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Deep Learning for Covid 19 and Pneumonia Detection using Chest X-Ray Images

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Abstract: *Animals are also susceptible to Covid-19, a virus that spreads rapidly and infects both humans and animals. This deadly viral disease affects people's daily lives, health and economy of a country. COVID-19 is spreading widely. According to clinical research on people infected with COVID-19, most of these patients develop lung infections due to contact with the disease. A chest CT scan and a chest X-ray (also called a chest radiograph) are two better imaging methods for detecting lung-related problems. However, a chest X-ray is a less expensive procedure than a chest CT scan. The most effective machine learning method is deep learning, which provides insightful analysis of examining large numbers of chest X-ray images that can have a significant impact on Covid-19 screening. Both patients with COVID-19 and healthy individuals received chest X-rays from a PA perspective. We used deep learning- based CNN models and compared their performance after image cleaning and data augmentation.*

Keywords: Deep Learning.

I. INTRODUCTION

COVID-19 pandemic, now sweeping the planet, has been called a human health emergency and has caused a ridiculous amount of destruction. A group SARS-Co V-2 virus is the responsible for the COVID- 19 diseases. In December 2019, the first case of a Covid- 19 patient appeared in Wuhan. On January 30, 2020, India reported its first case, which spread to other countries. This scenario should be handled carefully to take the necessary preventive measures before the pimples appear. To prevent this disaster, many scientists are making great efforts.

X-rays may be used to evaluate a patient's lungs since COVID-19 exclusively attacks human respiratory epithelial cells. Deep convolutional neural networks have allowed for remarkable advancements in the field of picture recognition, which has proven notably useful in the area of computer-assisted medical diagnosis. This X-ray of a patient with pneumonia was identified by a neural network, which performed better than radiologists.

II. PURPOSE

In the high-tech age we live in, no one could have predicted the outbreak of pneumonia associated with SARS CoV-2, also known as COVID-19 (coronavirus disease 2019), which gripped humanity in late 2019. The Covid-19 pandemic began in Wuhan, China, and the disease has spread so far that the equipment available to doctors is inadequate to treat it. As of this writing, more than 27,000,000 confirmed cases and 875,000 deaths have been recorded worldwide(September 8, 2020).Research and applications in the area of artificial intelligence (AI) and deep learning have been undertaken to aid physicians in light of the lengthy diagnosis procedure and expensive diagnostic expenses.

Even while certain countries may have access to faster turnaround time test kits, the typical turnaround time for test results is still 3–48 hours. Over time, COVID-19 testing is expected to be used in clinical settings. One of the key suggestions made by the Fleischner Society in a recently issued global consensus statement is to use chest radiography for patients with COVID-19 in the resource-limited situation when access to computed tomography (CT) is limited. 3 Cost of diagnostic laboratory kits is a significant issue for disease control, particularly in emerging and impoverished nations. Automated COVID-19 detection utilizing. X-ray imaging may be highly helpful for states andhealthcare facilities without access to a CT scanner or lab kit for testing. This is crucial since there is now no available treatment option that works well and calls fora precise diagnosis

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III. PROBLEM IDENTIFICATION

There have been considerable losses as a consequence of the COVID-19 pandemic's worldwide spread. The most significant problem facing the medical and healthcare industries is the early diagnosis of COVID19. Therefore, in order to assist patients in moving ahead and lower the number of infected individuals, the the diagnosis of a suspected case must be confirmed. X-ray inspection is said to be the most widely used technique of x-ray inspection owing to its cheap cost, many applications, and rapid examination time. The screening and diagnosis of COVID-19-related illnesses rely heavily on this. Since COVID-19 specifically targets human respiratory epithelial cells, we can use x-rays to assess lung health.

IV. OBJECTIVE

- To build an Image classifier of X-ray images for patients who have tested positive for COVID-19.
- Detect “normal” (i.e., not infected) X-ray images from healthy patient.
- Train a CNN to automatically detect COVID-19 in X-ray images via the dataset collected.
- Evaluate the results from trained model.

