```
1
```

Topic:-

Covid-19 Chest XRay Image Recognition

Problem Statement:-

Build an image classification model which will Identify covid poisitve patient by looking into the chest Xray images.

General Lifecycle of Image classification project

1) Data Collection

2) Importing libraries

3) Data Preprocessing

4) Model Building

5) Optimizing Model

6) Checking/ Vlidating model

7) Result

Importing all the importanat Library

In [1]:

```
import matplotlib.pyplot as plt
import cv2
import pathlib
from keras.layers import Dense, Conv2D, MaxPool2D, Dropout, Flatten
from keras.models import Sequential
```

In [28]:

```
#import imp lib
import numpy as np
import os
import pandas as pd
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
import keras_tuner
from keras_tuner import RandomSearch
from keras_tuner.engine.hyperparameters import HyperParameters
from sklearn.metrics import f1_score,accuracy_score
from tensorflow.keras.metrics import Accuracy
from tensorflow.keras.preprocessing import image
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

Importing Data

About Dataset

Context Helping Deep Learning and AI Enthusiasts like me to contribute to improving COVID-19 detection using just Chest X-rays.

Content It is a simple directory structure branched into test and train and further branched into the respective 3 classes which contains the images.

Acknowledgements The University of Montreal for releasing the images.

Inspiration Help the medical and researcher community by sharing my work and encourage them to contribute extensively.

In [3]:

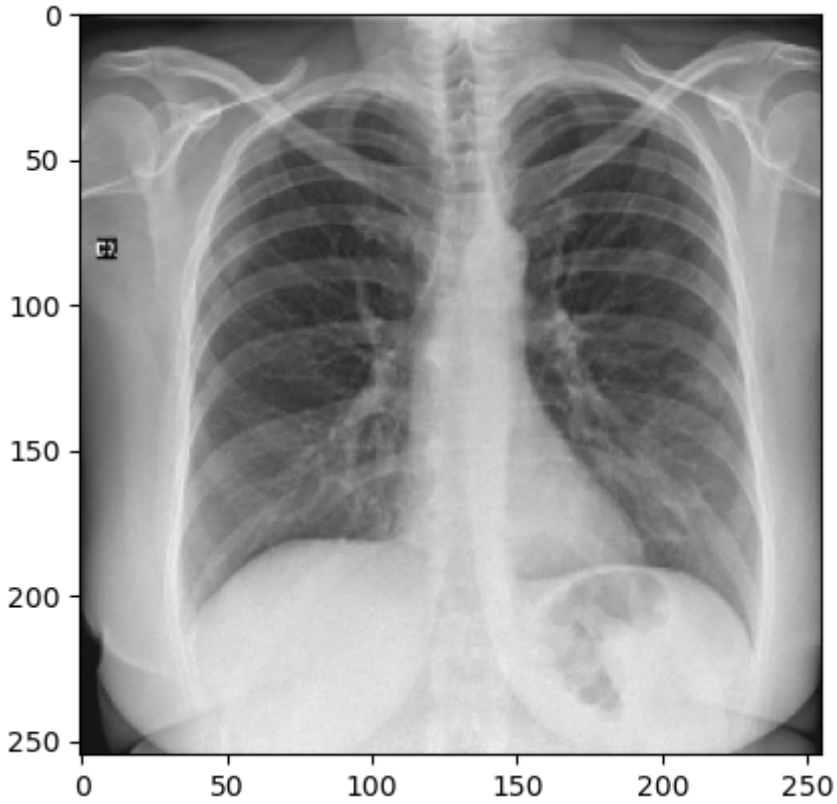
```
img = cv2.imread('C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-datas
img = cv2.resize(img, (255, 255))

img = img / 255.0
```

In [4]:

