Pulmonary Lobe Based Lung Diseases Detection Using Deep Learning Techniques

Aruna
UG Scholar
Kongunadu College of Engineering and Technology, Thottiyam, Trichy, India

Atchaya L
UG Scholar
Kongunadu College of Engineering and Technology, Thottiyam, Trichy, India

Bhavadharani M
UG Scholar
Kongunadu College of Engineering and Technology, Thottiyam, Trichy, India

Dr. T. Yuvaraja [5]
Associate Professor /ECE
Kongunadu College of Engineering and Technology, Thottiyam, Trichy, India

Jeevetha U
UG Scholar
Kongunadu College of Engineering and Technology, Thottiyam, Trichy, India

***Abstract*:- Coronavirus disease 2019 (COVID-19) is an infectious disease triggered by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Since the disease has spread all over the globe in enormous numbers and is declared a pandemic. Although radiological imaging is not recommended for diagnostics as the patient arrives in the clinic, a chest X-ray is often useful to monitor treatment outcomes and comorbidities in seriously ill patients.**

The detection of COVID-19 from chest X-ray and its differentiation from lung diseases with identical opacities is a puzzling task that relies on the availability of expert radiologists. Recently, several researchers have reported the use of AI-based tools in solving image classification problems in healthcare, based on training with X-ray images, CT scans, histopathology images, etc. Deep learning is an extremely powerful tool for learning complex, cognitive problems, and the frequency of their use and evaluation in different problems is increasing. In the present study, we have made use of a deep learning algorithm using the convolutional neural network (CNN) that can efficiently detect COVID-19 from CT-scan images. And also implement Multi-class CNN to identify the multiple lung diseases such as Pneumonia, tuberculosis, and so on. Experimental results shows that the proposed system provide improved accuracy in disease prediction and also provide the diagnosis information about analyzed diseases.

Key Words: Lung Diseases, CT scan ,X-ray, CNN algorithm, Deep learning

I INTRODUCTION

The ongoing pandemic of coronavirus disease 2019 (COVID-19) has led to global health and healthcare crisis, apart from the tremendous socioeconomic effects [1-3]. One of the significant challenges in this crisis is to identify and monitor the COVID-19 patients quickly and efficiently to facilitate timely decisions for their treatment, monitoring, and management [4-7]. In monitoring arithmetic circuits are mostly used. [8-10] In existing framework implemented machine learning techniques to predict diseases related to lung disease Machine learning techniques provide results with less accuracy and complexity is high to overcome the existing challenges, implement the deep learning framework to identify the Coronavirus diseases [8-10]

A DEEP LEARNING

Deep learning is an artificial intelligence (AI) function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network. Deep learning is an AI function that mimics the workings of the human brain in processing data for use in detecting objects, recognizing speech, translating languages, and making decisions

B. DEEP LEARNING IN IMAGE PROCESSING

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video 4 frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals with the third-dimension being time or the z-axis.

C. STEPS OF IMAGE PROCESSING

1. Image Acquisition
2. Image Enhancement
3. Image Restoration
4. Color Image Processing
5. Wavelets and Multi-resolution Processing
6. Compression
7. Morphological Processing

D SEGMENTATION

Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually. Segmentation is a classifier which helps to fragment each character from a word present in a given image or page. After performing Segmentation, the characters of the string will be separated and it will be used for further processing. Types are:

- Color based image segmentation
- Texture based segmentation
- Shape based segmentation

E FEATURE EXTRACTION

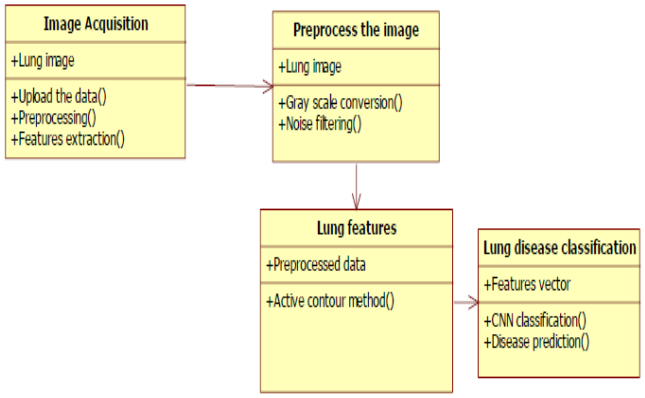
In pattern recognition and in image processing, feature extraction is a special form of dimensional reduction. Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