V.EXISTING SYSTEM

COVID-19 tests are now hard to get since there aren't enough of them and they're not being made rapidly enough, which is concerning. Bad actors attempt to take advantage of victims when there is panic, particularly by selling counterfeit COVID-19 test kits after receiving orders. We must depend on other diagnostic methods since the majority of COVID-19 test kits are not readily accessible.

Worldwide, the corona virus is spreading quickly. By September 28, 2020, more than 1 million individuals had died and 33.3 million had contracted the coronavirus epidemic. Since detecting this ailment takes time and costly testing equipment, it is vital to develop an automated diagnostic system that speeds up the testing procedure, guaranteeing that the patient gets the required medical care and treatment as soon as possible.

VI. PROPOSED SYSTEM

The overall COVID-19 diagnostic system has two components:

- Collect images to create a data set
- Data testing and model creation training

1. Group the images to form a dataset:

We used a dataset consisting of X-ray images for testing and training purposes. In the training set we have images of patients with COVID-19 pneumonia and images of patients without COVID-19 pneumonia.

2. Test the data and train the model:

CNN method was used to train our model. Convolutional neural networks are often used in deep learning to analyze visual data. Each X-ray image used in training is first fed into convolution and max- pooling layers, then normalized and fed to fully connected neural network layers. The class of the output is then predicted by the neural network and compared with the actual output. The neural network weights are then modified using a comparison.diagnosis of a suspected case must be confirmed. X-ray inspection is said to be the most widely used technique of x-ray inspection owing to its cheap cost, many applications, and rapid examination time. The screening and diagnosis of COVID-19-related illnesses rely heavily on this. Since COVID-19 specifically targets human respiratory epithelial cells, we can use x-rays to assess lung health.

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VII. LITERATURE SURVEY

	Author andyear	Title	Methodolgy	Concept
1.	Narayana Darapaneni,Swetha Rajani,Uday shankar, Pallavajula Satya,Dr Krishna Prashant, M Harrichandan Reddy, Anweh Reddy Paduri, Aravind Kumar Adhi, Vachaspathi Madabhushanam.(2020)	COVID-19 Severity of Pneumonia Analysis Using Chest Xrays	Using deep learning model to determine the severity percentage in a lung x-ray image of pneumonia.	This can help doctors and radiologists diagnose patients more accurately, saving time and enhancing treatment consistency.
2.	Muhammad Farooq and Abdul Hafeez.(2020)	A deep learning framework for screening of covid19 from radiographs	VGG 16 architecture to improve model performance and reduce training time. We call it COVID ResNet.	This model can help in the early screening of COVID19 cases and help reduce the burden on healthcare Systems
3.	IremMertiyz,Tolga Mertyüz,OuzYakut,Beyda Taar.(2020)	COVID-19 Disease Diagnosis from Radiology data with Deep Learning Algorithms	Deep learning algorithm has been developed for disease diagnosis by analysis of computed tomography images.	In order to reduce the loss of life and to prevent the epidemic from spreading

VIII. SYSTEM REQURIMENTS

Software model

In a large dataset, TensorFlow is the framework of choice for all deep learning approaches. For classification of picture partition and identification of image modes utilising low-cost and high throughput imaging techniques, Kera's libraries are enough . The Google Collaboratory backend supports TensorFlow libraries.

