provide following:
    1. whether person is COVID19 positive or not
    2. If the person is COVID19 positive then what's the severity
2. Analyse chest X-Ray images to figure out above points and also in later stage CT scans

** I*n no way we are thinking to ignore any testing mechanism followed by Hospitals (Directed by regulated testing bodies such as ICMR in India), while our solution is to increase efficiency of doctors so that delayed diagnosis does not lead to unfortunate deaths or more spreads*

Proposed Features of the application

Users

1. Diagnostician – people who can use the application to diagnose for COVID19
2. Trainer – people who provide valuable input to improve the platform

Basic functionality

1. A Diagnostician can take a photo from his / her mobile of an X-Ray and upload to our platform, she / he can see prediction whether the person is COVID19 positive or not
2. A Diagnostician can upload photo on WhatsApp / Telegram or a mobile application and get results as above
3. A trainer can provide us data to further train our system

**A Diagnostician if do not get satisfactory answer from our platform then can help us train or model*

Suggestive outline

1. Front end – Develop a front end which can take input image from various types of user no login required – Tech stack we can decide suggestion:
    1. React
    2. Angular
2. Backend – MVC based framework. REST API that processes inputs
    1. SailsJ
    2. Django python
3. AI prediction model – I suggest to use Convolutional neural network (CNN) for processing medical images. With the different CNN-based deep neural networks developed and achieved a significant result on ImageNet Challenger, which is the most significant image classification and segmentation challenge in the image analysing field

CNN (same background information) - http://colah.github.io/posts/2014-07-Conv-Nets-Modular/

Data sets:

1. https://josephpcohen.com/w/public-covid19-dataset/
2. https://nihcc.app.box.com/v/ChestXray-NIHCC
3. https://coronacases.org/forum/coronacases-org-helping-radiologists-to-help-people-in-more-than-100-countries-1
4. https://stanfordmlgroup.github.io/competitions/chexpert/
5. https://physionet.org/content/mimic-cxr/2.0.0/
6. https://www.kaggle.com/nih-chest-xrays/data

Reference to some models used earlier

1. http://openaccess.thecvf.com/content_cvpr_2017/papers/Wang_ChestX-ray8_Hospital-Scale_Chest_CVPR_2017_paper.pdf

For starters we will be using COVIDNet (open source by University of waterloo) and integrate with our system

Tech stack

Front end – Bootstrap
APIs- Django DRFs
AI - Python3

Self-inferences based on Research

1. The clinical manifestations of the COVID-19 pneumonia is complicated and could be characterized as fever, cough, myalgia, headache, and gastrointestinal symptoms onset. Although the nucleic acid detection was considered determinant for identifying the COVID-19 infection and more rapid detection kit for the novel coronavirus has come into mass production, computed tomography (CT) scan is still the most efficient modality for detecting and evaluating the severity of pneumonia

References:

https://coronacases.org/forum/coronacases-org-helping-radiologists-to-help-people-in-more-than-100-countries-1

https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930183-5

https://www.ijidonline.com/action/showPdf?pii=S1201-9712%2820%2930053-9