

CONVOLUTIONAL NEURAL NETWORK FOR RECOGNIZE AND DIAGNOSIS OF COVID19 FROM CHEST X-RAY IMAGES

Submitted in partial fulfillment of the requirements for the
award of Bachelor of Technology degree in
Information Technology

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**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

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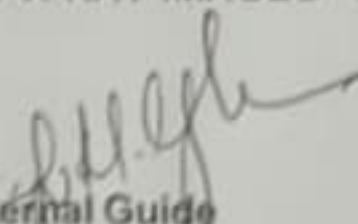
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BONAFIDE CERTIFICATE

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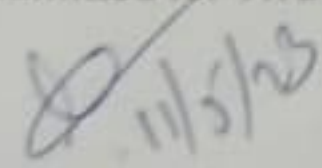

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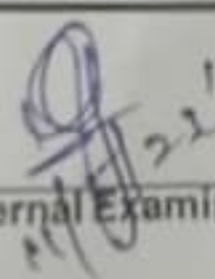
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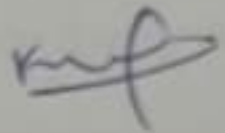

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DECLARATION

I Komal K (Reg No. 39120057) here by declare that the Project Report entitled "CONVOLUTIONAL NEURAL NETWORK FOR RECOGNIZISE AND DIAGN0SIS OF COVID19 FROM CHEST X-RAY IMAGES" done by me under the guidance of Dr. L. Mary Gladence, M.E., Ph.D., is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology

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PLACE: Chennai

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ABSTRACT

Corona-virus disease 2019 also known as COVID-19 has become a pandemic. The disease is caused by a beta corona-virus called Severe Acute Respiratory Syndrome Corona-virus 2 (SARS-CoV-2). The severity of the disease can be understood by the massive number of deaths and affected patients globally. If the diagnosis is fast-paced, the disease can be controlled in a better manner. Laboratory tests are available for diagnosis, but they are bounded by available testing kits and time. The use of radio logical examinations that comprise Computed Tomography (CT) can be used for the diagnosis of the disease. Specifically, chest X-Ray images can be analyse to identify the presence of COVID-19 in a patient. In this paper, an automated method for the diagnosis of COVID-19 from the chest X-Ray images is proposed. The method presents an improved depth wise convolution neural network for analyzing the chest X-Ray images. Wavelet decomposition is applied to integrate multi resolution analysis in the network. The frequency sub-bands obtained from the input images are fed in the network for identifying the disease. The network is designed to predict the class of the input image as normal, viral pneumonia, and COVID-19. A comparative study with the existing methods is also performed. The metrics like accuracy, sensitivity, and F1- measure are calculated for performance evaluation. The performance of the proposed method is better than the existing methodologies and thus can be used for the effective diagnosis of the disease

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CHAPTER 1

INTRODUCTION

A pandemic is an outbreak of a disease globally affecting many populations. The world has witnessed many pandemics in the 20th century. Flu viruses are the major cause of pandemics. These viruses show changing behaviour with the changing seasons and thus their behaviour needs to be predicted for prevention. Health professionals generally make the correct predictions about most viruses. But some viruses have exceptional behaviour and are difficult to predict. Such viruses cause pandemics as humans do not have the immunity to resist to such virus. The latest coronavirus disease known as COVID-19 has appeared and spread extremely fast. Since its discovery in December 2019 in Wuhan, China, the disease has already spread over 199 countries and territories. The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) causes COVID-19. The virus is a Ribonucleic Acid (RNA) virus from the Coronavirus family, most viruses from this family cause common cold. The more severe variety of corona-viruses is Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Corona-virus (MERSCoV). COVID-19 causes respiratory ailments ranging from common cold to serious diseases like pneumonia. The number of cases worldwide has reached 5 817 385 causing the deaths of 362 705 individuals as on May 30, 2020 as per the situation report published by World Health Organization (WHO). The accurate information about the emergence of COVID-19 is still unknown. But the initial cases have established links with the Huanan (Southern China) Seafood Wholesale Market. The disease is contagious, and the virus gets spread amongst humans via respiratory droplets, physical contact, and also through fecal-oral transmission. Numerous cases of pneumonia of unknown cause were reported in Wuhan, China in December 2019. The cases showed similar clinical characteristics with viral pneumonia. The patients suffering from COVID-19 infection are observed to have serious pneumonia with abnormal observations on chest Computed Tomography (CT) examination.

The unavailability of medicine for this disease requires efficient diagnosis methods for controlling the disease.

A deep learning-based model is applied on CT images for detection of COVID-19. Some researchers have also developed public datasets comprising of chest X-Ray images of COVID-19 patients. A method named COVID-Net is developed and applied on these public datasets for diagnosis of COVID-19. The use of deep learning for diagnosis from the chest X-Ray images provides good results. Deep learning models are being widely used for medical image processing. The detection of pneumonia is done using convolution neural networks. In this paper, an automated method for the diagnosis of COVID-19 from a deep network is proposed. The proposed network utilizes the feature generated by multiresolution analysis. The combination of wavelet transforms along with the deep network brings multiple advantages. The wavelet decomposition is fed into the network. The network used is not the traditional Convolutional Neural Network (CNN). A depth wise separable network is utilized in this work. The fight against COVID-19 has taken several forms and fronts. Computerized solutions offer contactless alternatives to many aspects of dealing with the pandemic [6]. Some examples include robotic solutions for physical sampling, vital sign monitoring, and disinfection. Moreover, image recognition and AI are being actively used to identify confirmed cases not adhering to quarantine protocols. In this work, we propose an automatic diagnosis artificial intelligence (AI) system that is able to identify COVID-19-related pneumonia from chest X-ray images with high accuracy. One customized convolutional neural networks model and two pre-trained models (i.e., MobileNets [7] and VGG16 [8]) were incorporated. Moreover, CXR images of confirmed COVID-19 subjects were collected from a large local hospital and inspected by board-accredited specialists over a period of 6 months. These images were used to enrich the limited number of existing public datasets and form a larger training/testing group of images in comparison to the related literature. Importantly, the reported results come from testing the models with this completely foreign set of images in addition to evaluating the models using the fused aggregate set. This approach exposed any overfitting of the model to a specific set of CXR images, especially as some datasets contain multiple images per subject.

CHAPTER 2

LITERATURE SURVEY

2.1 Inferences from Literature Survey

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system. The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project Literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations.

COVID-19 Epidemic Analysis using Machine Learning and Deep Learning Algorithms

The catastrophic outbreak of Severe Acute Respiratory Syndrome - Coronavirus (SARS-CoV-2) also known as COVID-2019 has brought the worldwide threat to the living society. The whole world is putting incredible efforts to fight against the spread of this deadly disease in terms of infrastructure, finance, data sources, protective gears, life-risk treatments and several other resources. The artificial intelligence researchers are focusing their expertise knowledge to develop mathematical models for analyzing this epidemic situation using nationwide shared data. To contribute towards the wellbeing of living society, this article proposes to utilize the machine learning and deep

learning models with the aim for understanding its everyday exponential behaviour along with the prediction of future reachability of the COVID-2019 across the nations by utilizing the real-time information from the Johns Hopkins dashboard.

COVID-19 in India: State-wise Analysis and Prediction

The highly infectious coronavirus disease (COVID-19) was first detected in Wuhan, China in December 2019 and subsequently spread to 212 countries and territories around the world, infecting millions of people. In India, a large country of about 1.3 billion people, the disease was first detected on January 30, 2020, in a student returning from Wuhan. The total number of confirmed infections in India as of May 3, 2020, is more than 37,000 and is currently growing fast.

COVID-19 Outbreak Prediction with Machine Learning

Several outbreak prediction models for COVID-19 are being used by officials around the world to make informed-decisions and enforce relevant control measures. Among the standard models for COVID-19 global pandemic prediction, simple epidemiological and statistical models have received more attention by authorities, and they are popular in the media. Due to a high level of uncertainty and lack of essential data, standard models have shown low accuracy for long-term prediction. Although the literature includes several attempts to address this issue, the essential generalization and robustness abilities of existing models needs to be improved. This paper presents a comparative analysis of machine learning and soft computing models to predict the COVID-19 outbreak. Among a wide range of machine learning models investigated, two models showed promising results (i.e., multi-layered perceptron, MLP, and adaptive network-based fuzzy inference system, ANFIS). Based on the results reported here, and due to the highly complex nature of the COVID-19 outbreak and variation in its behavior from nation-to-nation, this study suggests machine learning as an effective tool to model the outbreak.

Forecasting the novel coronavirus COVID-19

What will be the global impact of the novel coronavirus (COVID-19)? Answering this question requires accurate forecasting the spread of confirmed cases as well as analysis of the number of deaths and recoveries. Forecasting, however, requires ample historical data. At the same time, no prediction is certain as the future rarely repeats itself in the same way as the past. Moreover, forecasts are influenced by the reliability of the data, vested interests, and what variables are being predicted. Also, psychological factors play a significant role in how people perceive and react to the danger from the disease and the fear that it may affect them personally.

This paper introduces an objective approach to predicting the continuation of the COVID-19 using a simple, but powerful method to do so. Assuming that the data used is reliable and that the future will continue to follow the past pattern of the disease, our forecasts suggest a continuing increase in the confirmed COVID-19 cases with sizable associated uncertainty. The risks are far from symmetric as underestimating its spread like a pandemic and not doing enough to contain it is much more severe than overspending and being over careful when it will not be needed. This paper describes the timeline of a live forecasting exercise with massive potential implications for planning and decision making and provides objective forecasts for the confirmed cases of COVID-19.

Prediction of Spreads of COVID-19 in India from Current Trend

The article describes modelling efforts for evaluating the current level of COVID19 infections in India, using exponential model. The Data from 15 March 2020 to 30 April 2020 are used for validating the model, where intrinsic rise rate is kept constant. It is observed that some states of India, like Maharashtra, Gujarat and Delhi have a much higher daily infection cases. This is modelled by assuming an initial higher infections, keeping rise rate same. The sudden outbursts are captured using offset of values for these three states. Data from other states like Madhya Pradesh, Uttar Pradesh and Rajasthan are also analysed and they are found to be following the same constants as India is following. Worldwide, many attempts are made to predict outburst of COVID-19 and in the model, described in this paper, turning point is not predicted, as cases in

India are still rising. The developed model is based on daily confirmed infections and not on cumulative infections and rationalization is carried out for the population of various regions, while predicting infections for various states. Assigning a decay constant at this stage will be a premature exercise and keeping that in mind, exponential model predicts that India will attain 1 lakh case by 15 May 2020. The figure of 2 lakh and 3 lakh will be attained on 22 May 2020 and 26 May 2020, respectively.

An interpretable mortality prediction model for COVID-19 patients

The sudden increase in COVID-19 cases is putting high pressure on healthcare services worldwide. At this stage, fast, accurate and early clinical assessment of the disease severity is vital. To support decision making and logistical planning in healthcare systems, this study leverages a database of blood samples from 485 infected patients in the region of Wuhan, China, to identify crucial predictive biomarkers of disease mortality. For this purpose, machine learning tools selected three biomarkers that predict the mortality of individual patients more than 10 days in advance with more than 90% accuracy: lactic dehydrogenase (LDH), lymphocyte and high-sensitivity C-reactive protein (hs-CRP). In particular, relatively high levels of LDH alone seem to play a crucial role in distinguishing the vast majority of cases that require immediate medical attention. This finding is consistent with current medical knowledge that high LDH levels are associated with tissue breakdown occurring in various diseases, including pulmonary disorders such as pneumonia. Overall, this Article suggests a simple and operable decision rule to quickly predict patients at the highest risk, allowing them to be prioritized and potentially reducing the mortality rate.

2.2 EXSISTING SYSTEM

The person administering the test will twirl a long stick with a soft brush on the end, similar to a pipe cleaner, up your nose for a few seconds. There will be a collection of secretions collected by the soft bristles for study. To get a good specimen, the swab must go back a long way, so cells and fluids must be extracted from the whole passageway that links the base of the nose to the back of the neck. However, since the body isn't used to having an object in that place, it produces a slew of strange sensations. For one thing, it activates the lachrymal reflex, which means it will bring tears to your eyes if it's done correctly. I wouldn't go so far as to say it hurt, but it is uncomfortable. Since the swab will also touch the back of the throat, it may also trigger a gag reflex.