F.LITERATURE REVIEW

- May provide a unique window of opportunity for intervention
- Unavailable at the time of real time analysis
- Data generation was clinically driven and not systematic
- No specific treatment has been recommended for Coronavirus infection except for meticulous support
- The relationship between radiological and histopathological findings remains to be investigated
- Computational complexity is high
- Handling uncertainty data and difficult to validate new datasets

II PROPOSED ARCHITECTURE:

In proposed methodology, so can train the medical images related to lung diseases in terms of CT scan images. In testing side, input the CT scan image, apply pre-processing to 30 eliminate the noises in image using median filter algorithm. And extract the features using contour model. Finally classify the multiple lung diseases using CNN algorithm and to provide diagnosis details with improved accuracy rate. Provide better segmentation results. Multiple features are read and processed [11-12]



A MODULES

- Image Acquisition
- Pre-processing
- Features Extraction
- Lung Classification
- Disease Prediction

B SYSTEM ARCHITECTURE

This architecture has five parts such as pre-processing, features extraction, segmentation and classification. User can be input Lung CT image as input and pre-

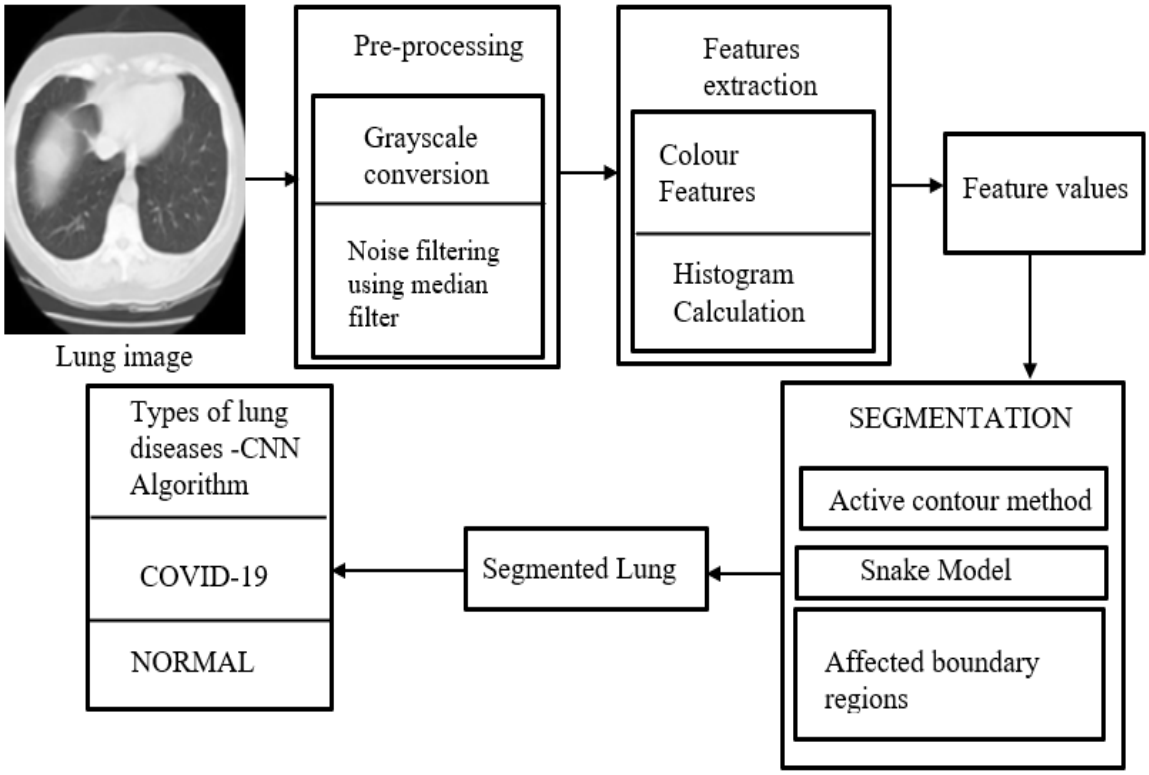


Fig. 1 System Architecture

processing steps to convert the image into gray scale and filter the noise using median filter algorithm. Then perform features extraction steps to extract the color, shape and other features and constructed as sparse matrix. After that perform active contour method to segment the lung boundaries. Finally classify the features whether is affected or not using CNN algorithm and provide the multiple lung diseases.