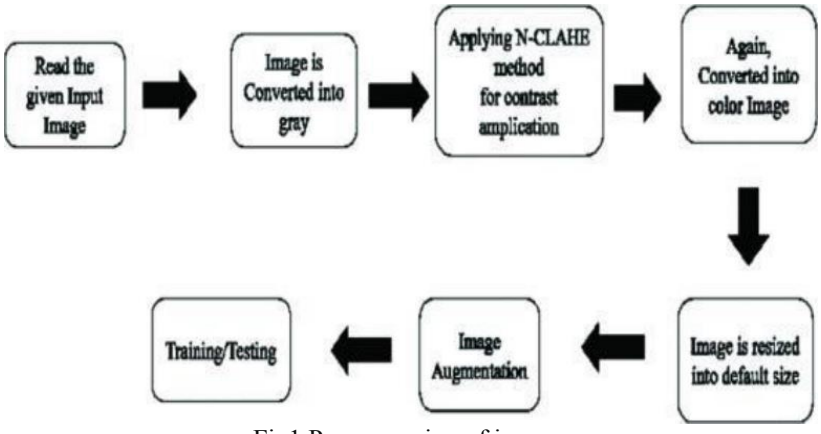

Fig1.Preprocessing of image

Typically, the image classification is built using the Convolution Neural Network Model. Images are seen significantly differently by computers and humans. Machines, in general, can only see the numerical representation of a picture. The 0 to 225 pixel picture range is used. After the pre-processing stage, a computer can categorise using any characteristics or patterns of the image.

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Datasets

The dataset is an integral part of any software-related project. One of the COVID-19 datasets has been recognised by the Kaggle community. The medical professionals that compiled this information repository.

References are included in its metadata, and images are taken from 43 distinct publications. The database of chest X-ray pictures uses two sets of images, such as Normal and Infected images. All photos are in the 1024 × 1024 pixel Portable Network Graphics (PNG) format. Convolution neural network can transform images between 224 × 224 and 227 x 227 pixels with ease (CNN). This dataset's primary objective is to be utilised to perform research onCOVID-19, a tool that can quickly identify any picture abnormality. Three classes Normal lungs,Infected lungs, and Pneumonia Infected lungs with Chest X-ray of images are created using a CNN model

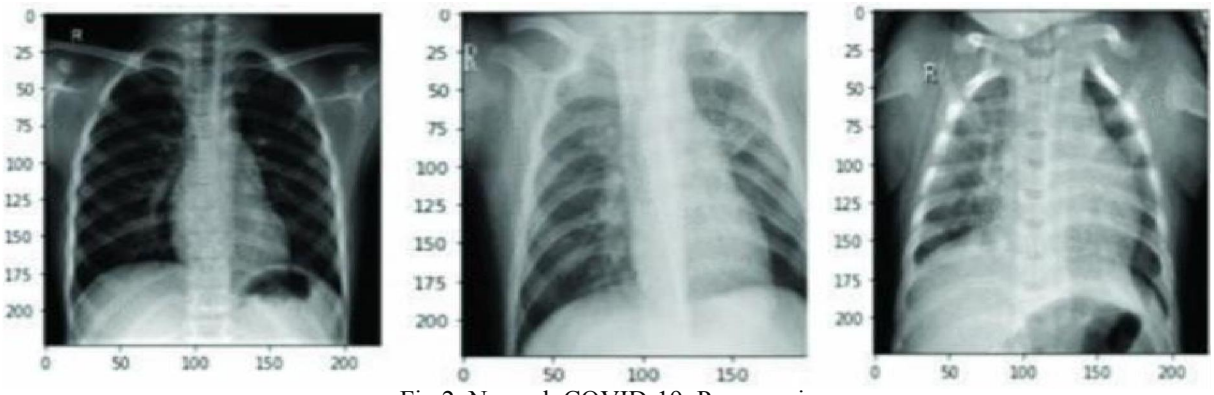


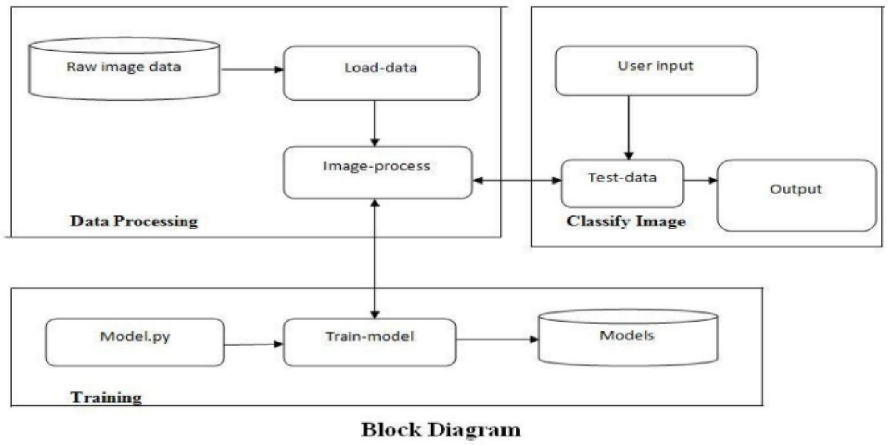
Fig 2. Normal, COVID-19, Pneumonia

Convolution Neural Network

The majority of CNN's computer vision and artificial intelligence applications are outlined, including time series analysis for medical pictures, text classification, video identification, and image classification. The different pixel arrangements of photos are supported by CNN. Without any pre-processing procedures, computer vision algorithms may immediately operate with the pictures.

