# "Detection of COVID-19 from Chest X-Ray Images"

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**Abstract:**

The increasing number of cases of confirmed coronavirus disease (COVID-19) in China is striking. The purpose of this study was to investigate the relation between chest CT findings and the clinical conditions of COVID-19 pneumonia. Among those who develop symptoms, most (about 80%) recover from the disease without needing hospital treatment. About 15% become seriously ill and require oxygen and 5% become critically ill and need intensive care. Complications leading to death may include respiratory failure, acute respiratory distress syndrome (ARDS), sepsis and septic shock, thromboembolism, and/or multiorgan failure, including injury of the heart, liver or kidneys. In rare situations, children can develop a severe inflammatory syndrome a few weeks after infection. Proposed method not only detects the availability of NOVEL CORONA but also it tracks the treatment progress. 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. 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.

**Keyword:** Covid-19, CNN, X-Rays.

## I. INTRODUCTION

### 1.1 Background

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 X-Rays 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.

### 1.2 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."

### 1.3 Need

To develop a system that detects Novel corona symptoms with maximum precision and with minimum processing time to avoid the spread of covid 19 virus in community.

### 1.4 Organization of Project Paper:

In this Paper, chapter 1 includes background of the project, Motivation, Need and project undertaken. Chapter 2 includes background and literature survey for this project concept. Chapter 3 includes specifications, problem Statement, and software and hardware requirements. Chapter 4 includes design part. In that System Anaysis architecture diagram, all UML diagrams are there. In chapter 5 there is implementation part of project. In that, all required algorithm for project such Convolutional Neural Network (CNN),

## II. Literature Survey:

### 2.1. Background

A novel corona virus has resulted in person-to-person transmission but as far as we know, it causing corona virus disease 2019 (COVID-19) can also be from an asymptomatic carrier with no coved symptoms. Till now there is no Paper about any clinically approved antiviral medicine or vaccines that are effective against COVID-19. For NOVEL CORONA Patients CT scan have some symptoms such as, Reticulation, Ground Glass Opacities and Consolidation of X-Rays 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 retrained 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. 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. It has spread rapidly across the world, bringing massive health, economic, environmental and social challenges to the entire human population. At the moment, WHO recommends that people should wear face masks to avoid the risk of virus transmission and also recommends that a social distance of at least 2m be maintained between individuals to prevent person-to person spread of disease.

### 2.2 Literature Survey

1. Wei Zhao, Zheng Zhong, Xingzhi Xie, Qizhi Yu and Jun Liu **"Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study,"** American Journal of Roentgenology: 1-6.

10.2214/AJR.20.22976

Wei Zhao et.al [1] states that In December 2019, a series of cases of pneumonia of unknown causation emerged in Wuhan, Hubei, China, and quickly raised intense attention around the world [1]. A novel bat-origin coronavirus, 2019 novel corona-virus, was identified by means of deep sequencing analysis [2]. The virus, named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [3], is phylogenetically closest to bat SARS-like coronavirus but in a separate clade, which means that a novel coronavirus is spreading [2]. As of February 17, 2020, 72,436 laboratory-confirmed cases were consecutively Papered in 31 provinces (municipalities and regions) in China, including 11,741 severe cases, 1868 fatal cases, and 6242 suspected cases [4}The study had several limitations. First, only 101 patients with confirmed COVID-19 were included; negative results and infections with other viruses were not included in the analyses. Comprehensive investigation of the imaging features of patients with negative results and other virus infections may help us to differentiate COVID-19 pneumonia from other X-Rays infections and then to screen patients with highly suspected cases. Second, we did not evaluate follow-up CT findings in our study. Exploring the CT changes and comparing them with the clinical parameters may help us monitor and predict outcome and support clinical decision making.

2. Wang W, Xu Y, Gao R, **"Detection of SARS-CoV-2 in Different Types of Clinical Specimens. JAMA"** Published online March 11, 2020. doi:10.1001/jama.2020.3786

Wang W et.al [2] proposed that In this examination, SARS-CoV-2 was recognized in examples from numerous destinations of 205 patients with COVID-19, with lower respiratory lot tests regularly testing positive for the infection. Significantly, the live infection was identified in defecation, inferring that SARS-CoV-2 might be sent by the fecal course. A little level of blood tests had positive PCR test results, proposing that contamination now and then might be fundamental. Transmission of the infection by respiratory and extrarespiratory courses may help clarify the fast spread of illness. What's more, trying of examples from different destinations may improve the affectability and diminish bogus negative test outcomes. Two more modest investigations detailed the presence of SARS-CoV-2 in butt-centric or oral swabs and blood from 16 patients in Hubei Province,3 and viral burden in throat swabs and sputum from 17 affirmed case.