C CLASS DIAGRAM

The class diagram is the main building block of object-oriented modelling. It is used for general conceptual modeling of the structure of the application, and for detailed modelling translating the models into programming code. Class diagrams can also be used for data modelling.

3.4 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Activity diagram is another important diagram in UML to describe dynamic aspects of the system. Activity diagram is basically a flow chart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent. Activity diagrams deals with all type of flow control by using different elements like fork, join etc.

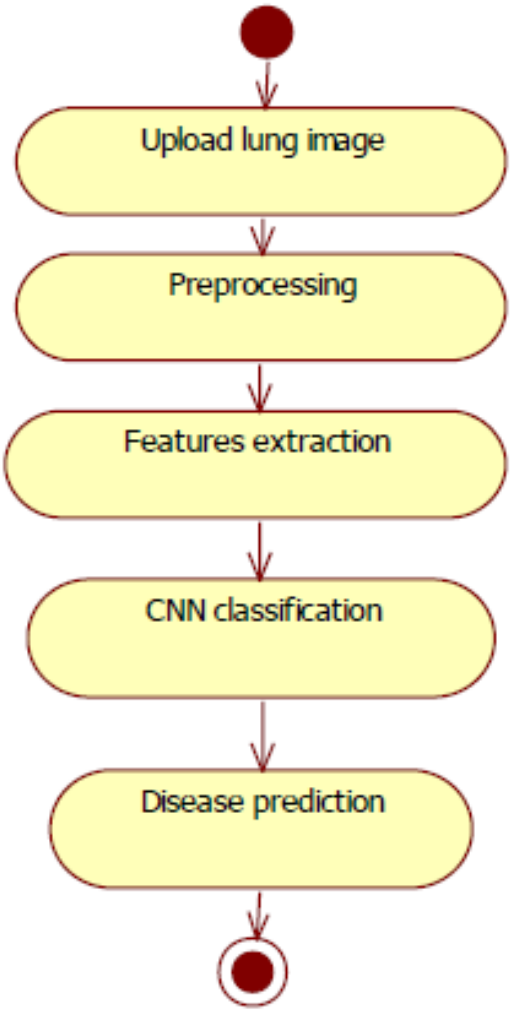
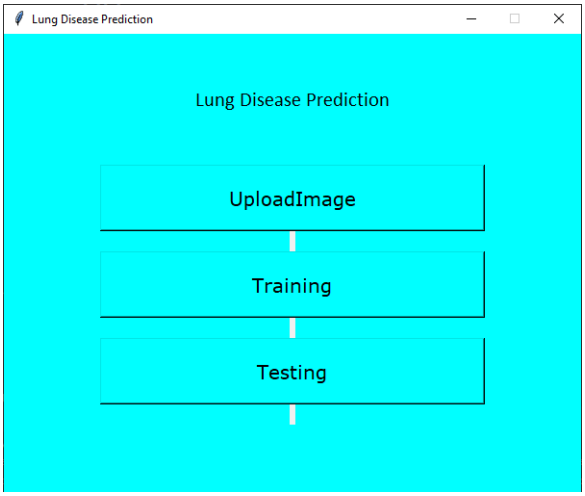
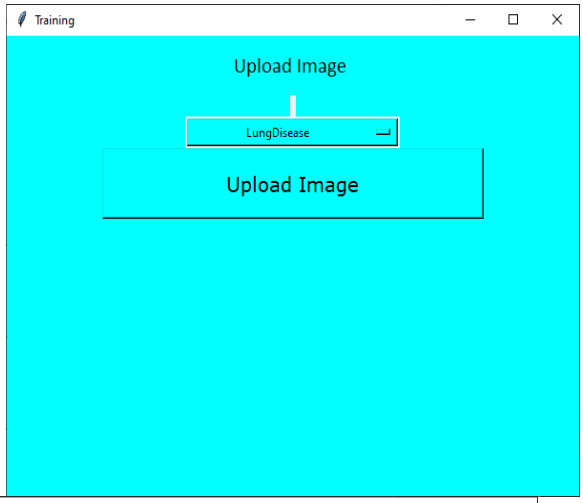


