# AUTOMATIC COVID-19 LUNG INFECTION SEGMENTATION FROM CT IMAGES

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## ABSTRACT

*COVID-19, the disease caused by the new corona virus, can cause lung complications such as pneumonia and, in the most severe cases, acute respiratory distress syndrome, or ARDS. Sepsis, another possible complication of COVID-19, can also cause lasting harm to the lungs and other organs. The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air, and quickly fall on floors or surfaces. As everyone is aware corona virus disease 2019 (COVID-19) spread globally in early 2020, causing the world to face an existential health crisis. So in order to automate detection of lung infections from computed tomography (CT) images offers a great potential to augment the traditional healthcare strategy for tackling COVID-19. However, segmenting infected regions from CT slices faces several challenges, including high variation in infection characteristics, and low intensity contrast between infections and normal tissues. Further, collecting a large amount of data is impractical within a short time period, inhibiting the training of a deep model. Our propose solution will analyze the CT image of lung and detect the infected part of lung along with the percentage of affected part. System will Identify the Inflection severity and will help patients to take essential measures.*

*Keyword*: *- CT (computerized tomography), LRR (Low rank representation).*

## INTRODUCTION

Recently the entire world is going through the huge pandemic i.e. corona disease (Covid-19). It usually spread through the virus and not by bacteria. This virus falls in the family called Coronovididae. This virus has caused severe human loss and millions of humans are been affected by it, and still the number is going on increasing. Even it had force many countries to have a lockdown and it also lead to the huge financial losses. Lockdown was done to prevent the spread of infection from one person to another, to avoid the contacts of persons. Usually Covid-19 affects the lungs in most cases. So in order to reduce the death of human and to identify the Covid-19 at its early stage, we are proposing the system. Our system will take the CT image as an input and provided. The formatter will need to create these components, incorporating the applicable criteria that follow. will analyze and predict if user is affected by virus. Recognition of COVID-19 is a challenging task which consistently requires taking a gander at clinical images of patients. In this paper, the transfer learning technique has been applied to clinical images of different types of pulmonary diseases, including COVID-19. It is found that COVID-19 is very much similar to pneumonia lung disease. Further findings are made to identify the type of pneumonia similar to COVID-19. Transfer

Learning makes it possible for us to find out that viral pneumonia is same as COVID-19. This shows the knowledge gained by model trained for detecting viral pneumonia can be transferred for identifying COVID-19. Transfer Learning shows significant difference in results when compared with the outcome from conventional classifications. It is obvious that we need not create separate model for classifying COVID-19 as done by conventional classifications. This makes the herculean work easier by using existing model for determining COVID19. Second, it is difficult to detect the abnormal features from images due to the noise impedance from lesions and tissues. For this reason, texture feature extraction is accomplished using Haralick features which focus only on the area of interest to detect COVID-19 using statistical analyses. Hence, there is a need to propose a model to predict the COVID-19 cases at the earliest possible to control the spread of disease. We propose a transfer learning model to quicken the prediction process and assist the medical professionals. The proposed model outperforms the other existing models. This makes the time-consuming process easier and faster for radiologists and this reduces the spread of virus and save lives.

## EASE OF USE

### *1. METHODOLOGY*

The proposed system for COVID -19 detection in CT images is shown with the help of a flowchart in figure 1.The methodology is carried out in five main steps and each step of this system is discussed in detail in section below.

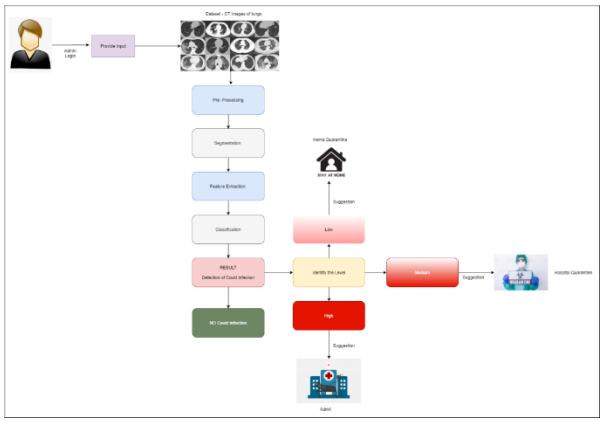

**Fig -1** Architecture diagram

**Architecture Description:**

Above architecture diagram shows the complete process of the system. wherein admin uploads the CT image to our system thereafter various pre-processing steps takes places on the uploaded image. And also process like segmentation, feature extraction, classification and finally we will get result whether the CT Image has the covid infection or not. If covid is positive then system will identify the level of severity an based on it, system will suggest the necessary steps that user need to take. like he/she need to be done

home quarantine or need to be hospitalized. And if the result is negative then no further actions needs to be taken.

**A) Data Collection**

The first step is to obtain lung CT images of cancer patients. For research work, the images have been downloaded from the COVID Imaging Archive database. The images are stored in DICOM format.[3] The image database contains Computed Tomography images of patients with and without covid-19.

**B) Image Pre-Processing**

The objective of image preprocessing stage is to suppress unwanted distortions present in the image and to enhance some features useful for further processing. It includes two main steps such as image smoothing and image enhancement. Image smoothing is done to remove unwanted noise present in the image.[2] CT scan images are prone to salt and pepper noise, hence median filtering is found to be quite effective technique in eliminating this impulse noise while preserving the edges. Median filtering gives the best results for image smoothing as it removes noise without blurring the image.