3. Tao Ai, Zhenlu Yang, Hongyan Hou, Chenao Zhan, Chong Chen, Wenzhi Lv, Qian Tao, Ziyong Sun, Liming Xia ," **Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Paper of 1014 Cases**" Feb 26 2020https://doi.org/10.1148/radiol.2020200642

Tao Ai,et.al [3] introducing Key Results. The positive rates of reverse-transcription polymerase chain reaction (RT-PCR) assay and chest CT in our cohort were 59% (601 of 1014 patients) and 88% (888 of 1014 patients), respectively, for the diagnosis of patients suspected of

having coronavirus disease 2019 (COVID-19) hest CT accuracy in diagnosing COVID-19 during the peak of the Italian epidemic: A retrospective correlation with RT-PCR testing. trategy of combining initial RT-PCR and chest CT was analysed to ... confirming COVID-19 infection, incorporating multiple RT- Materials and Methods This study included 1014 patients in Wuhan, China, who underwent both chest CT and RT-PCR tests between January 6 and February 6, 2020. With use of RT-PCR as the reference standard, the performance of chest CT in the diagnosis of COVID-19 was assessed. In addition, for patients with multiple RT-PCR assays, the dynamic conversion of RT-PCR results (negative to positive, positive to negative) was analyzed as compared with serial chest CT scans for those with a time interval between RT-PCR tests of 4 days or more.

4. Laura Matrajt, Tiffany Leung **"Evaluating the Effectiveness of Social Distancing Interventions to Delay or Flatten the Epidemic Curve of Coronavirus Disease"** pmc article doi: 10.3201/eid2608.201093. Epub 2020 Apr 28.

Tiffany Leung and Laura Matrajt [2] introducing that a numerical model to examine the adequacy of social separating mediations in a moderate sized city. Intercessions decreased contacts of grown-ups >60 years old, grown-ups 20-59 years old, and youngsters <19 years old for about a month and a half. Our outcomes recommend mediations began before in the plague defer the pandemic bend and intercessions began later straighten the pestilence bend. We noticed that, while social removing mediations were set up, most new cases, hospitalizations, and passings were deflected, even with humble decreases in contact among grown-ups. Nonetheless, when intercessions finished, the pestilence bounced back. Our models propose that social removing can give critical opportunity to expand medical care limit however should happen related to testing and contact following of all speculated cases to alleviate infection transmission.

Shashi Yadav "**Deep Learning based Safe Social Distancing and Face Mask Detection in Public Areas for COVID- 19 Safety Guidelines Adherence"**

International Journal for Research in Applied Science & Engineering Technology (IJRASET) 2020

Shashi Yadav et.al[5] introducing to establish safe climate that adds to public security, we propose a productive PC vision put together methodology centered with respect to the continuous mechanized observing of individuals to recognize both safe social removing and face veils in broad daylight puts by executing the model on raspberry pi4 to screen action and identify infringement through camera. After identification of penetrate, the raspberry pi4 imparts ready sign to control focus at state police base camp and furthermore offer alert to public. In this proposed framework current profound learning calculation have been blended in with mathematical methods for building a vigorous modular which covers three parts of location, following, and approval. Accordingly, the proposed framework favors the general public by

saving time and helps in bringing down the spread of Covid. It tends to be actualized adequately in current circumstance when lockdown is facilitated to investigate people in open social events, shopping centers, and so on Robotized investigation decreases labor to assess people in general and furthermore can be utilized in any place.

**List of Modules and Algorithm:**

**Methodology:**

Proposed method takes X-Rays Images 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 X-Rays Images 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. 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.

Proposed system contains four modules viz., User and System

**System Modules:**

- Input train data
- Preprocessing
- Segmentation
- Update weight and bias
- Score Calculation
- Prediction
- Prediction result

**User Modules:**

- Input test data
- Prediction
- Prediction result

## III. Algorithm

### 1. Convolutional Neural Networks

A breakthrough in building models for Covid-19 X-Rays Images classification came with the discovery that a convolutional neural network (CNN) could be used to progressively extract higher- and higher-level representations of the X-Rays image content. Instead of preprocessing the CT image to derive features like textures and shapes, a CNN takes just the CT image's raw pixel data as input and "learns" how to extract these features, and ultimately infer what object they constitute.