CHAPTER 3

PROPOSED SYSTEM

A skilled man or woman carrying a protracted stick with a tender brush on the quit will weave it, like a pipe cleaner, thru your nose in a short time. A collection of secretions could be collected with soft bristles for have a look at. A swab has an extended manner to go to provide a very good pattern, so cells and fluids should be extracted from the entire passage from the bottom of the nostril to the returned of the neck. But for the reason that body isn't the usual item in that area, it makes many peculiar sensations. In one manner, the reflex moves the tear, which means that if executed efficiently, the tears may be well for your eyes. I do not want to mention it hurts, however it's inconvenient. When the swab also touches the again of the throat, this can additionally purpose the gag reflex.

We have proposed an automatic prediction of covid-19 using a deep convolutional neural networks and Chest X-ray images. The proposed models will have end-to-end structure without manual feature extraction and selection methods. Chest Xray is the best tool for the detection of covid-19. The method presents an improved depth wise convolution neural network for analysing the chest X-Ray images. Wavelet decomposition is applied to integrate multiresolution analysis in the network. The frequency sub-bands obtained from the input images are fed in the network for identifying the disease. The network is designed to predict the class of the input image as normal, viral pneumonia, and COVID-19. A comparative study with the existing methods is also performed. The metrics like accuracy, sensitivity, and F1-measure are calculated for performance evaluation. The performance of the proposed method is better than the existing methodologies and thus can be used for the effective diagnosis of the disease.

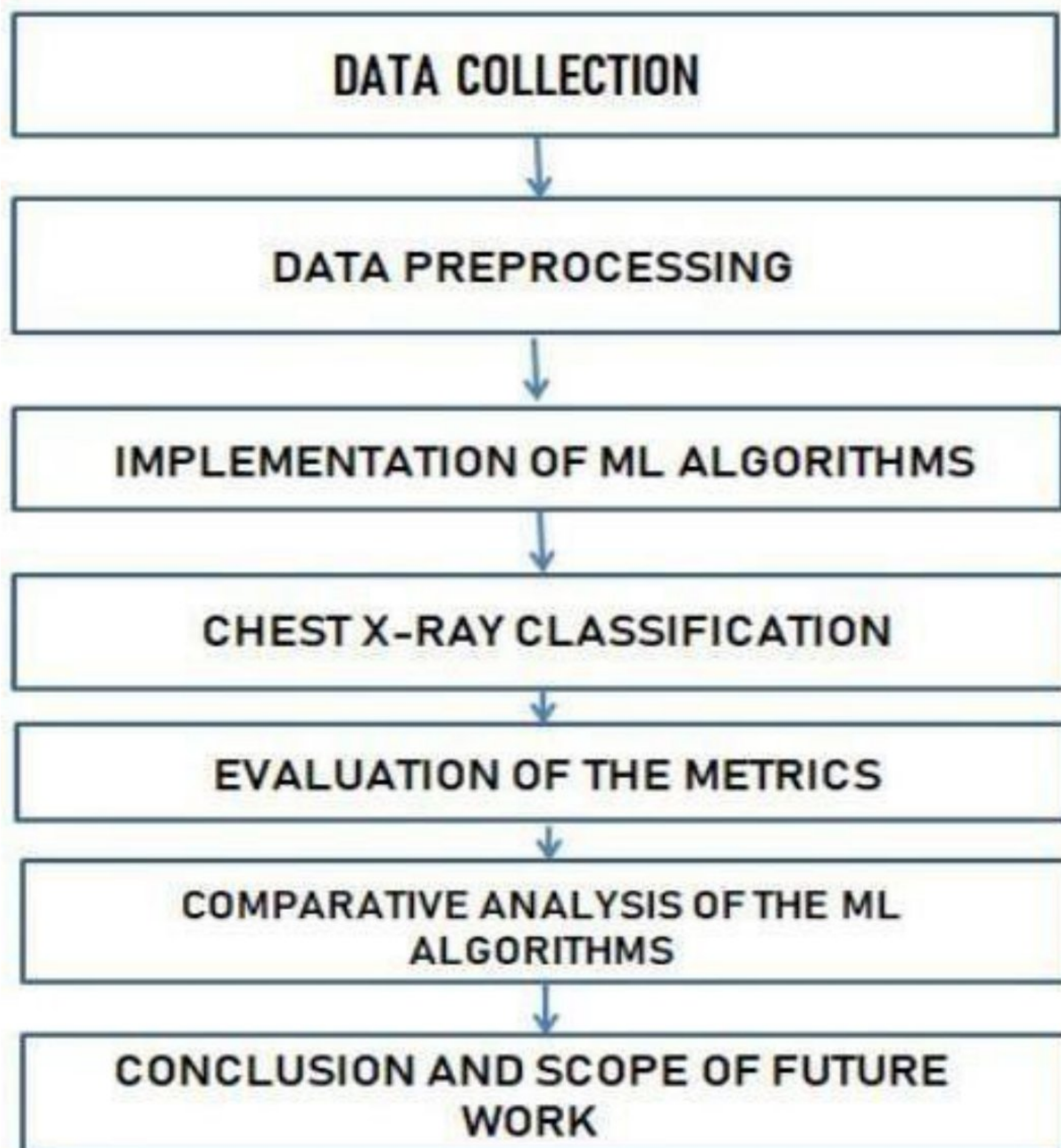
3.1 SOFTWARE REQUIREMENTS

- Operating system : Windows 7.
- Coding Language : python

HARDWARE REQUIREMENTS

- | | |
|-----------------|------------------------|
| • System | • : Pentium Dual Core. |
| • Hard Disk | • : 120 GB. |
| • Monitor | • : 15"LED |
| • Input Devices | • : Keyboard, Mouse |
| • Ram | • : 1GB. |

3.1 SYSTEM ARCHITECTURE



1.1 Architecture Diagram

CHAPTER 4

METHODOLOGY

Data collection Module

This experiment leveraging the data from Covid Chest Xray Dataset and Pneumonia dataset by Praveen from GitHub and Kaggle respectively. Using these two datasets, we have created a customized dataset as normal, viral pneumonia, and COVID-19. The COVID-19 dataset comprises of the chest X-Ray images. These images are used for the detection. The images are of different sizes, thus they are resized.

Data Pre-Processing Module

The input images are normalized prior to any further processing. Normalized images are enhanced images with no errors due to lightening conditions. This segment mentioned the technique of preparing the raw data to make these suitable for building and training machine learning models. We used 3 repositories for data set preparation. 2 sets from GitHub and another from kaggle. 2 directories make for COVID19 and normal data set. Data set image will be classified to normal and COVID-19.

Training the CNN Module

Before we thought of training the CNN, we will load the data and target Before training the model, we will set up data generators to read images from source folders instead of labeling the image one by one. Basically, Image DataGenerator will label the images based on the directory the image is contained. It points to the sub-directory of the data. Grayscale normalization should be done in order for CNN to converge faster by using rescale parameter.

Prediction Module

Finally, any given input chest X-Ray image is classified into one of three classes, i.e., normal, COVID-19, or viral pneumonia

Deep Learning Models

Deep learning is the current trend and most prolific AI technique used for classification problems. It has been used widely and successfully in a range of applications, especially in the medical field. The next few paragraphs describe the models used in this work.

2D sequential CNN models are one class in the deep learning literature. They are a special class of feedforward neural networks that have been found to be very useful in analyzing multidimensional data (e.g., images) [18]. However, CNNs conserve memory relative to multilayer perceptron's by sharing parameters and using sparse connections. The input images are transformed into a matrix to be processed by the various CNN elements. The model consists of several alternating layers of convolution and pooling.

Convolutional layer

The convolutional layer determines the features of the various patterns in the input. It consists of a set of dot products (i.e., convolutions) applied to the input matrix. This step creates an image processing kernel containing a number of filters, which outputs a feature map (i.e., motifs). The input is divided into small windows called receptive fields, which are convolved with the kernel using a specific set of weights. In this work, a 2D convolution layer was used (i.e., using the CONV2D class).

Pooling layer

This down-sampling layer reduces the spatial dimensions of the output volume by reducing the number of feature maps and network parameters. Moreover, pooling helps in improving the generalization of the model by reducing overfitting [36]. The output from this step is a combination of features invariant to translational shifts and distortions [37].

Dropout

Overfitting is a common problem in neural networks. Hence, dropout is used as a

strategy to introduce regularization within the network, which eventually improves generalization. It works by randomly ignoring some hidden and visible units. This has the effect of training the network to handle multiple independent internal representations.

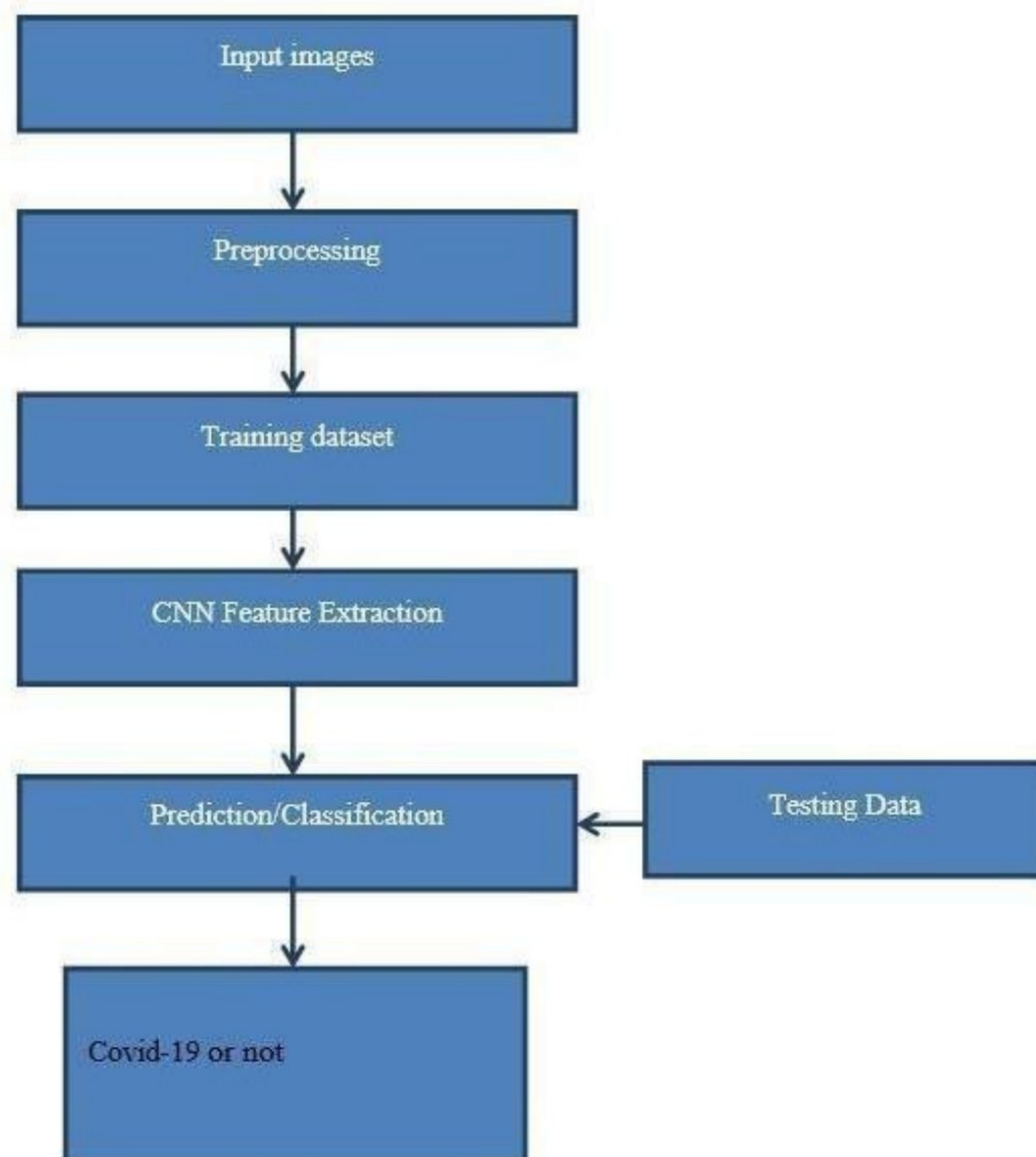
Fully connected layer

This layer accepts the feature map as input and outputs nonlinear transformed output via an activation function. This is a global operation that works on features from all stages to produce a nonlinear set of classification features. The rectified linear unit (ReLU) was used in this step as it helps in overcoming the vanishing gradient problem [38].

