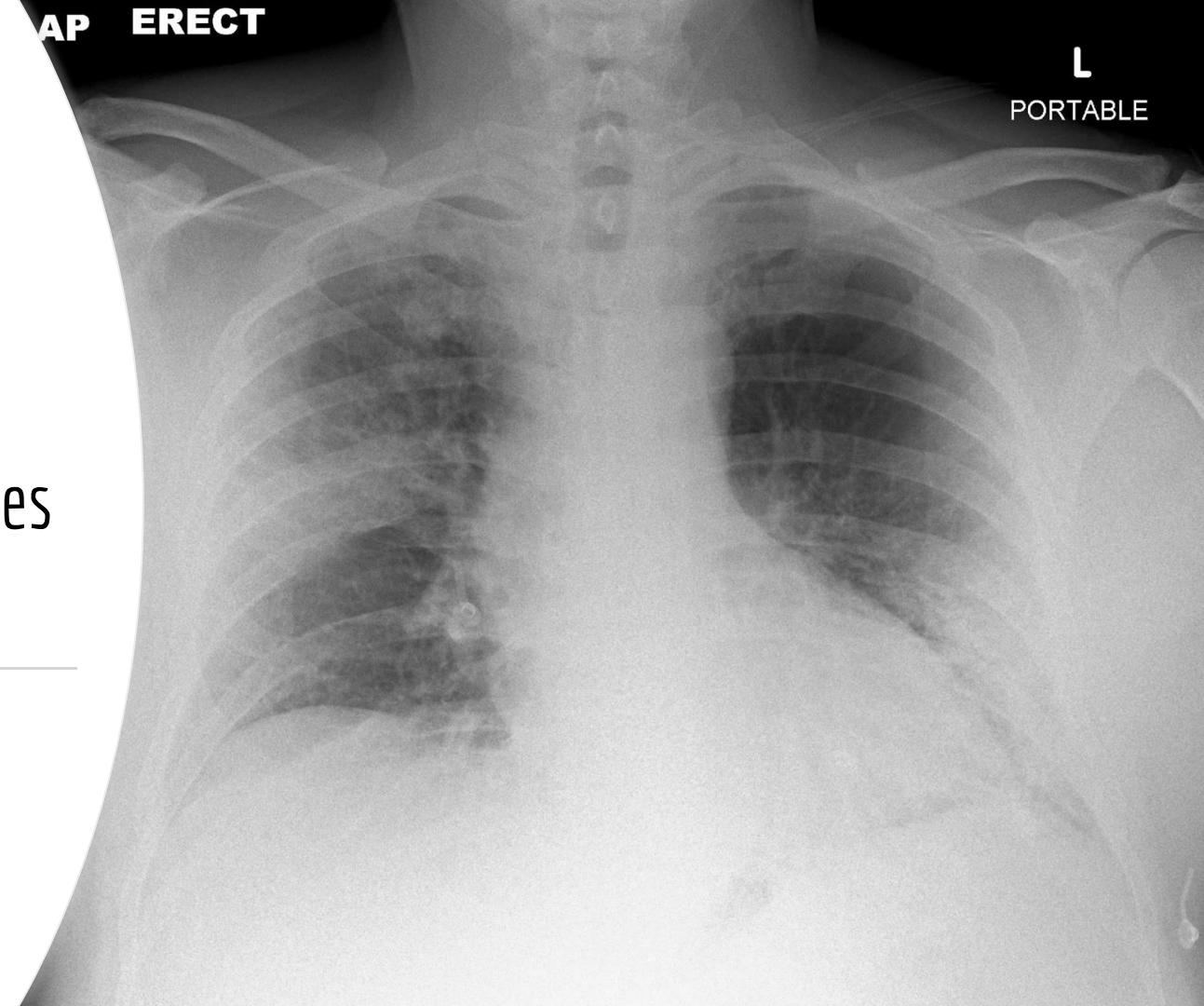
Predicting COVID-19 for Chest X-Ray images using Deep Learning

A.I.thon

Theme : Diagnosis

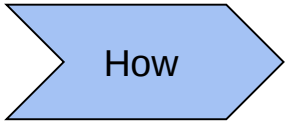
Team : NA's

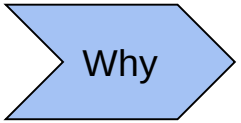


Introduction

- Rapid rise in COVID-19 death toll cases
- Doctors round the world are looking for new strategies and technical solutions to counter COVID-19 cases
- Chest X-rays provides non-invasive tool to monitor progression of disease