## IV. System Analysis Proposed Architecture

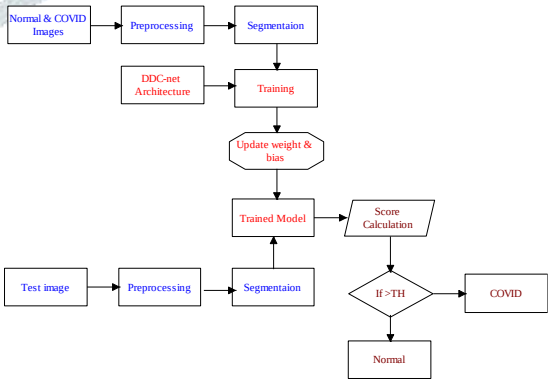


**Fig.1 Architecture**

Proposed method takes X-Rays Images 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 X-Rays Images 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. A new artificial intelligence-powered deep learning model will help radiologists to distinguish COVID-19 from community-acquired pneumonia and other X-Rays diseases in chest CT imaging. 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.

## V. Result and Discussion:

In covid-19 detection and stage prediction system we have been implemented highly trained model that can accurately recognize diseases. In this system we used Gaussian blur for gray scale conversion, Otsu's method for binary conversion of images after that we used convex hull for edge detection.

### A. Gray scale conversion

In gray scale conversion colour image is converted into a gray form using Gaussian blur. Colour image containing noise and unwanted background which is removed or blurred by using this method.

### B. Binary conversion

Gray scale image is given to input for Otsu's method for binary conversion. In Binary form of images converted in 0 and 1 form means black and white.

### C. Edge Detection

In Edge detection binary image get dimensions by counters using convex hull algorithm. In which eccentricity finding drawing edges around white portion of binary image.

### D. Training Model

In our system we are using tensor flow for extracting features of training dataset. In which 1200 image samples are trained by using training model. Finally plot files generated as an output of our trained model.

### E. Testing Model

In final phase of data testing in which X-Rays disease and normal X-Rays images were matched by our training model with higher precent of accuracy.

After matching all type of disease images respective results of stage and detection display on console and stored in text file as well.

### Output of the System:

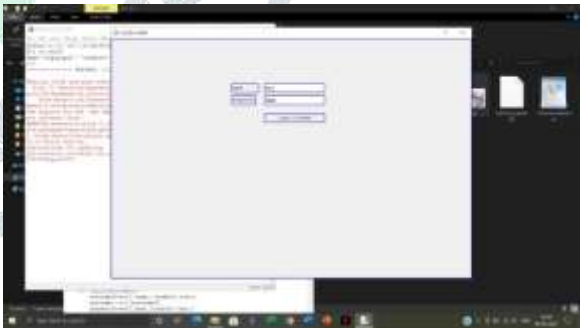

**Fig.2 Login Screen**

**Fig.3 Registration Screen**

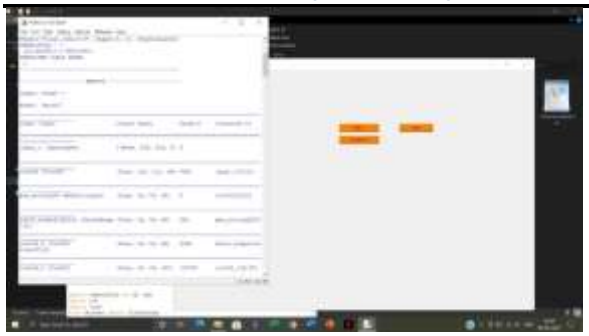

**Fig.4 Result Screen**

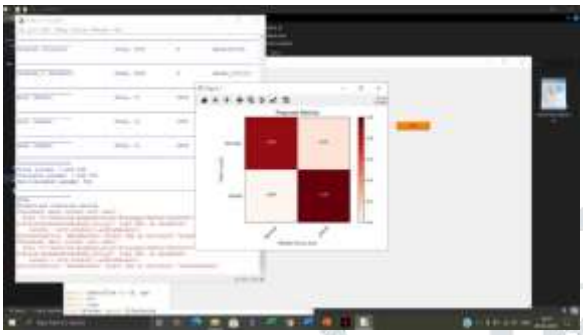

**Fig.5 Proposed method Comparison Screen**

## VI. 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.

## IEEE References:


1. Wei Zhao, Zheng Zhong, Xingzhi Xie, Qizhi Yu and Jun Liu **"Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study,"** American Journal of Roentgenology: 1-6. 10.2214/AJR.20.22976

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