4.1 DATA FLOW DIAGRAM:

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

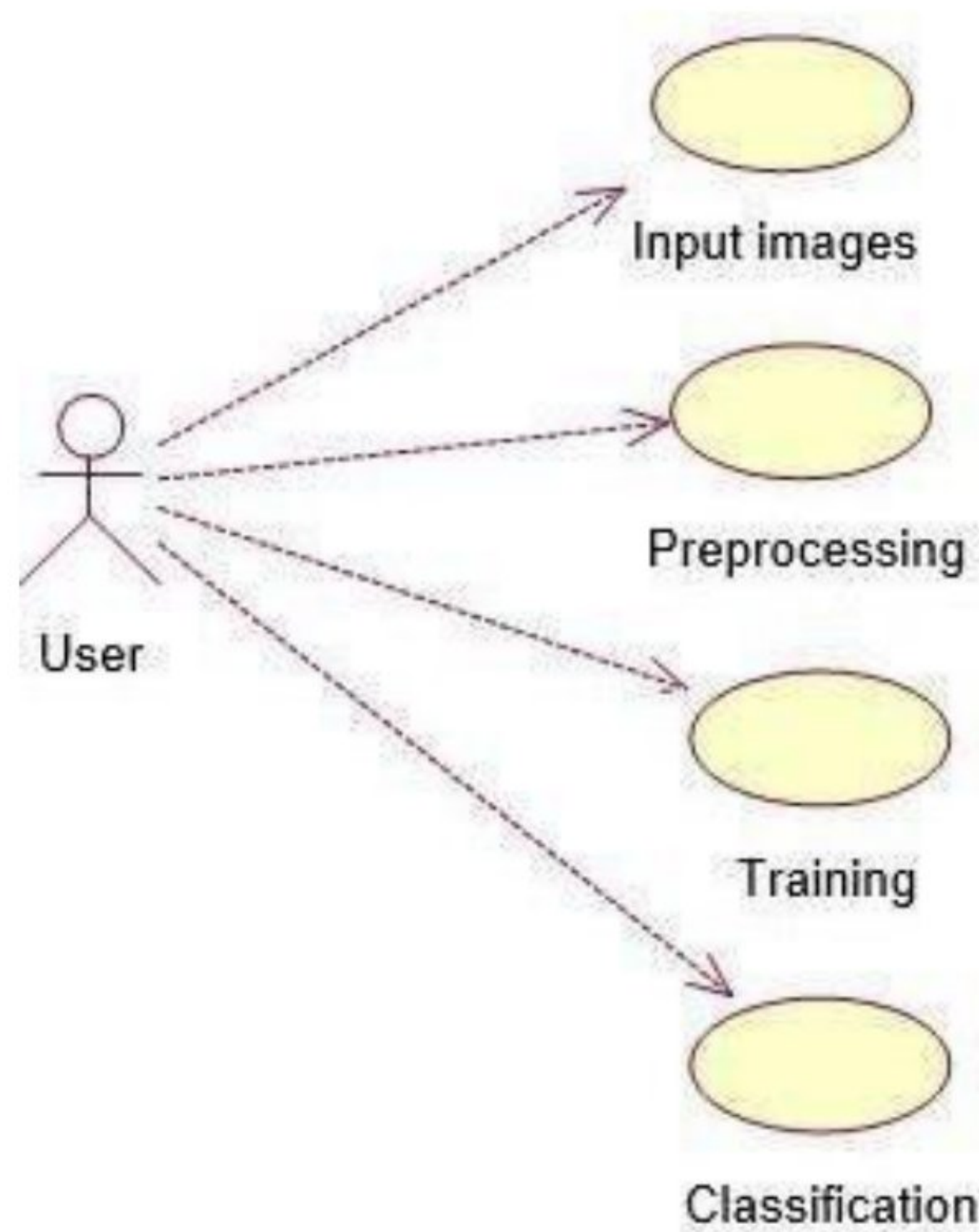
Data flow diagram



4.1 Data Flow Diagram

USE CASE DIAGRAM:

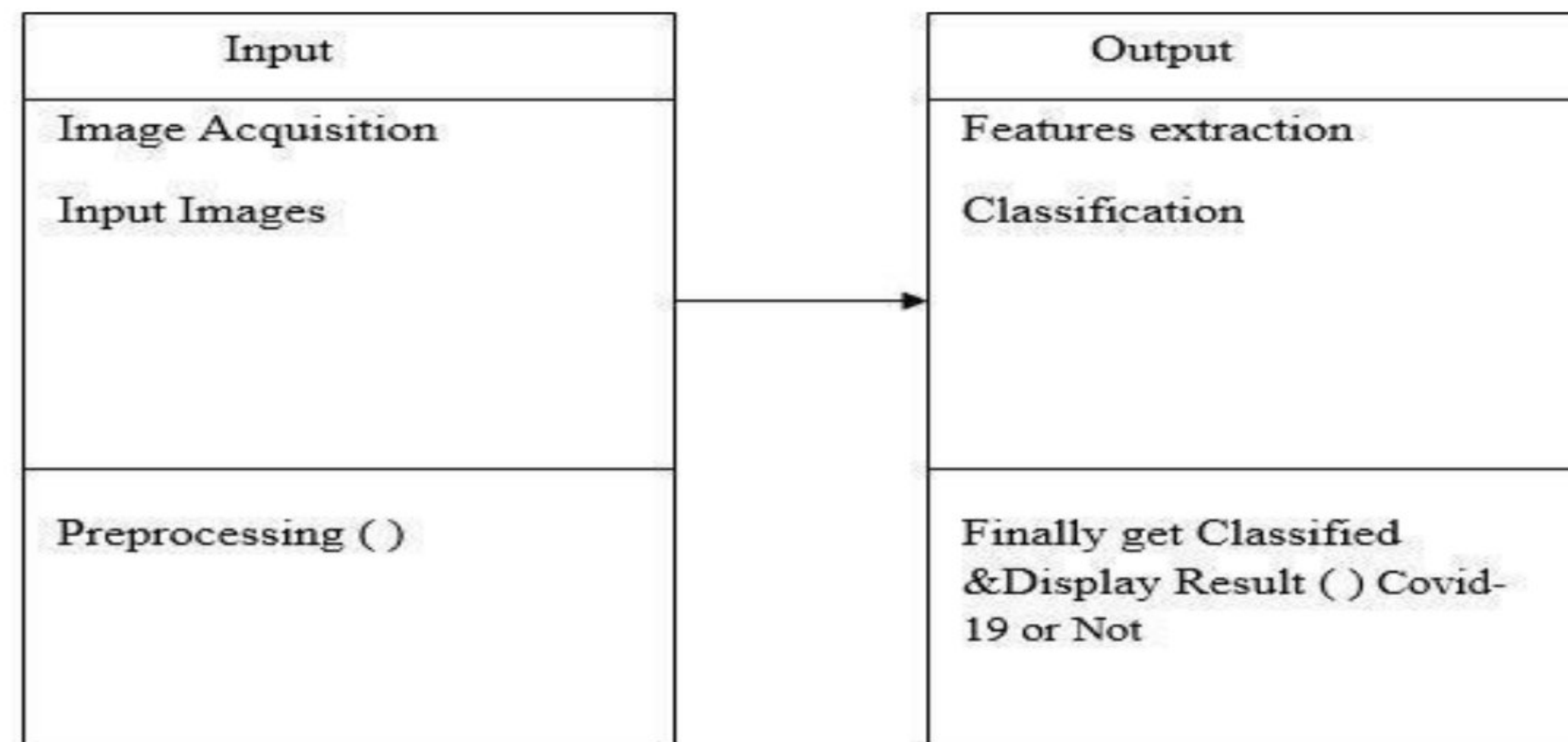
The Unified Modeling Language (UML) use case diagram is a sort of human diagram defined and constructed from use case evaluation. The purpose is to offer a graphical assessment of the capability of the gadget in terms of actors, their goals (represented as use instances), and any dependencies among person instances. The primary use case of a diagram is to show which gadget functions are achieved for which actor. You can describe the jobs of the actors in the system.



4.1.1 USE CASE DIAGRAM

CLASS DIAGRAM:

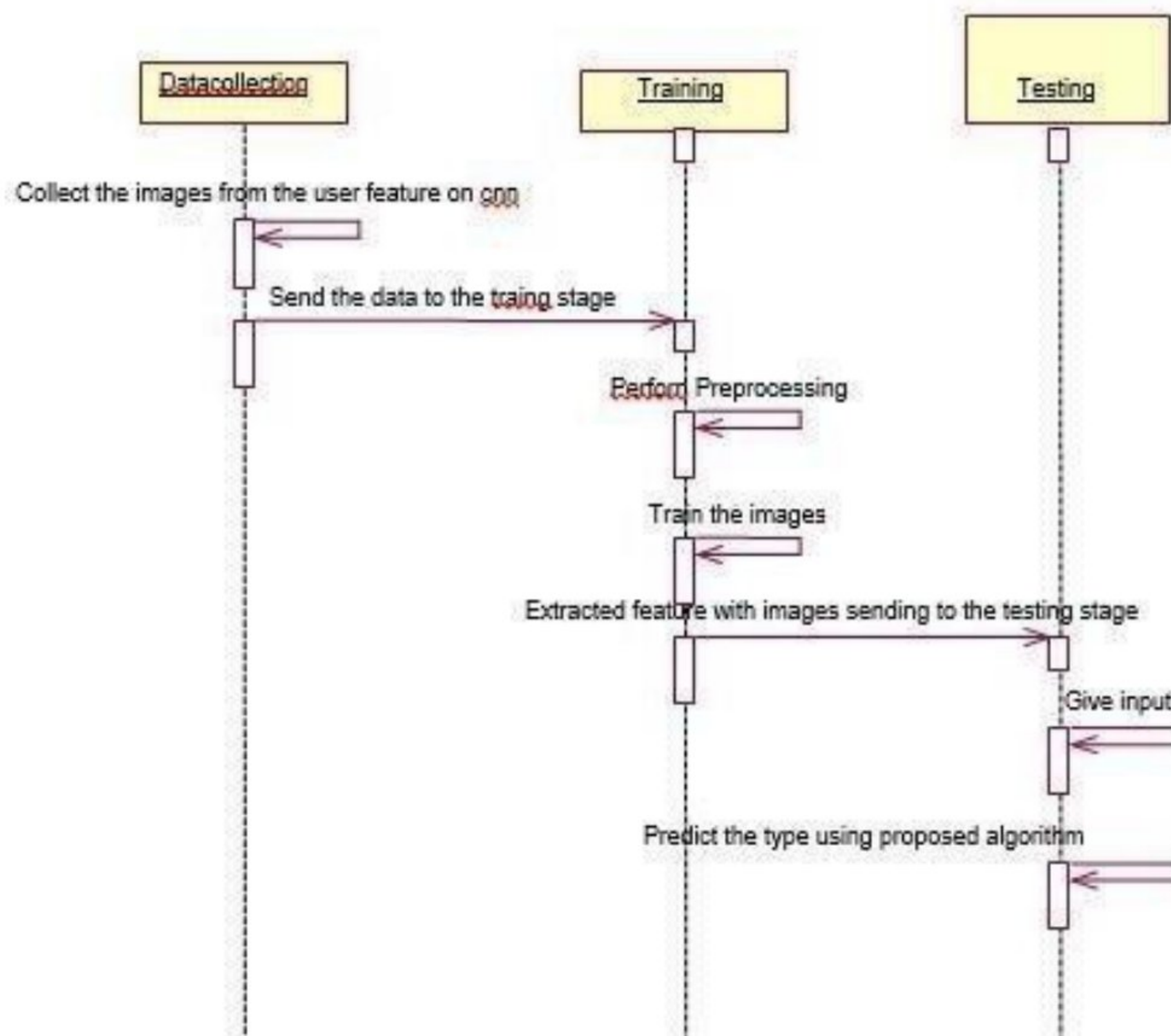
In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.