IDEA





Idea

Idea feasibility

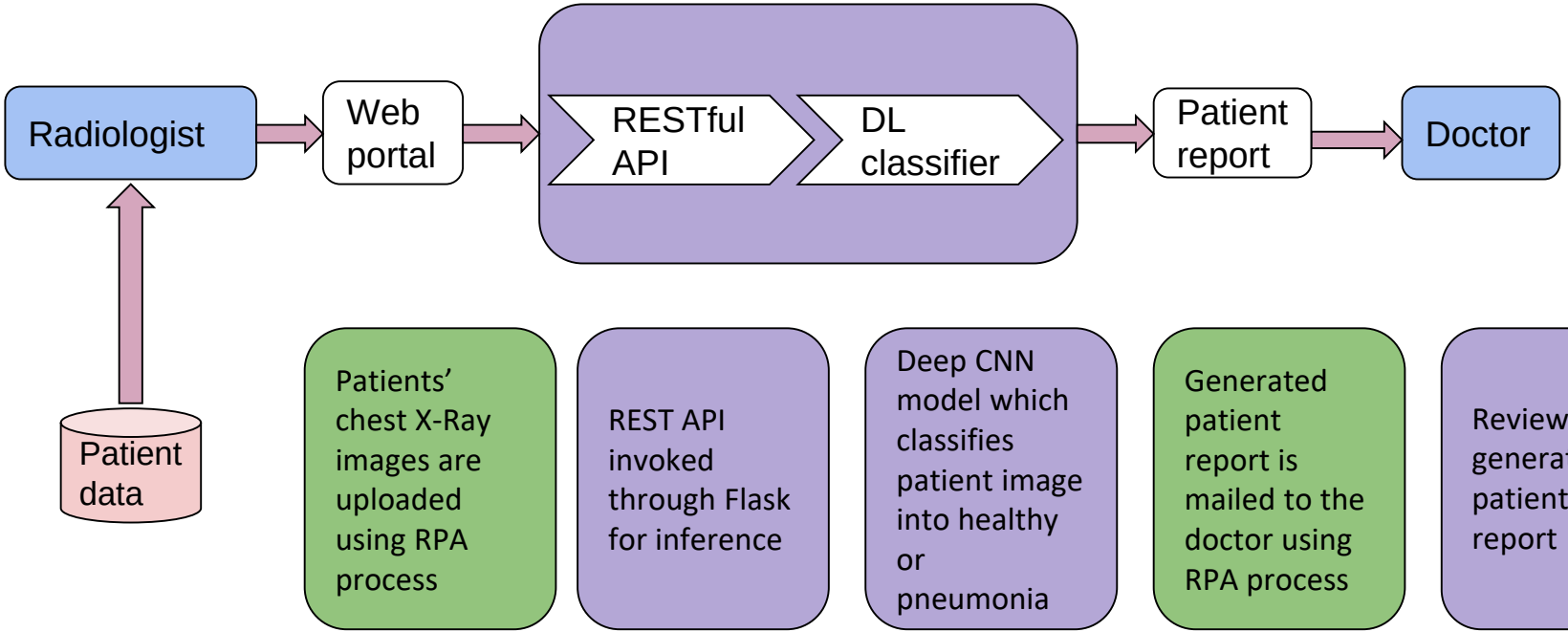
Innovation & Potential impact

Diagnosis COVID-19 pneumonia symptoms in patients using X ray images.

Using deep learning to predict COVID-19. We have used CNN model along with RPA process which is easy to implement in a real time system.

Using X-ray to predict COVID-19 is quick and efficient non-invasive method. This will help hospitals for patient management and increase the testing.

SYSTEM ARCHITECTURE


Radiologist
Web portal
RESTful API
DL classifier
Patient report
Doctor
Patient data
Patients' chest X-Ray images are uploaded using RPA process
REST API invoked through Flask for inference
Deep CNN model which classifies patient image into healthy or pneumonia
Generated patient report is mailed to the doctor using RPA process
Reviews the generated patient's report