IX. SYSTEM ARCHITECTURE

The process of defining a system's components, modules, interface, and data in order to meet predetermined criteria is known as system design



Block Diagram

X. SYSTEM IMPLEMENTATION

List of Modules:

- Image Collection
- Data Preprocessing

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- Building Model
- Covid-19 Detection

Modular Description:

Image Collection:

Total image dataset includes 1,878 X-ray images out of which 570 pneumonic and 630 non-pneumonic X-ray images were procured from open image database from 2018 and 369 Covid-19 positive images were procured from open image database available at Societ`a Italiana di Radiologia Medicae Interventistica (SIRM) and radiopaedia.org which included X-ray reports of patients aged 25-67 years old. Additionally, 309 Covid-19 negative X-ray images were also procured from the open database of European Society of Radiology (ESR).

Data Pre-Processing

Appropriate preprocessing of the training data was done for eviction of heavily degraded imagesthat would cost the accuracy of the trained model.

The data was augmented which includes rotation (±10 percent), left and right shift (±10%), height shift (±10%), zoom in (20%).

The X-ray image was normalized by 1/225. The training dataset obtained after data augmentation resulted in a total number of 15,024 X-ray images from a limited dataset

Building Models

In this module we are building a VGG16 model using tensorflow.

The proposed architecture developed on keras framework using Tensorflow backend is inspired by 3 state-of-theart architectures - Inception, DenseNet, Xception, and are combined by selecting appropriate features from all, smooth gradient flow and fast convolution respectively. The model is implemented using 2D convolutions as it is easy to train it with more training samples which results in higher accuracy.

VGG16 is a variant of ResNet model which has 48 Convolution layers along with 1 MaxPool and 1 Average Pool layer. It has 3.8 x 10^9 Floating points operations. It is a widely used ResNet model and we have explored VGG16 architecture in depth.

COVID-19 Detection

We are applying the VGG16 model to detect the pneumonia and Covid-19.We will pass x-ray images as input to our system, our system will efficiently detects the pneumonia and Covid-19 using VGG16 model.

XI .RESULT

Test Case#	TC01
Test Name	User input format
Test Description	To test user input values
Input	x-ray Image as input
Expected Output	The file should be read by the program and display the image
Actual Output	The file is read and display contents accordingly
Test Result	Success

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Test Case#	UTC02
Test Name	User input format
Test Description	To test user input values
Input	Image as null
Expected Output	It Should show the alert Message enter valid input
Actual Output	Shown alert message
Test Result	Success

XII. CONCLUSION

It is suggested that a deep learning-based technique be used to categorise various chest conditions. Upon analysing chest X-rays, the suggested automated method may be able to differentiate between illnesses. As data comes in from various sources, it is necessary to use a preprocessing technique called pixel normalisation to bring picture pixel intensities into line. Image enhancement is also used to tackle the issue of social stratification. In order to classify chest X-rays into one of four categories, we modify and retrain three pre-trained deep learning models (EfficeintNetB1, NasNetMobile, and MobileNetV2). This study's findings suggest that all three models benefit from regularisation procedures. In terms of classification accuracy, the regularised EfficientNetB1 model stands head and shoulders above the rest of the pack. It is alsoshown that the suggested technique outperforms other methods.

Future study may involve a bigger database with more than four classes that need to be categorised. The use of several portable deep learning models may also shorten the calculation time. In order to maximise effectiveness, it is also feasible to choose the optimal features for classification using optimization methods, notably metaheuristic approaches.

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