4.1.2 CLASS DIAGRAM

SEQUENCE DIAGRAM:

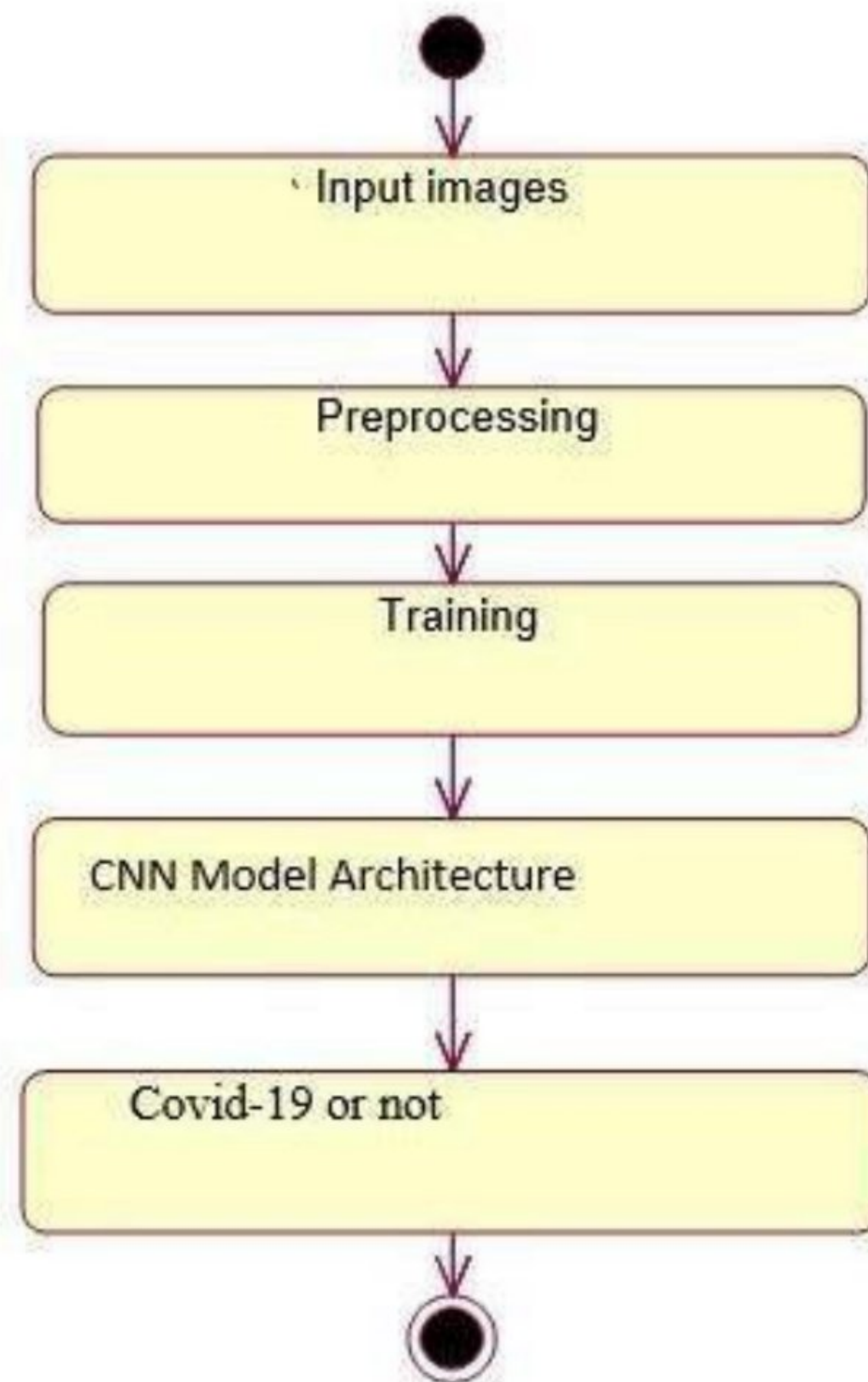
A Unified Modeling Language (UML) collection diagram is a kind of interaction diagram that suggests how processes interact with each other and in what order. This submit is a series of posts. Sequence diagrams are on occasion known as occasion diagrams, occasion scripts, and timing diagrams.



4.1.3 SEQUENCE DIAGRAM

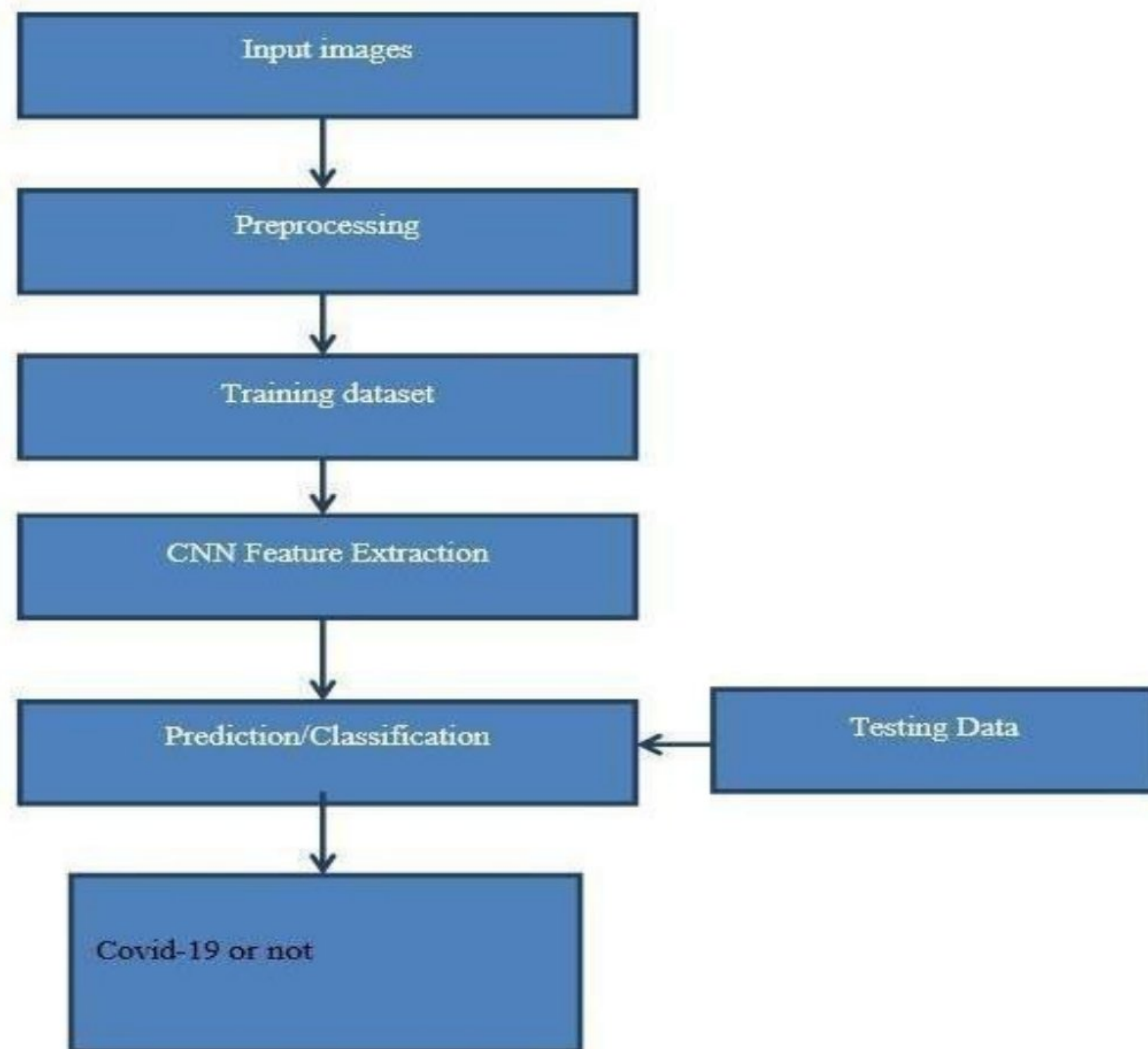
ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational stepby-step workflows of components in a system. An activity diagram shows the overall flow of control.



4.1.4 ACTIVITY DIAGRAM

4.2 PROJECT MANAGEMENT PLAN



4.2 Project Management Plan

CHAPTER 5

IMPLEMENTATION DESIGN

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- ❖ Convey information about past activities, current status or projections of the Future.
- ❖ Signal important events, opportunities, problems, or warnings.
- ❖ Trigger an action.
- ❖ Confirm an action

CHAPTER 6

RESULTS

Four different approaches were used to evaluate the three deep learning models. First, only the public dataset was used to train and test the models. Second, the fused dataset was used to test and train the models (i.e., the sets were combined together and treated as one without any distinction). Third, the public dataset was used for training the model and the locally collected dataset was used for testing. This approach shows the ability of the model to generalize to new data and avoid overfitting to specific images/subjects. Fourth, the combined (i.e., fused) dataset was used for training and local dataset for testing. Table 2 shows the number of training and testing subjects used for each approach. Note that the local dataset did not include normal CXR images as those are abundantly available. The confusion matrices resulting from testing were analyzed to produce several standard performance measures. These include accuracy, specificity, sensitivity, F1-score, and precision.

CHAPTER 7

CONCLUSION

Global disasters bring people together and spur innovations. The current pandemic and the worldwide negative consequences should present an opportunity to push forward technological solutions that facilitate everyday life. In this study, we have collected chest X-ray images from hospitalized COVID-19 patients. These data will enrich the current available public datasets and enable further refinements to the systems employing them. Moreover, deep learning artificial intelligence models were designed, trained, and tested using the locally collected dataset as well as public datasets, both separately and combined. The high accuracy results present an opportunity to develop mobile and easy access applications that improve the diagnosis accuracy, reduce the workload on strained health workers, and provide better healthcare access to undermanned/underequipped areas. Future work will focus on this avenue as well as development and evaluation of multiclass classification models.

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APPENDICES

SOURCE CODE:

```
#!/usr/bin/env python

import os

import sys


from flask import Flask, request, jsonify, send_file, render_template

from io import BytesIO

from PIL import Image, ImageOps

import base64

import urllib


import numpy as np

import scipy.misc

from tensorflow.keras.preprocessing import image

from tensorflow.keras.models import load_model

import os

import tensorflow as tf

import numpy as np

from tensorflow import keras

#from skimage import io

from tensorflow.keras.preprocessing import image
```

```

# Flask utils

from flask import Flask, redirect, url_for, request, render_template

from werkzeug.utils import secure_filename

from gevent.pywsgi import WSGIServer

from tensorflow.keras.models import load_model

import efficientnet.keras as efn

import efficientnet.tfkeras

from tensorflow.keras.models import load_model


app = Flask(__name__)


# Load your trained model


@app.route("/")

@app.route("/first")

def first():

    return render_template('first.html')


@app.route("/login")

```

```
def login():  
    return render_template('login.html')  
  
@app.route("/chart")  
def chart():  
    return render_template('chart.html')  
  
@app.route("/performance")  
def performance():  
    return render_template('performance.html')  
  
@app.route("/index", methods=['GET'])  
def index():  
    return render_template('index.html')  
  
@app.route("/upload", methods=['POST'])  
def upload_file():  
    print("Hello")  
  
    try:  
        img = Image.open(BytesIO(request.files['imagefile'].read())).convert('RGB')  
        img = ImageOps.fit(img, (224, 224), Image.ANTIALIAS)  
  
    except:
```

```

        error_msg = "Please choose an image file!"

        return render_template('index.html', **locals())

# Call Function to predict

args = {'input' : img}

out_pred, out_prob = predict(args)

out_prob = out_prob * 100

print(out_pred, out_prob)

danger = "danger"

if out_pred=="You Are Safe, But Do keep precaution":

    danger = "success"

print(danger)

img_io = BytesIO()

img.save(img_io, 'PNG')

png_output = base64.b64encode(img_io.getvalue())

processed_file = urllib.parse.quote(png_output)

return render_template('result.html',**locals())

def predict(args):

    img = np.array(args['input']) / 255.0

    img = np.expand_dims(img, axis = 0)