MACHINE LEARNING PIPELINE

Data Preprocessing

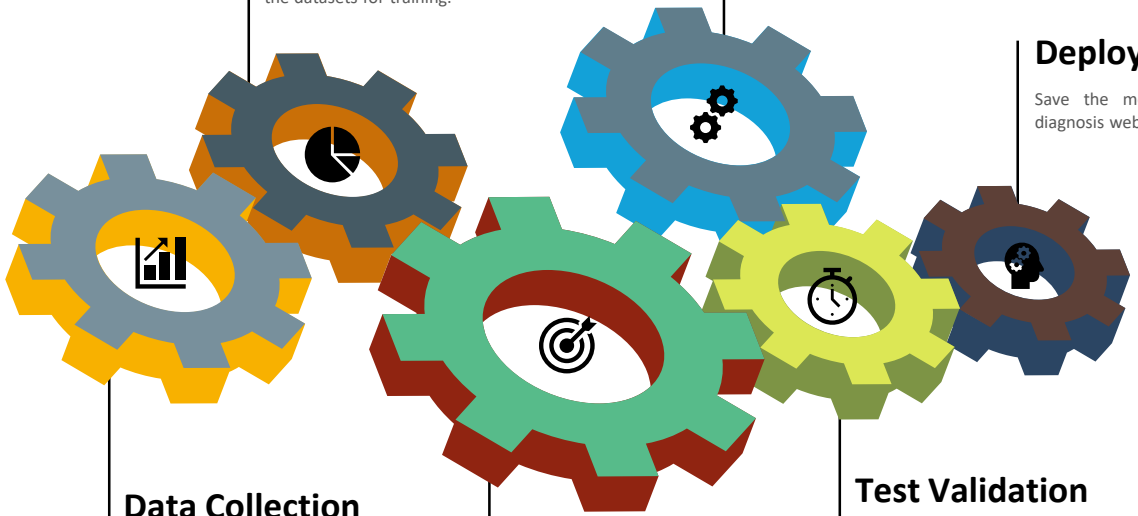
Label the data, resize each image and split the datasets for training.

Model Evaluation

Visualize loss and accuracy graph. Build confusion matrix.

Deployment

Save the model to be deploy on the diagnosis website.



Data Collection

Set of pneumonia patients and healthy person chest x-rays from kaggle datasets.

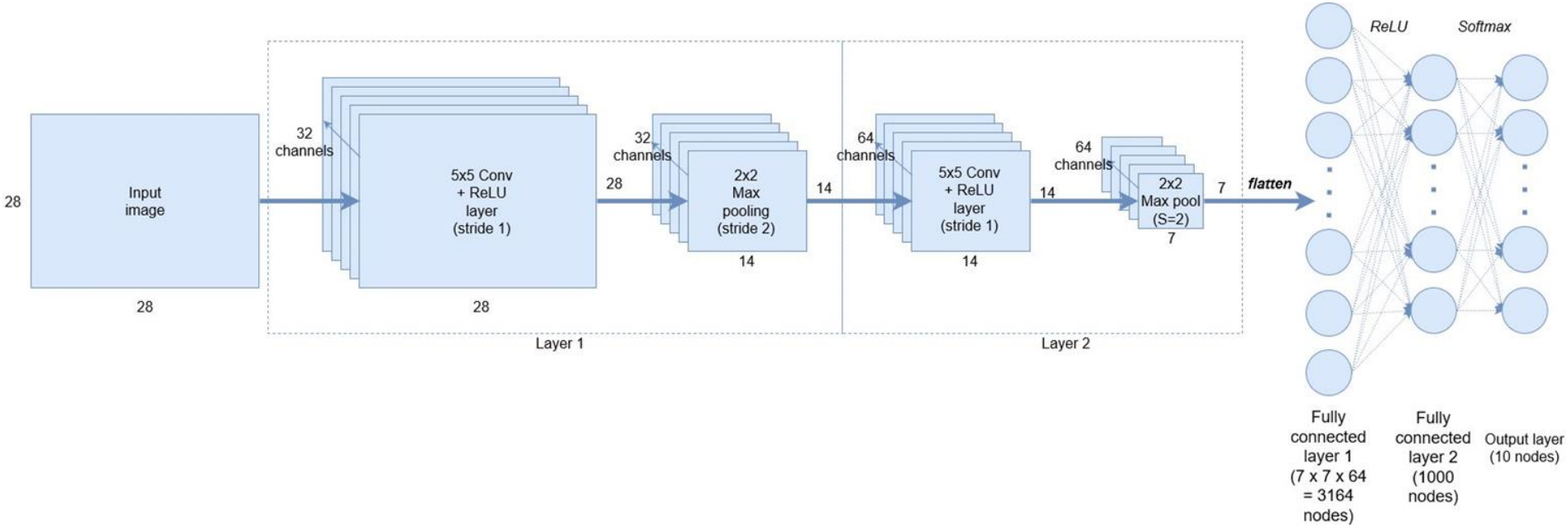
Data Modelling

Perform data augmentation to avoid overfitting. Train the model through Convolutional Neural Networks.