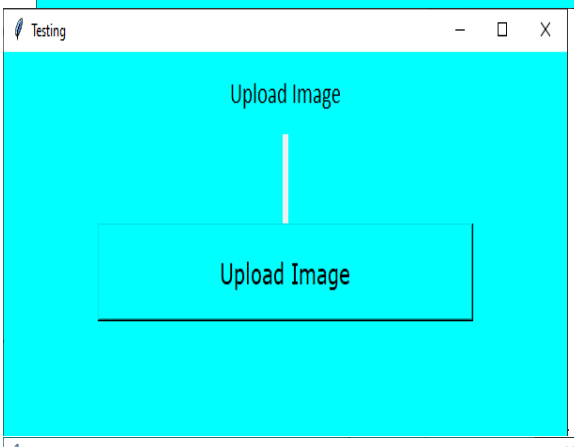
Fig. 3 Flowchart

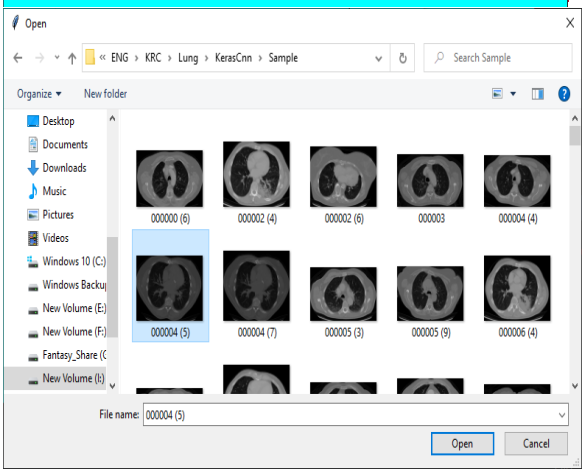
III RESULTS AND DISCUSSION

OUTPUT IMAGES

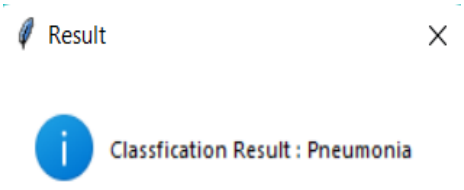


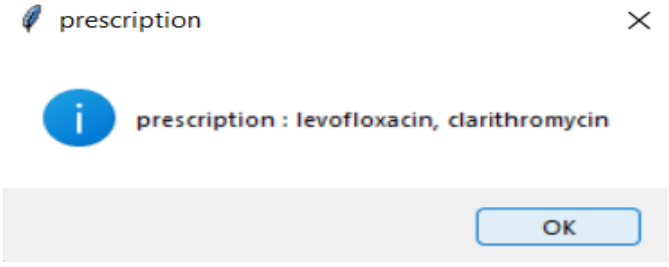




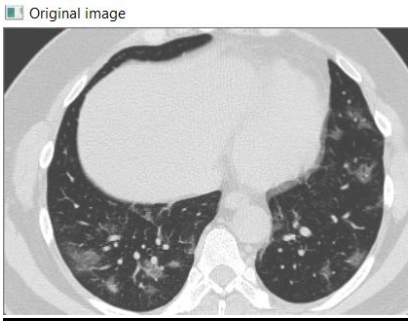


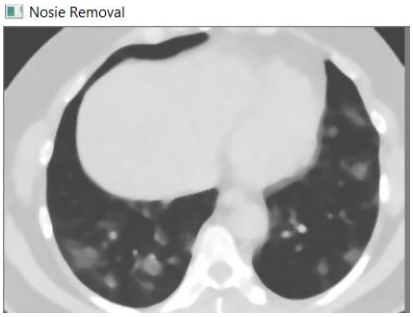
PNEUMONIA

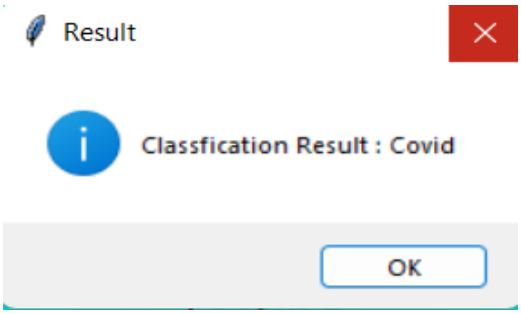


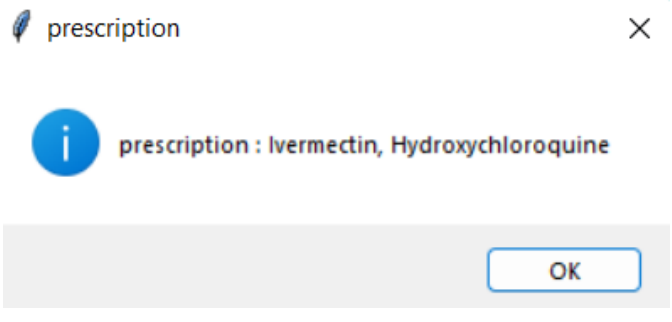


COVID

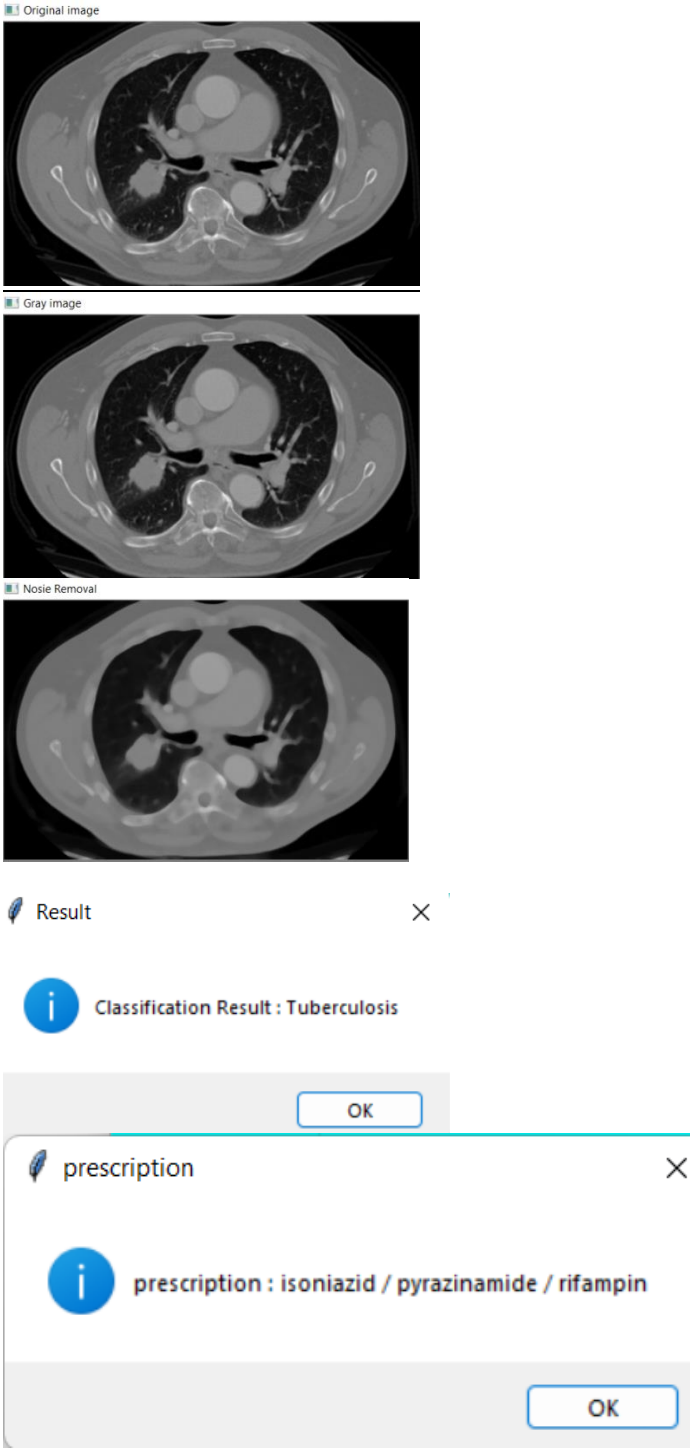






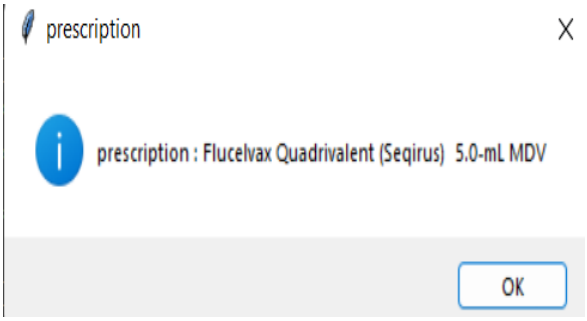


TUBERCULOSIS

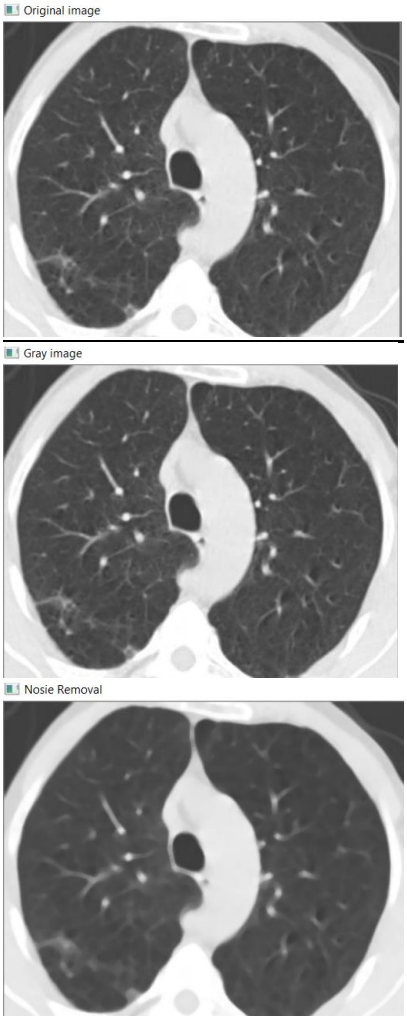

Original image
Gray image
Nosie Removal
Result
Classification Result : Tuberculosis
OK
prescription
prescription : isoniazid / pyrazinamide / rifampin
OK

INFLUENZA


Original image
Gray image
Nosie Removal
Result
Classification Result : Influenza
OK



NORMAL



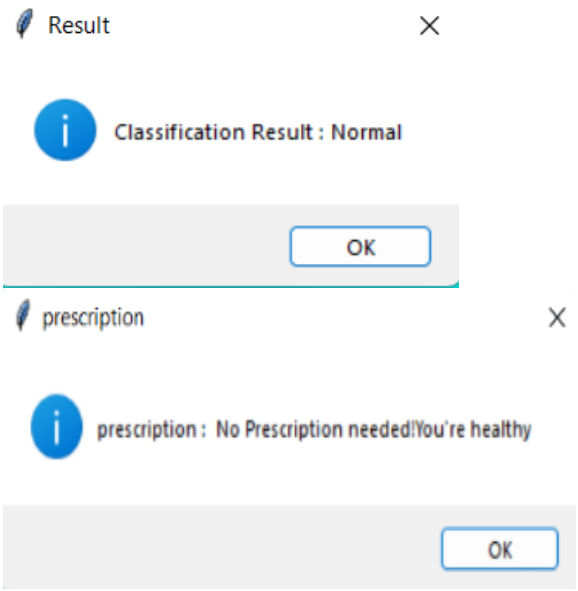


Table 1 CONDITION FOR DISEASE CLASSIFICATION