```

```

model = 'save.h5'

# Load weights into the new model

model = load_model(model)

pred = model.predict(img)

if np.argmax(pred, axis=1)[0] == 0:

    out_pred = "Normal"

elif np.argmax(pred, axis=1)[0] == 1:

    out_pred = "CORONA-VIRUS AFFECTED"

return out_pred, float(np.max(pred))

if __name__ == '__main__':

    app.run(debug=True)

```

SCREENSHOTS:



Fig. 5.1.1 Image showing covid-19 detection using image processing

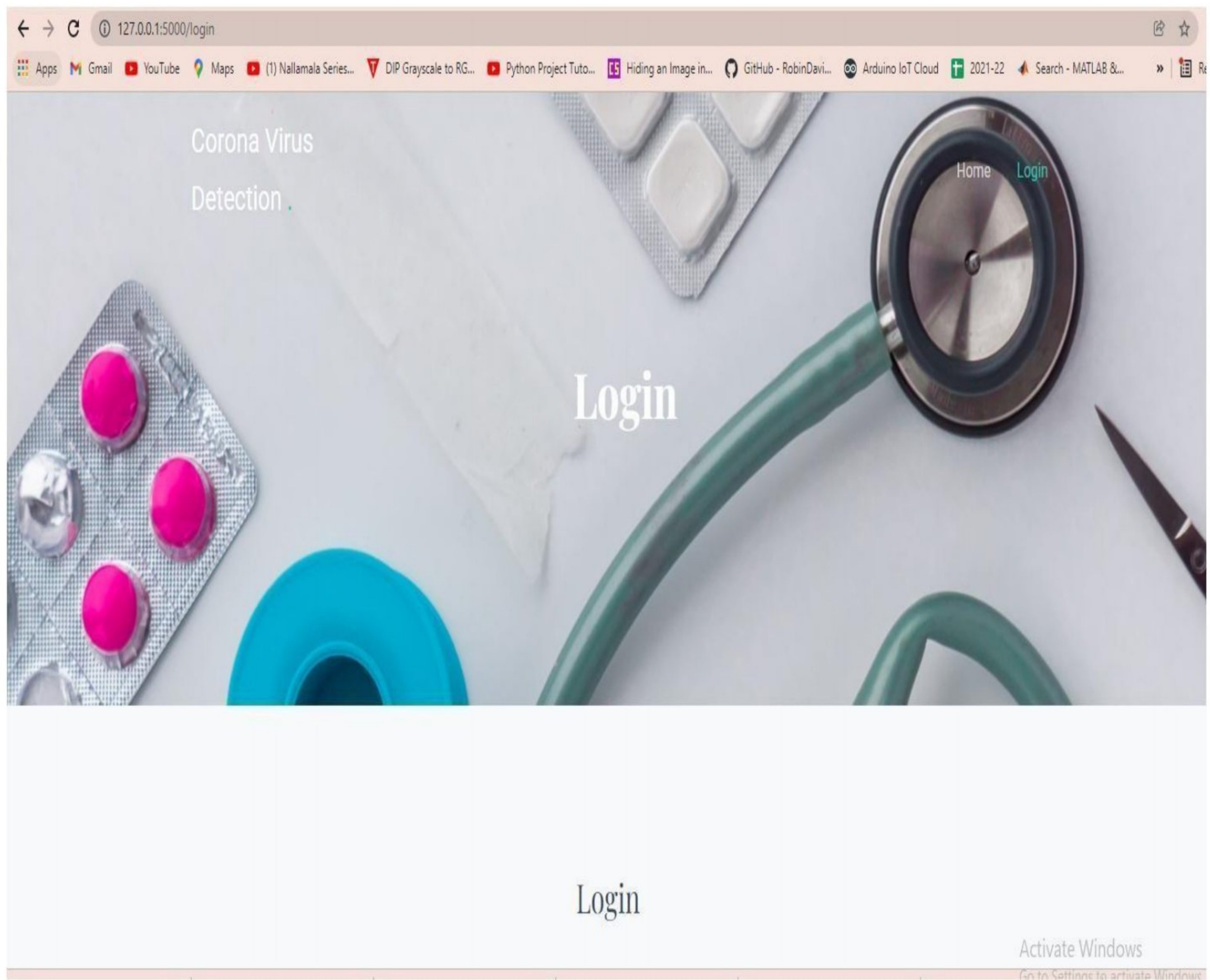


Fig.5.1.2 Image showing login page of covid-19 detection

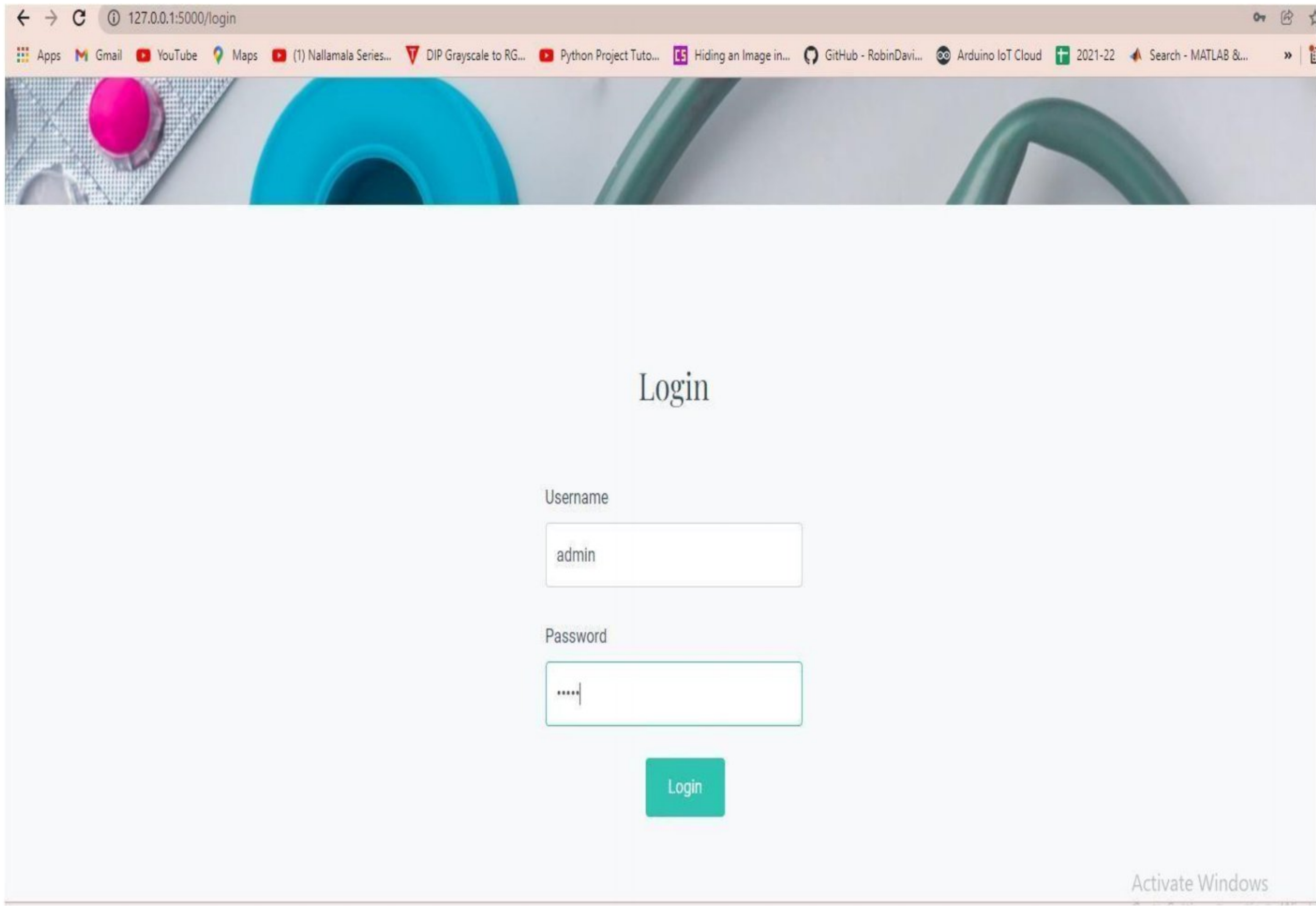


Fig.5.1.3 Login page accessing username and password

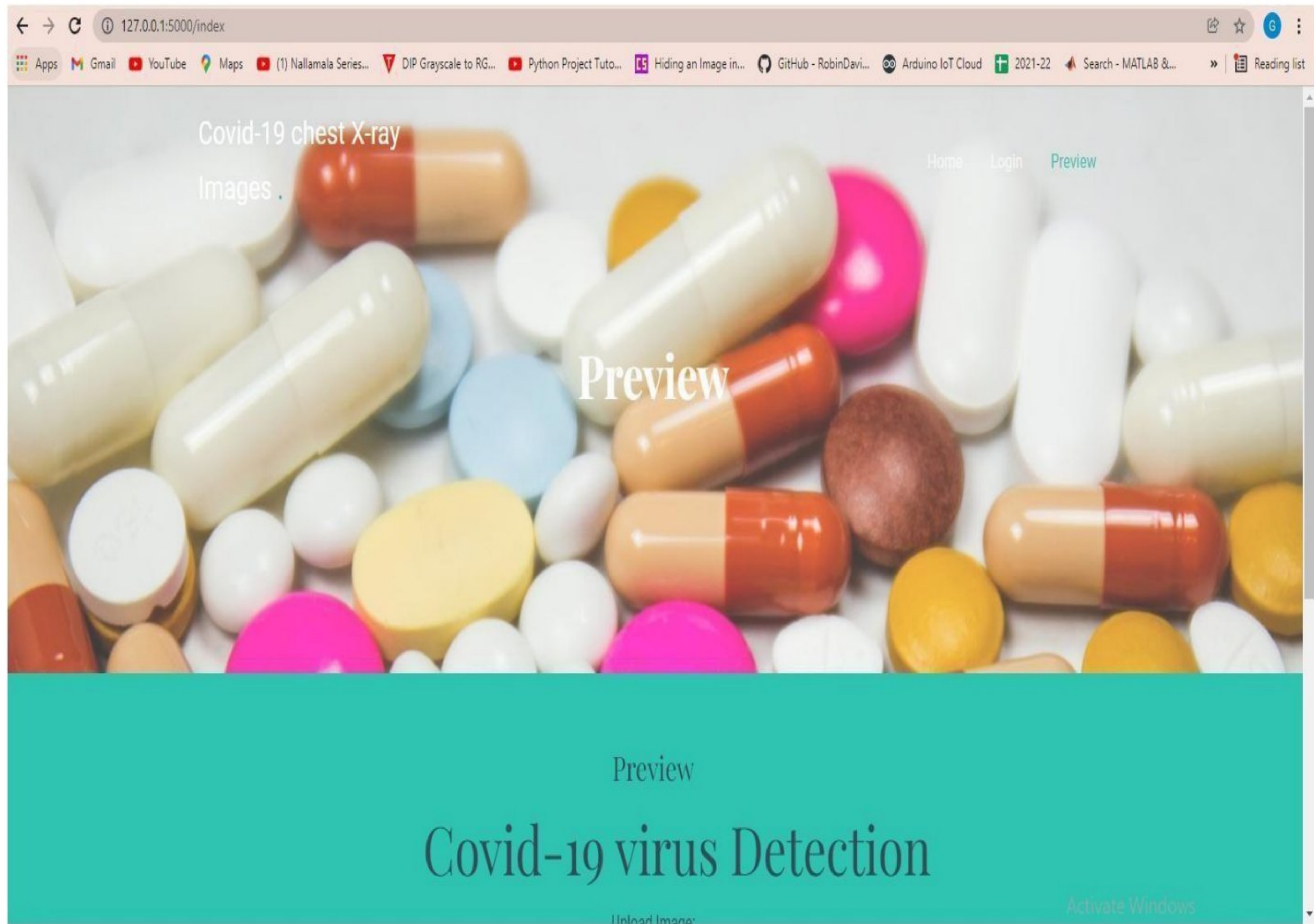


Fig.5.1.4 Preview image of covid-19 virus detection

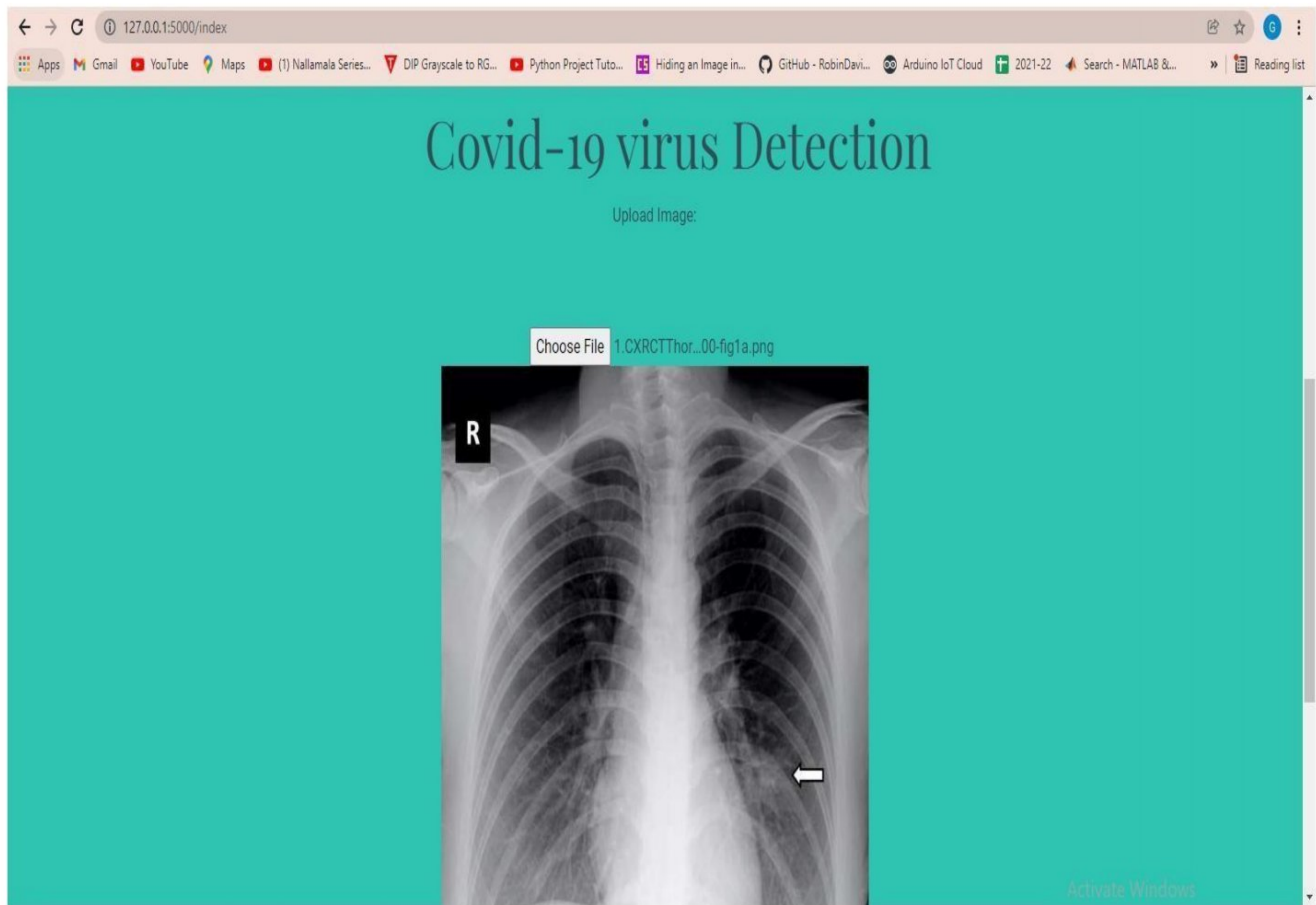


Fig 5.1.5 X-Ray image showing detection of covid-19 virus

CONVOLUTIONAL NEURAL NETWORK FOR RECOGNIZE AND DIAGNOSIS OF COVID-19 FROM CHEST X-RAY IMAGES

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Abstract In 2019, the coronavirus disease, also called COVID-19, have become a virus. The disease is resulting from a extreme acute respiratory syndrome coronavirus 2 referred to as a betacoronavirus (SARS-CoV-2). The severity of the disorder can be understood by means of the unexpected deaths and illnesses everywhere in the world. If the analysis is made quick, the sickness may be better controlled. Lab assessments are available for analysis, but are restrained via check kits and time. X-ray studies, together with computed tomography (CT), may be used to diagnose the disease. In specific, chest x-rays can be analyzed to look if a patient has COVID-19. This article proposes an automated approach for diagnosing COVID-19 from chest x-rays. An improved deep convolutional neural network method for the evaluation of chest X-ray pics. Wavelet decomposition is used to integrate multi-decision network evaluation. The frequency subbands obtained from the enter photographs are fed to the community to perceive the disorder. The network is designed to are expecting the form of ordinary input photograph, viral pneumonia, and covid-19. A comparative have a look at with existing strategies is also carried out. Measures along with accuracy, sensitivity, and F1 estimate overall performance. The proposed approach approach is higher than the existing strategies in its characteristics and for this reason can be used for the effective prognosis of the ailment.

Keywords: COVID-19, medical image processing, deep learning, Resnet-SVM.

I. INTRODUCTION

A pandemic is a virulent disease of a ailment that

influences many populations round the arena. In the 20 th century, the arena went thru many pandemics. Influenza viruses are the principle reason of pandemics. These viruses show off seasonal variation in conduct and consequently their conduct ought to be monitored. Health doctors typically make correct predictions approximately maximum viruses. But some viruses have notable behavior and are hard to expect. Such viruses cause pandemics because human beings do no longer have immunity to face up to this type of virus. The today's coronavirus sickness, nicknamed COVID-19, emerged and spread extremely quick. Since its discovery in December 2019 in Wuhan, China, the disorder has already spread to 199 international locations and regions. The intense acute breathing syndrome coronavirus 2 (SARS- CoV-2) causes COVID-19. It is a ribonucleic acid(RNA) virus from the coronavirus circle of relatives, most viruses on this family purpose the common bloodless. More severe sorts of coronaviruses are intense acute respiration syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS- CoV). The respiratory reasons of COVID-19 range from the common cold to critical illnesses including pneumonia. As of May 30, 2020, the range of instances has elevated to 5, 817, 385, out of 362,705 deaths, in keeping with the situation file posted via the World Health Organization (WHO).

II. LITERATURE REVIEW

Literature assessment is the most vital step within the software program improvement process. Before the device is evolved, the time component, the economy and the energy of the organisation have to be determined. When these kinds of situations are met, the subsequent step

is to determine which operating system and language can be used to develop the device. When programmers begin building a tool, they want a variety of external help. This aid may be acquired from older software program, from books, or from websites. Before developing a device, those considerations are taken under consideration while the system is being advanced.

The most a part of the venture improvement is thinking about and completely getting to know all of the necessities essential for the improvement of the mission. For any reason, literature evaluate is the maximum important a part of the software program development procedure. Before the gear are developed and their associated design, time factor, resource requirements, manpower, financial and corporation strengths are diagnosed and analyzed. With these things satisfied and absolutely understood, the next step is to determine the specification of the software program within the respective device, as to what form of operating machine may be required for the reason, and what's going to be needed to move all the important software. To the subsequent steps to increase related gear and sports.

A. COVID-19 Epidemic Analysis using Machine Learning and Deep Learning Algorithms