Test Validation

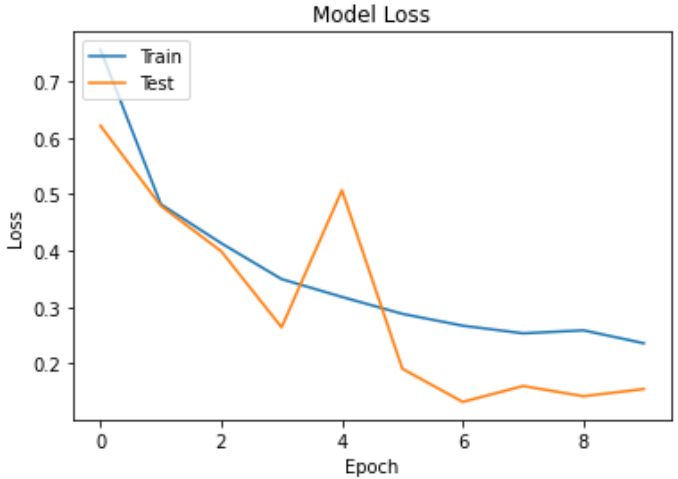
Validate the data by making prediction using test dataset.

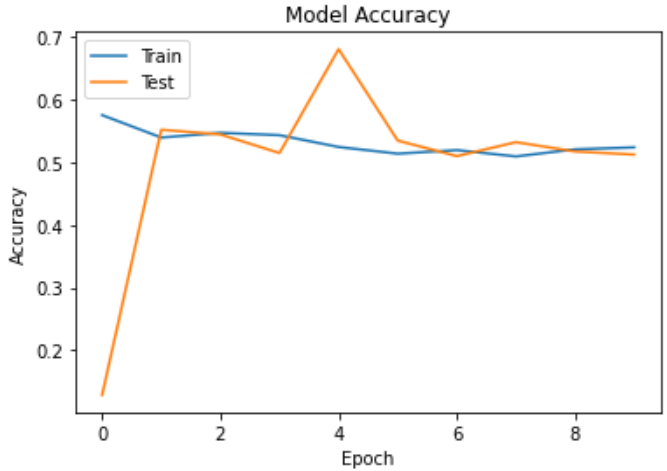
DEEP LEARNING MODEL

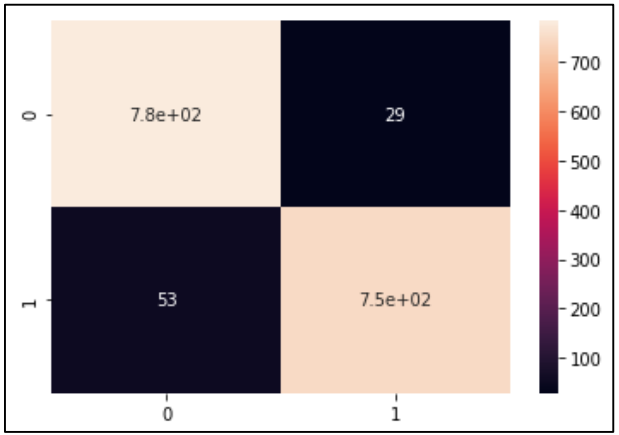

28
Input image
28
32 channels
5x5 Conv + ReLU layer (stride 1)
28
Layer 1
32 channels
28
2x2 Max pooling (stride 2)
14
64 channels
5x5 Conv + ReLU layer (stride 1)
14
Layer 2
64 channels
14
2x2 Max pool (S=2)
7
7
flatten
ReLU
Softmax
Fully connected layer 1 (7 x 7 x 64 = 3164 nodes)
Fully connected layer 2 (1000 nodes)
Output layer (10 nodes)