Image enhancement technique improves the quality of digital images to produce better output for further processing. Contrast adjustment is done to enhance the image since image quality is affected by artifacts caused due contrast variations in the image. Contrast adjustment enhances the contrast of an image by transforming input pixel values to new values such that by default 1% data gets saturated at low and high intensity of input image data.

C) **Image Segmentation**

The process of separating out required region of interest from the image is known as segmentation. Mathematical morphological operations are powerful tools in acquiring lung region from binary images. In our methodology, first the preprocessed gray scale images were converted to binary images. Morphological opening operation was performed to the binary image with disk structuring element for removal of unwanted components from the image. The opened image was then complemented and clear border operation was performed to it. The lung masks were obtained by filling the holes and gaps present in the lungs. Finally exclusive OR operation was performed to lung mask output and clear border output to give us the segmented infected region.

D) **Featue Extraction**

Feature extraction is the most essential step that transforms input data into required features. This stage extracts out significant features of segmented region of interest and these features serve as input for classification of CT scan images.[7] The size and shape of infection present in the lungs is estimated by extracting three geometrical features. The features are area, perimeter and eccentricity of covid lung nodule.

**E) Classification**

The Classification stage involves labeling the CT scan images as normal and abnormal. In our method SVM algorithm will be used for detection of covid infection in CT images. SVM classifiers are supervised learning models that analyze input data and classify them according to pattern. The SVM classifier builds a model by using training dataset and categorizes it into two

classes. The SVM algorithm then assigns new examples of testing dataset to one of the two classes. SVM classifier thus finds the best hyper plane that separates the two groups and thus classifies the lung CT images. For the best hyper plane data points of one class are separated from the other by largest margin between the two classes.

## COMPONENT DESIGN

### Class Diagram

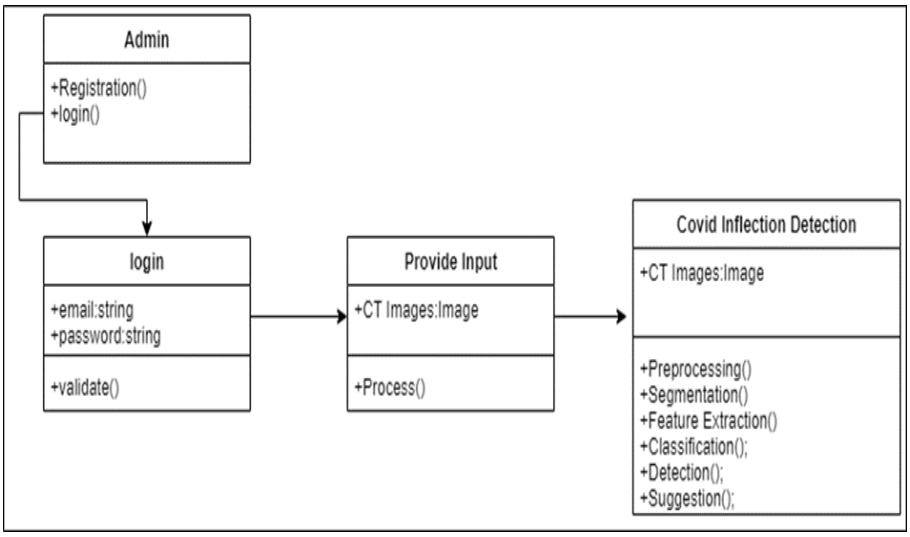


**Fig -2** Class Diagram

## PROJECT IMPLEMENTATION

In this section, we are going to provide a brief introduction about Our proposed system will have an admin module, through which a CT image will be uploaded. Further system will analyze the uploaded image and will perform various activities which includes Pre-processing, segmentation, feature extractions, classification etc, so that it will gives us the perfect outcome. System will provide the alert also advice such that he has to take emergency treatment, or just to have home quarantine etc. So far there is no system implemented which analyze the CT image, and based on the results obtained, provide alert and necessary actions can be taken.[1]

### Mathematical Model

Let S be the set of whole system i.e. S= input, process, output .

Where, - Input is the set of CT Images.

- Process is step or techniques applied to the system.
- Output is Lung Infection.

**Inputs:**

Input = = U, CT, IP,ID,S .

Where,
- U be the user.
- CT = Set of CT Images of Lungs.
- Ip = Image Processing on that Lungs CT Images.
- ID = Identify the Inflection

**Procedure:**

**Step1:** Admin will Upload the CT Image of Lungs.

**Step2:** System will perform Operations like Pre-Processing, Segmentation, Feature Ex traction, Classification on that CT Images.

**Step3:** Finally System will show output. i.e. Detection of Inflection in the Lungs due to Covid - 19.

**Output:** System will provide output as if the person is infected by covid or not, if infected than it will suggest necessary steps based on the level severity of infections.

***Figures and Tables***

HARDWARE RESOURCES REQUIRED

| SR NO. | PARAMETERS | MINIMUM REQUIREMENTS. |
|---|---|---|
| 1 | PROCESSORS | CORE i3. |
| 2 | RAM | 4 GB |

SOFTWARE RESOURCES REQUIRED

| SR NO. | PARAMETERS | MINIMUM REQUIREMENTS |
|---|---|---|
| 1 | OPERATING SYSTEM | WINDOWS 7/8. |
| 2 | CODING LANGUAGE | JAVA/J2EE |
| 3 | IDE | ECLIPSE KEPLER |
| 4 | DATABASE | SQL YOG COMMUNITY/XAMPP SERVER |
| 5 | WEB SERVER | APACHE TAMCAT. |

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