Severe coronavirus syndrome (SARS-CoV2), which is also known as COVID-2019, has created a extreme, catastrophic respiratory outbreak that is a global threat to society. The complete international is making an exquisite effort to fight the spread of this deadly sickness in terms of infrastructure, price range, sources of data, defensive system, lifestyles threatening treatment and some other resources. AI Researchers have put their information into growing mathematical fashions to analyse this epidemic state of affairs throughout countrywide public records. In order to contribute to the wellbeing of dwelling society, this newsletter proposes to use gadget mastering and deep mastering fashions to recognize its day-by-day exponential behavior, and to expect the destiny of the distance of COVID-2019 in unique countries using real time. Statistics from the Johns Hopkins dashboard.

B. COVID-19 in India: State Analysis and Forecast

The enormously contagious coronavirus disease (COVID-19) become first identified in Wuhan, China in December 2019 and has when you consider that unfold to 212 international locations and regions around the arena, infecting thousands and thousands of people. In India, a massive country of approximately 1.3 billion human beings, the sickness turned into first identified on January 30, 2020 in a student returning from Wuhan. The overall range of showed infections in India is at 37,000 as of May three, 2020 and is now growing swiftly.

C. Predicting the COVID- 19 outbreak with Machine Learning

Officials round the sector are the use of several models to are expecting the outbreak of COVID-19, to tell selections and put in force the necessary measures. Among the usual guidelines for predicting the worldwide COVID-19 pandemic, the authors pay extra interest to easy epidemiological and statistical models, and they're famous within the media. Due to the high level of uncertainty and the shortage of vital statistics, organizational fashions have proven to be correct in predicting over a protracted time frame. Although there had been numerous attempts in the literature to deal with this issue, the huge generalizability and robustness of existing models want to be advanced. This article affords a comparative analysis of gadget getting to know and smooth computing models for predicting the covid 19 outbreak. Among the huge range of system learning models investigated, models have proven promising results (as an example, multiple perceptrons, MLP, and network-primarily based adaptive reasoning, ANFIS). Based in this result, and due to the very complicated nature of the covid-19 outbreak and the variation in conduct from country to us of a, this has a look at proposes machine gaining knowledge of as an effective tool to version the outbreak.

D. Forecasting the novel coronavirus COVID-19

What could be the worldwide impact of the new coronavirus (COVID-19)? The answer to this question is to accurately predict the unfold of confirmed instances, as well as through reading the number of deaths and recoveries. However, forecasting calls for enough historic statistics. Although nothing is correctly anticipated, due to the fact the future rarely repeats itself inside the same manner as the beyond. In addition,

forecasts are suffering from particular information, look at and forecasting variables.

Psychological elements also play a enormous function in how human beings perceive and respond to the threat of contamination and worry that it's going to affect them in my opinion. This article provides an goal method to predicting the continuation of COVID-19 using a easy and powerful approach. Assuming the data used is strong and that future disease styles will hold to observe, our projections for confirmed instances of COVID-19 anticipate a persisted upward thrust, with good sized uncertainties associated. The risks are far from symmetric, because they underestimate the growth like a pandemic and take measures which can be tons extra extreme than overexpanding and being overly careful while it isn't always important. This paper describes an operational time table with huge capability implications for coverage and choice making, and provides objective goals for confirmed instances of COVID-19.

E. Prediction of unfold of COVID-19 in India based on cutting-edge fashion

The article describes efforts to version efforts to estimate the modern contamination rate of COVID-19 in India using an exponential model. Data from March 15, 2020 to April 30, 2020 is used to check the model where the inner growth rate is taken into consideration consistent. It is mentioned that in some states of India, together with Maharashtra, Gujarat and Delhi, many better infection rates are recorded each day. This is a model assuming a better preliminary contamination charge at a steady boom charge. Flashes are acknowledged the use of offset values for these three situations. Data for other states including Madhya Pradesh, Uttar Pradesh and Rajasthan are also analyzed and located to observe the equal constants as India. There have been many tries to are expecting the outbreak of COVID-19 around the world, and the model described in this newsletter does no longer predict the tipping point as instances in India are still at the upward push. The advanced version is primarily based on confirmed daily infections instead of cumulative infections, and rationalization is performed for the population of different areas with contamination predictions for diverse situations. Assigning constant slippage at this point is an early exercise and given this, the exponential version predicts that India will reach 1 lakh by May 15, 2020. The target of 2 lakh and

3 lakh could be reached on 22 and 26 May 2020. May 2019 respectively.