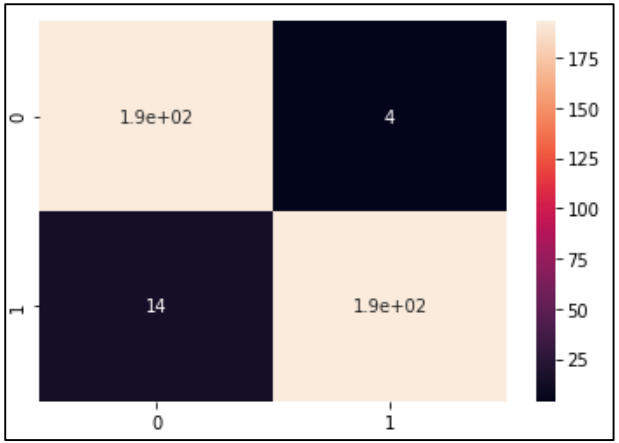
```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 242, 242, 32)      320
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 121, 121, 32)      0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 119, 119, 64)      18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 59, 59, 64)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 57, 57, 64)        36928
_________________________________________________________________
flatten (Flatten)            (None, 207936)            0
_________________________________________________________________
dense (Dense)                (None, 64)                13307968
_________________________________________________________________
dense_1 (Dense)              (None, 32)                2080
_________________________________________________________________
dropout (Dropout)            (None, 32)                0
_________________________________________________________________
dense_2 (Dense)              (None, 2)                 66
=================================================================
Total params: 13,365,858
Trainable params: 13,365,858
Non-trainable params: 0
```

MODEL EVALUATION


Model Loss
Train
Test
Loss
Epoch
0.7
0.6
0.5
0.4
0.3
0.2
0
2
4
6
8

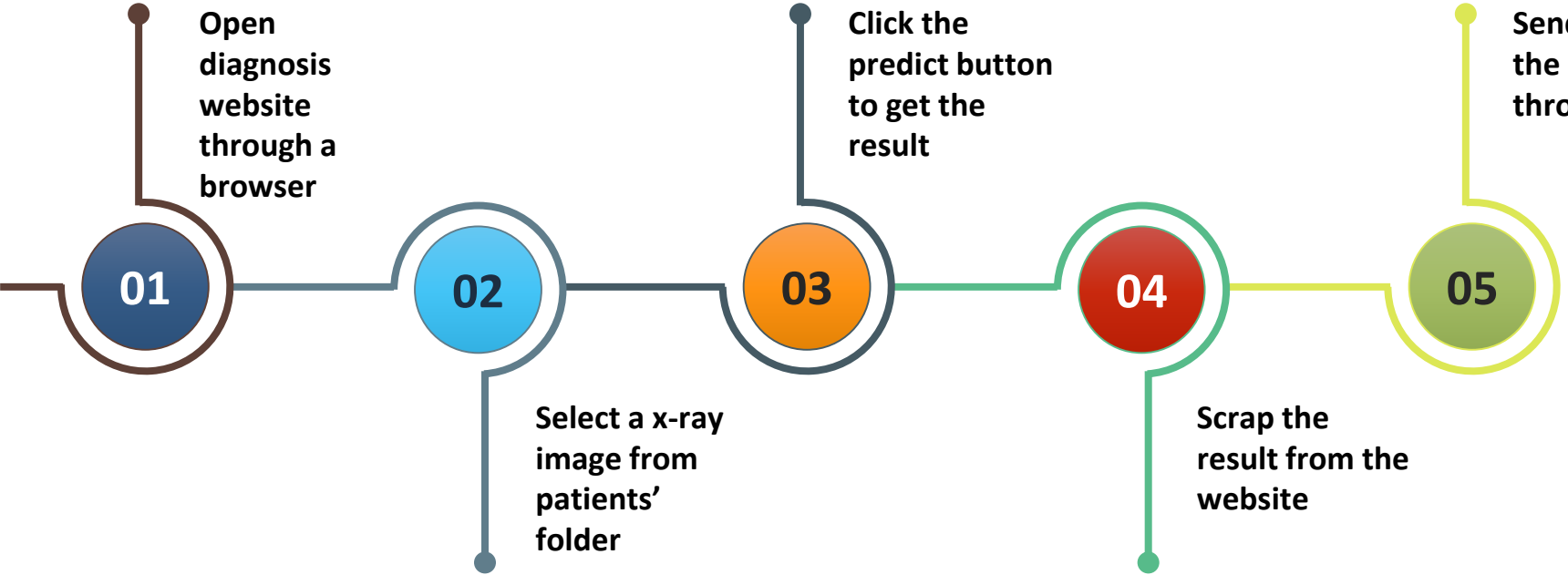

Model Accuracy
Train
Test
Accuracy
Epoch
0.7
0.6
0.5
0.4
0.3
0.2
0
2
4
6
8





	precision	recall	f1-score	support
0.0	0.93	0.98	0.96	197
1.0	0.98	0.93	0.96	207
accuracy			0.96	404
macro avg	0.96	0.96	0.96	404
weighted avg	0.96	0.96	0.96	404

RPA WORKFLOW


Open diagnosis website through a browser
01
02
Select a x-ray image from patients' folder
Click the predict button to get the result
03
04
Scrap the result from the website
Send result to the doctor through email
05