S. No.	Condition For Classification	Type Of Disease
1.	X=0; Y=0	Covid
2.	X=0; Y=1	Influenza
3.	X=0; Y=2	Normal
4.	X=0; Y=3	Pneumonia
5.	X=0; Y=4	Tuberculosis

IV CONCLUSION

The confirmatory diagnosis of COVID-19 is mainly dependent on clinical symptoms, epidemiological history, nucleic acid detection, immune identification technology, etc. All the methods mentioned above have some limitations such as time required, costs, equipment dependence, shortage of testing kits, availability of trained healthcare workers, inter operator variability's, especially in a pandemic like this, making them cumbersome diagnostic procedures. Timely diagnosis of the COVID-19 patients can enable help in the optimization of available resources, including trained human resources, for all the supportive measures required for confirmed patients. Automated AI-based intelligent chest X-ray classification has such untapped potential for this unmet need, as evident from recent researches. Rapid screening to diagnose such patients is also essential for controlling outbreaks. In conclusion, an AI system derived from heterogeneous multinational training data delivers acceptable performance metrics for the classification of chest CT for COVID-19 infection. We can conclude that the proposed system provided multiple lung disease classification using CNN algorithm. Our system implemented contour method to segment the lung lesions and with multi-class classification with multiple lung related diseases with improved accuracy rate. [13-15]

A FUTURE ENHANCEMENT

In the present time, the whole world is affected by Covid-19 disease, and the most important thing is no single

country scientists can prepare a vaccine for the same. In future, we can extend the framework to implement various deep learning algorithms to improve the accuracy with various images

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