F. Interpreting a mortality prediction version for COVID-19 patients

The unexpected rise in COVID-19 instances is setting serious stress on health care round the arena. Rapid, accurate, and early medical evaluation of ailment severity is critical at this level. To assist decision-making and logistical training in fitness structures, this look at makes use of a database of blood samples from 485 inflamed patients in the Wuhan place of China to perceive crucial predictive biomarkers of disorder mortality. For this purpose, machine learning tools decided on three biomarkers that expect mortality in every patient for more than 10 days with greater than 90% accuracy: lactate dehydrogenase (LDH), lymphocytes, and particularly touchy C-reactive protein (hsCRP). . In unique, particularly excessive LDH stages appear to play a critical function in figuring out the maximum commonplace causes that require instant clinical attention. This finding is constant with current medical technology that high LDH degrees are related to tissue destruction that occurs in a diffusion of diseases, along with lung illnesses including pneumonia. Overall, this newsletter proposes a simple and effective rule of thumb to fast predict excessive-risk sufferers, permitting them to prioritize and doubtlessly reduce mortality.

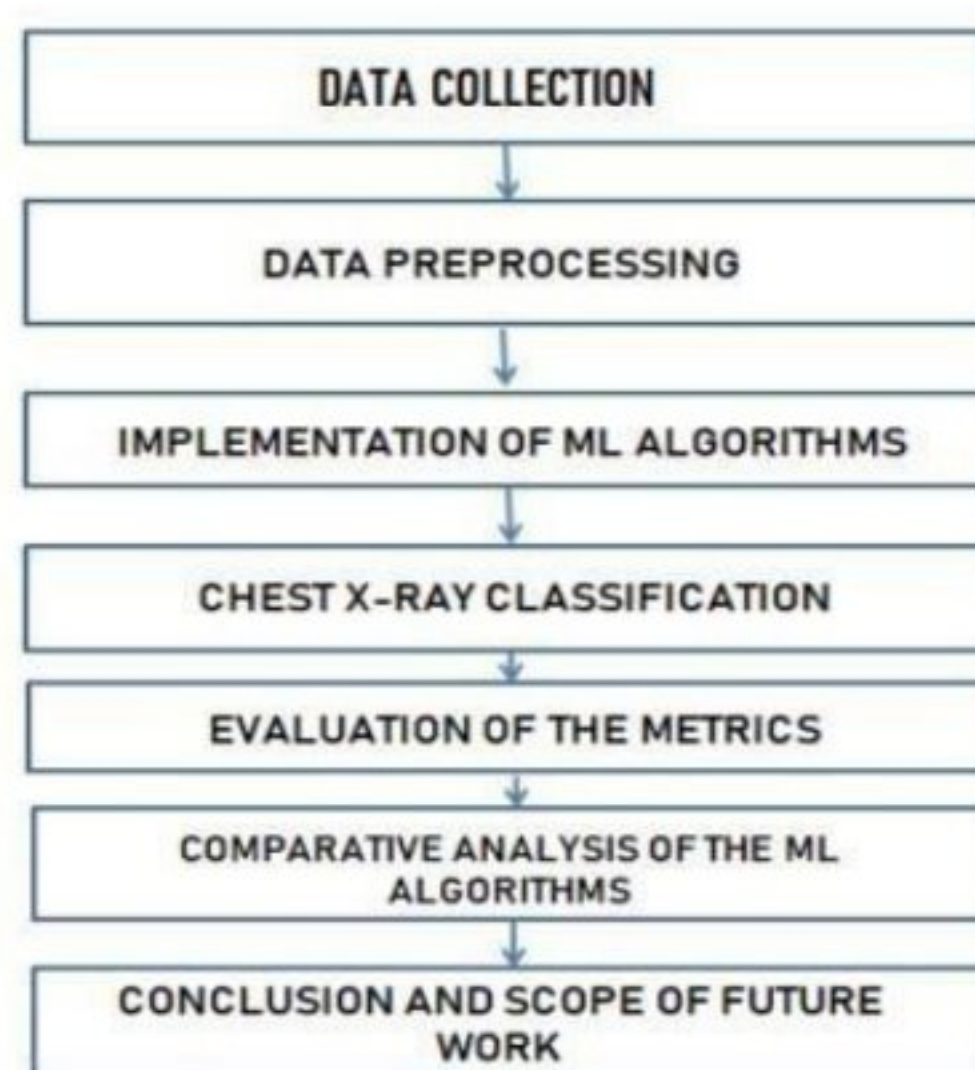
III. PROPOSED SYSTEM

A skilled man or woman carrying a protracted stick with a tender brush on the quit will weave it, like a pipe cleaner, thru your nose in a short time. A collection of secretions could be collected with soft bristles for have a look at. A swab has an extended manner to go to provide a very good pattern, so cells and fluids should be extracted from the entire passage from the bottom of the nostril to the returned of the neck. But for the reason that body isn't the usual item in that area, it makes many peculiar sensations. In one manner, the reflex moves the tear, which means that if executed efficiently, the tears may be well for your eyes. I do not want to mention it hurts, however it's inconvenient. When the swab also touches the again of the throat, this can additionally purpose the gag reflex.

We proposed an automatic covid-19 huge based totally prediction the usage of deep convolutional networks and chest X-rays. The proposed

models will have an end-to-end shape without guide techniques of function extraction and selection. A chest x-ray is the satisfactory device to hit upon covid-19. An advanced deep convolutional neural network method for the evaluation of chest X-ray snapshots. Wavelet decomposition is used to combine multiresolution network analysis. The frequency subbands obtained from the enter photos are fed to the community to identify the sickness. The community is designed to predict the type of everyday enter picture, viral pneumonia, and covid-19. A comparative has a look at with present methods is likewise achieved. Measures consisting of accuracy, sensitivity, and F1 estimate performance. The proposed approach is better in its traits than the present strategies and as a result may be used for powerful ailment diagnosis.

A. ARCHITECTURE DIAGRAM



IV. SYSTEM REQUIREMENTS

HARDWARE REQUIREMENTS

- System : Pentium Dual Core.
- Hard Disk : 120 GB.
- Monitor : 15"LED
- Input Devices : Keyboard, Mouse
- Ram : 1GB.

SOFTWARE REQUIREMENTS

- Operating system : Windows 7.
- Coding Language : python

A. Data collection Module

This test uses data from the container Covid X-ray Dataset and Praveen's Pneumonia dataset from GitHub and Kaggle, respectively. Using

those datasets, we created a custom dataset for normal, viral pneumonia and COVID-19. The COVID-19 dataset includes chest x-rays. These photographs are used for discovery. The photos are of various sizes, so they are resized.

B. Data pre-processing module

The enter photographs were normalized earlier than in addition processing. Normal photographs are enlarged images without errors because of loading situations. This phase describes a method for making ready uncooked records to make it suitable for system learning models and for modelling. We used 3 repositories to put together the dataset. 2 sets from GitHub and every other from Kaggle. 2 catalogs for COVID19 and regular brands. The records set could be displayed in everyday and COVID-19.

C. Training the CNN Module

Before we reflect on consideration on the set up of the variety, we can load the statistics and goal. Before we install the version, we can inform the generator to read the images from the supply folder instead of the pix one at a time. Essentially, the Image

Data Generator will label the photos into a list that incorporates the photograph. Shows subdirectory information. Grayscale adjustment should be completed in order that the zoom will turn to the zoom parameter quicker.

D. Prediction Module

Finally, any x-ray container photo falls into one in every of three classes i.e. Regular, is indicated as COVID-19, or viral pneumonia.

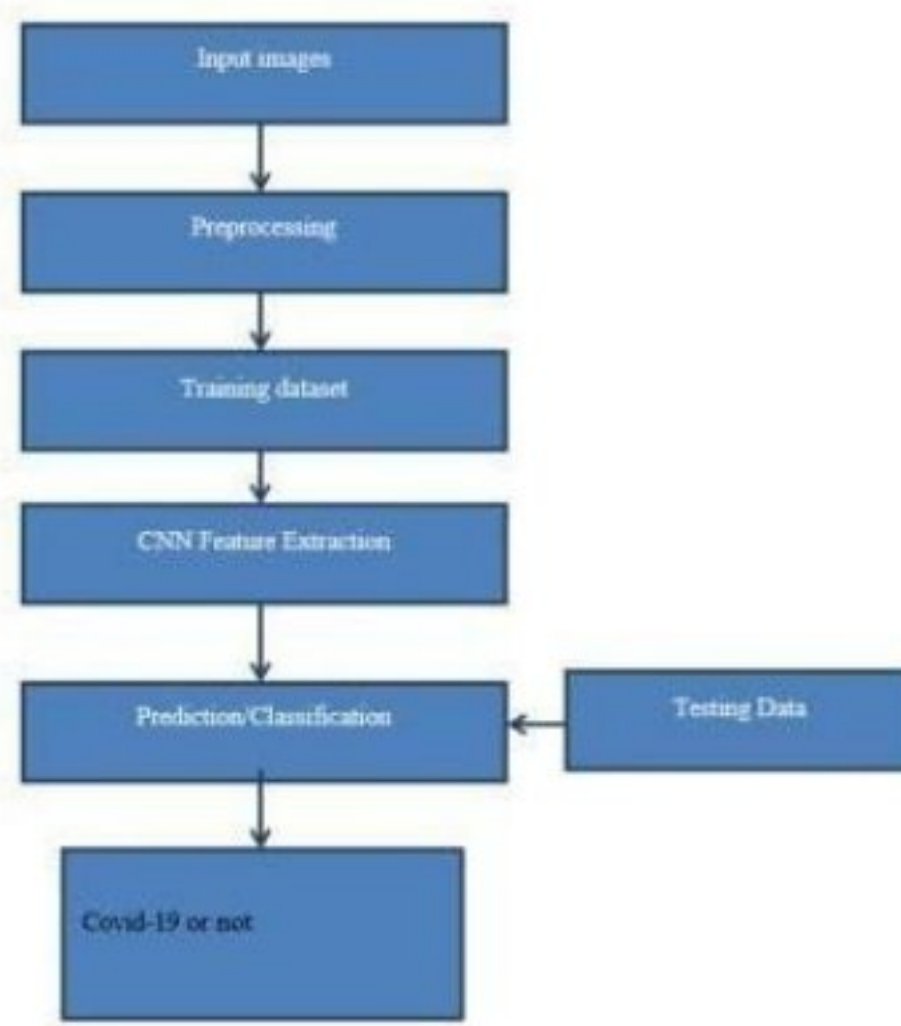
V. DATA FLOW DIAGRAM:

A DFD is also called a bubble chart. It is a simple graphical formalism that can be used to symbolize a system in phrases of inputs to the device, the diverse methods completed on those facts, and the outputs generated by means of it. Data flow diagram (DFD) is one of the major modeling tools. It is used to version parts of the device. These additives are the machine processes, the data utilized by the manner, the external object that corresponds to the device, and the facts flows inside the gadget.

Three. The DFD indicates how statistics actions through the system and how it's far changed by a chain of changes. It is a graphical method that depicts the glide of facts and the ameliorations that are implemented to move the facts from input to output.

4. A DFD is likewise referred to as a bubble chart. A DFD may be used to symbolize a system at any level of abstraction. A DFD may be divided into layers that represent incremental facts waft

and character operations.



1. UML DIAGRAMS

UML stands for Code of Canon Law. UML is a popular cause modeling language for item-oriented software program improvement. The flag is controlled and created with the aid of the object management institution.

UML is meant to end up a commonplace language for creating object-orientated laptop software fashions. In its modern form, UML has two major components: the metamodel and the notation. Certain methods or styles of techniques can also be delivered within the destiny; or to the UML.

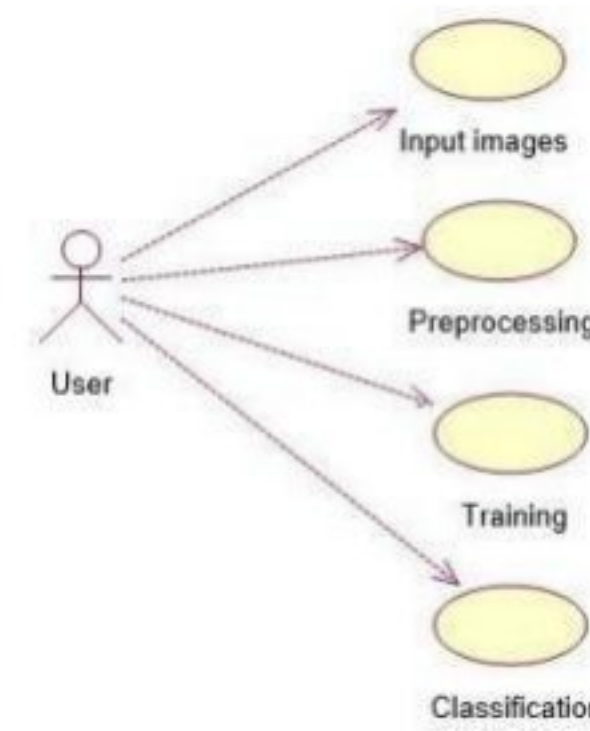
The Unified Modeling Language is a standard language for expressing, visualizing, constructing, and documenting the architecture of software systems, in addition to for modeling enterprise and other non-software program systems.

UML Sets engineering high-quality practices which have verified to be effective in modeling large and complicated structures.

UML is an essential a part of item-oriented software program development and the software improvement process. UML especially uses graphical notation to layout software projects.

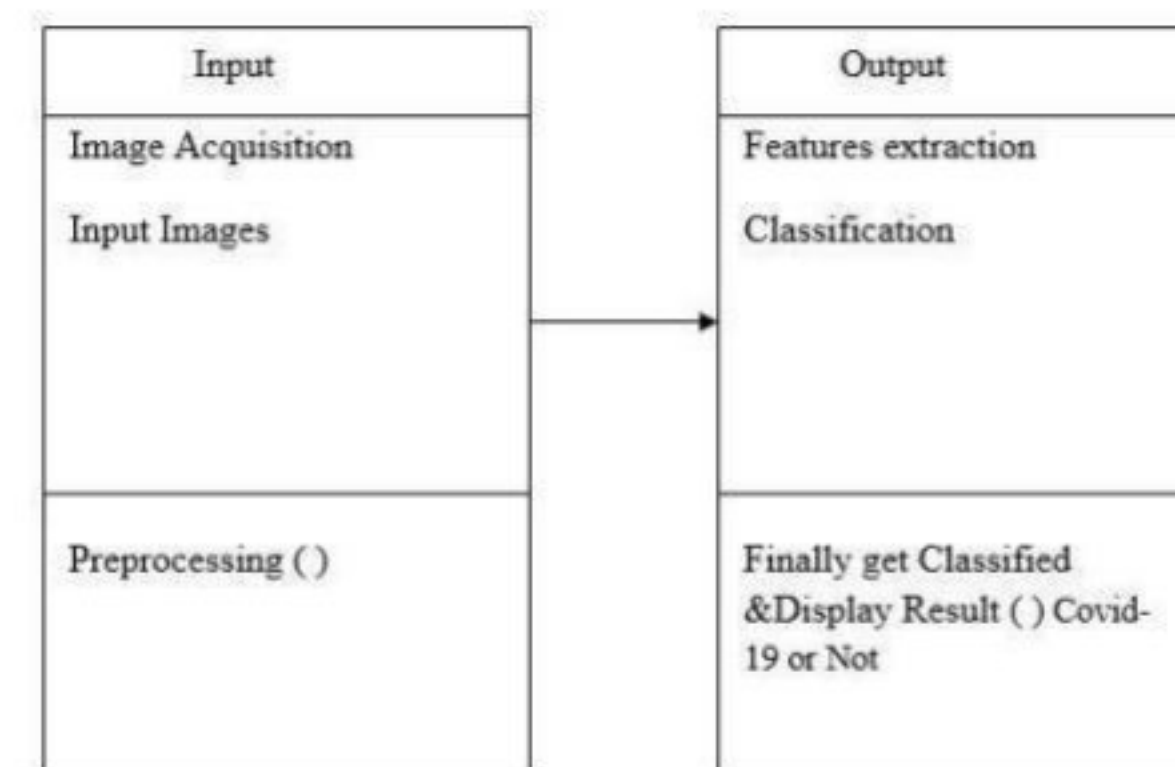
2. USE CASE DIAGRAM:

The Unified Modeling Language (UML) use case diagram is a sort of human diagram defined and constructed from use case evaluation. The purpose is to offer a graphical assessment of the capability of the gadget in terms of actors, their goals (represented as use instances), and any dependencies among person instances. The primary use case of a diagram is to show which gadget functions are achieved for which actor. You can describe the jobs of the actors in the system.



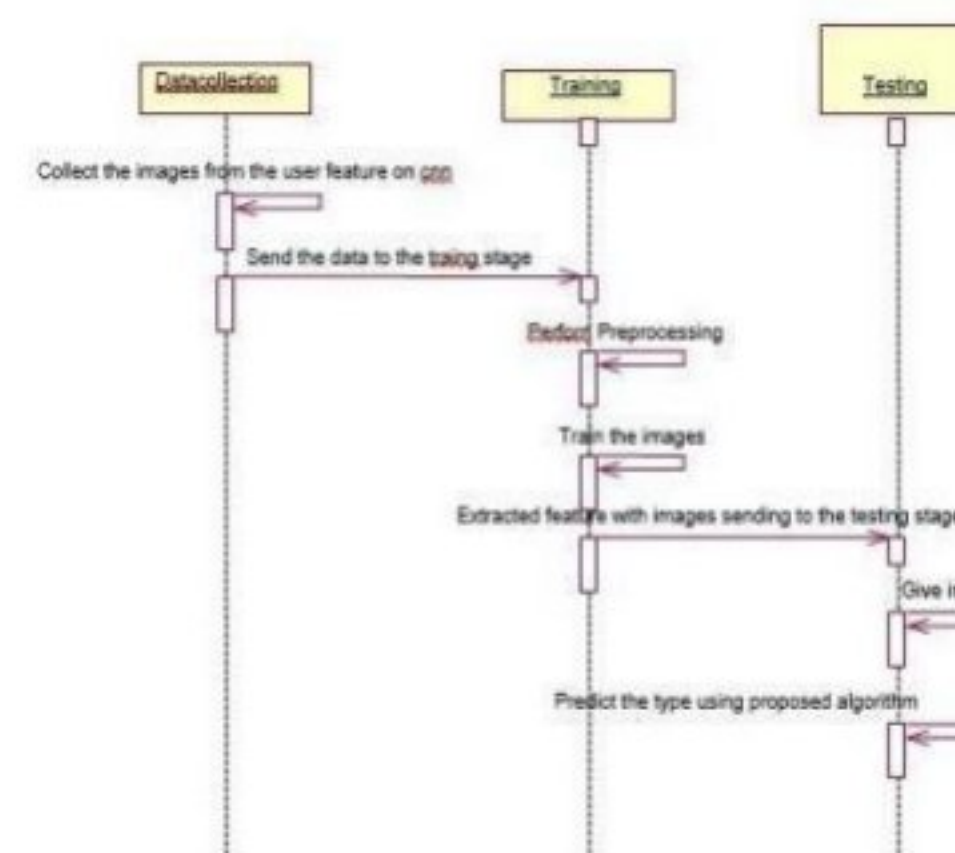
3. CLASS DIAGRAM:

In software program engineering, a Unified Modeling Language (UML) elegance diagram is a type of static structural diagram that describes the shape of a system by means of showing the system's training, their attributes, operations (or methods), and relationships between training. . This is why the elegance carries records.



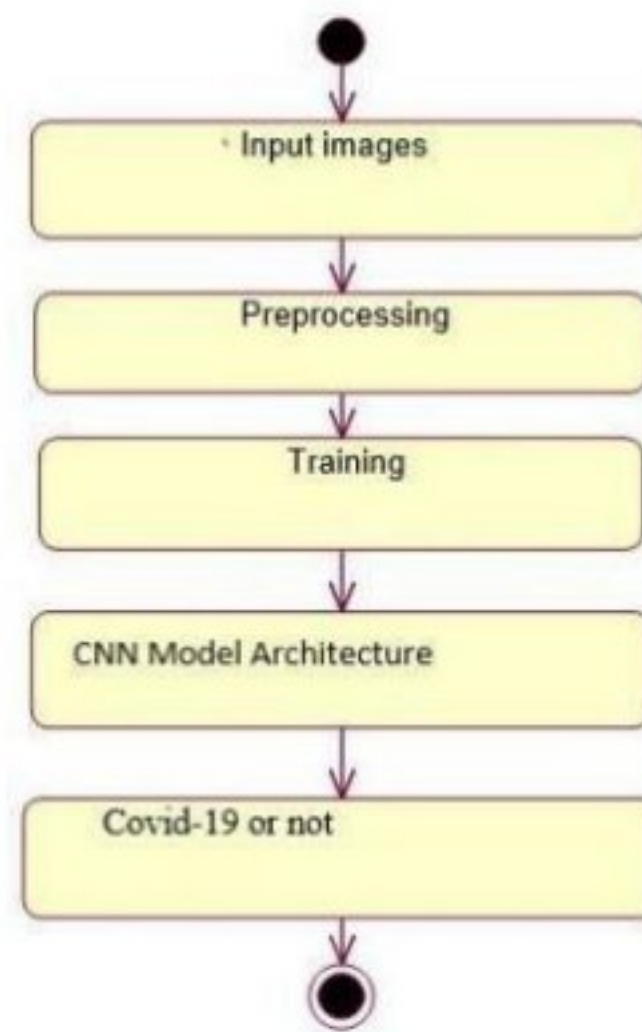
4. SEQUENCE DIAGRAM:

A Unified Modeling Language (UML) collection diagram is a kind of interaction diagram that suggests how processes interact with each other and in what order. This submit is a series of posts. Sequence diagrams are on occasion known as occasion diagrams, occasion scripts, and timing diagrams.



5. ACTIVITY DIAGRAM:

Activity charts are a graphical illustration of step-by-step using-step and operating activities with guide for selection, generation and concurrency. In a completely unique modeling language, an pastime diagram may be used to explain the operations and stepwith the aid of-step workflow of components in a machine. The movement diagram indicates the general float of control.



VI. INPUT DESIGN AND OUTPUT DESIGN

INPUT DESIGN

The enter strategy is the link among the information device and the consumer. It involves the development of a specification and process for information coaching, and those steps are necessary to bring the transactional records right into a usable process shape, which can be done by means of pc analyzing the data from a written or published script, or this could. It will likely be achieved with the help of the humans, introducing the keys. Given at once into defects. Input planning makes a speciality of controlling the quantity of enter required, controlling mistakes, averting delays, averting more steps, and keeping the manner easy. The login is designed to be safe and secure while maintaining user privacy. The committee's enter become as follows:

- What facts should be provided for enter?
- How is the statistics prepared or encoded?
- Alternate box to help employees input records.
- Methods of making ready inputvalidation and taking movements on mistakes.

OUTPUT DESIGN

Quality is a end result that meets the end consumer's requirements and shows the facts

clearly. In any device, the consequences of the manner are mentioned to users and different structures through outputs. The output plan defines how statistics is to be moved for fast want in addition to for printed output. It is the primary and immediate supply of person statistics. Efficient and wise output gadget connection device optimization, assisting the consumer to make choices.

1. The development of laptop products need to be organized and nicely notion out; theappropriate outputs ought to be designed in order that each output detail is organized in this type of manner that humans can use the device without difficulty and efficaciously. When growing a pc output, one ought to decide the particular output that need to satisfy the requirements.
2. Choose a way to present records.
3. Create a file, file or different format wherein records is generated from the gadget.

The output layout of accounting facts ought to perform one or greater of the following functions.

- Communicate records about past sports, contemporary reputation or forecast
- The future
- Crucial events, possibilities, questions or reminders.
- Start the action.
- Confirm movement.

VII. O

BJECTIVES

1. Input design is the technique of reworking an enter description into a laptop device. This method is vital to keep away from mistakes within the information access manner and to factor the right direction to the control to get the ideal facts from the computerized gadget.

2. This is completed by using growing suitable records entry shelves to procedure massive amounts of facts. The cause of the enter method is to simplify records access and eliminate errors. This facts entry display is designed so that each one facts operations can be accomplished. It additionally presents a method to view facts.

When facts is entered, it's miles checked for validity. Data may be entered through screens. Appropriate instructions are provided as wished, so that the user will no longer be in an

instantaneous country. So the reason of the input design is to create an enter format that is straightforward to comply with.

- Communicate records about past sports, contemporary reputation or forecast
- The future
- Crucial events, possibilities, questions or reminders.
- Start the action.
- Confirm movement.

VIII. REFERENCES

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