```
plt.imshow(img)
img.shape
```

Out[4]:

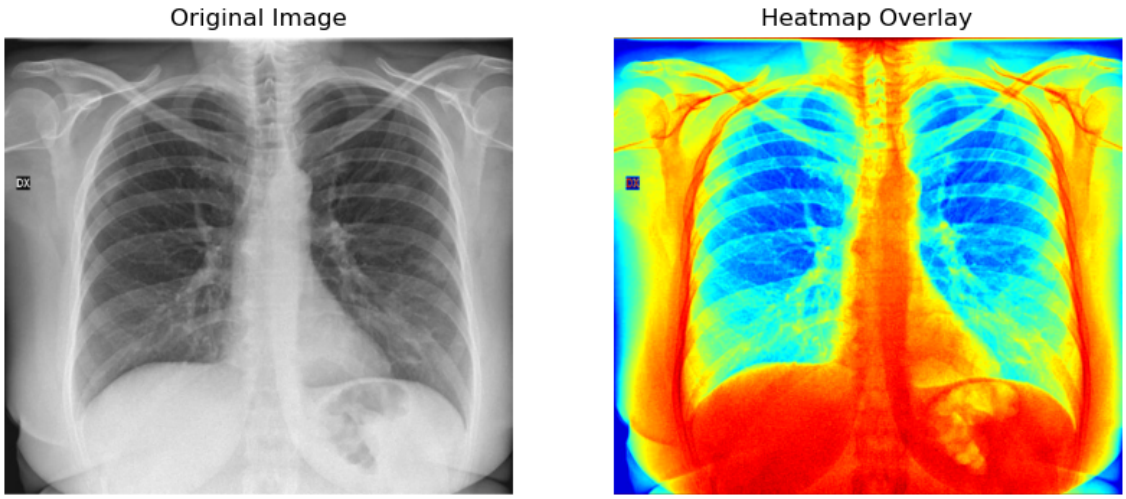
```
(255, 255, 3)
```



Heatmap of xray just to show how covid Xray looks

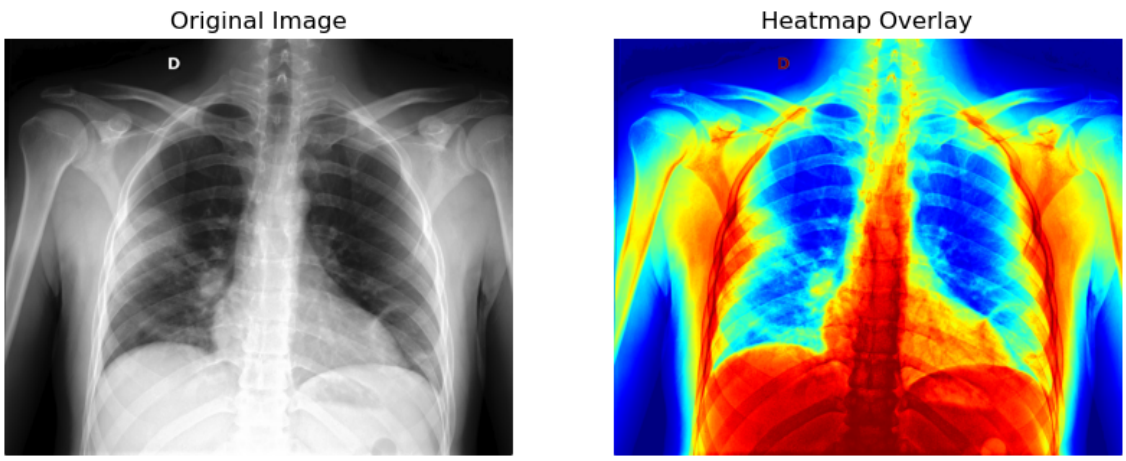
In [5]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Load the image
image_path = 'C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/t
image = cv2.imread(image_path)

# Apply the colormap to the image
heatmap = cv2.applyColorMap(image, cv2.COLORMAP_JET)

# Convert the heatmap to RGB format
heatmap_rgb = cv2.cvtColor(heatmap, cv2.COLOR_BGR2RGB)

# Display the original image and the heatmap overlay
fig, axs = plt.subplots(1, 2, figsize=(10, 5))
axs[0].imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
axs[0].set_title('Original Image')
axs[0].axis('off')
axs[1].imshow(heatmap_rgb)
axs[1].set_title('Heatmap Overlay')
axs[1].axis('off')

plt.show()

```



In [6]:

```
# Load the image
image_path = "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/t
image = cv2.imread(image_path)

# Apply the colormap to the image
heatmap = cv2.applyColorMap(image, cv2.COLORMAP_JET)

# Convert the heatmap to RGB format
heatmap_rgb = cv2.cvtColor(heatmap, cv2.COLOR_BGR2RGB)

# Display the original image and the heatmap overlay
fig, axs = plt.subplots(1, 2, figsize=(10, 5))
axs[0].imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
axs[0].set_title('Original Image')
axs[0].axis('off')
axs[1].imshow(heatmap_rgb)
axs[1].set_title('Heatmap Overlay')
axs[1].axis('off')

plt.show()

```



Data PreProcessing

In [7]:

```
# we have 251 images in training data which is very less for CNN so we need to do da
# Data augmentation is a technique to create more data using images we have currentl
# we'll do this on training data
```

Data Augmentation

In [9]:

```
# Data augmention is use to generate more data using exixting data
train_data = "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/t
target_size = (256, 256)
batch_size = 16

train_datagen = ImageDataGenerator(
    rescale=1 / 255,
    rotation_range=0.2,
    width_shift_range=0.1,
    height_shift_range=0.1,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)
```

In [10]:

```
train_generator = train_datagen.flow_from_directory(
    train_data,
    target_size=target_size,
    batch_size=batch_size,
    class_mode='categorical'
)

# Calculate the total number of samples in the generator
num_samples = len(train_generator) * batch_size
print("Total number of samples in the ImageDataGenerator:", num_samples)
```

```
Found 251 images belonging to 3 classes.
Total number of samples in the ImageDataGenerator: 256
```

Getting our labels

In [11]:

```
# other way is
train_generator.class_indices  # we got our labels of data
```

Out[11]:

```
{'Covid': 0, 'Normal': 1, 'Viral Pneumonia': 2}
```

In [12]:

```
# doing same for test data
# we could have keep same data augmentation code for test and train both , but for e
test_data = "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/te
target_size = (256, 256)
batch_size = 16

test_datagen = ImageDataGenerator(
    rescale=1 / 255,
    rotation_range=0.2,
    width_shift_range=0.1,
    height_shift_range=0.1,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)


test_generator = test_datagen.flow_from_directory(
    test_data,
    target_size=target_size,
    batch_size=batch_size,
    class_mode='categorical'
)

# Calculate the total number of samples in the generator
num_samples = len(test_generator) * batch_size
print("Total number of samples in the ImageDataGenerator:", num_samples)
```

```
Found 66 images belonging to 3 classes.
Total number of samples in the ImageDataGenerator: 80
```

In [13]:

```
test_generator.class_indices # labels for test data
```

Out[13]:

```
{'Covid': 0, 'Normal': 1, 'Viral Pneumonia': 2}
```

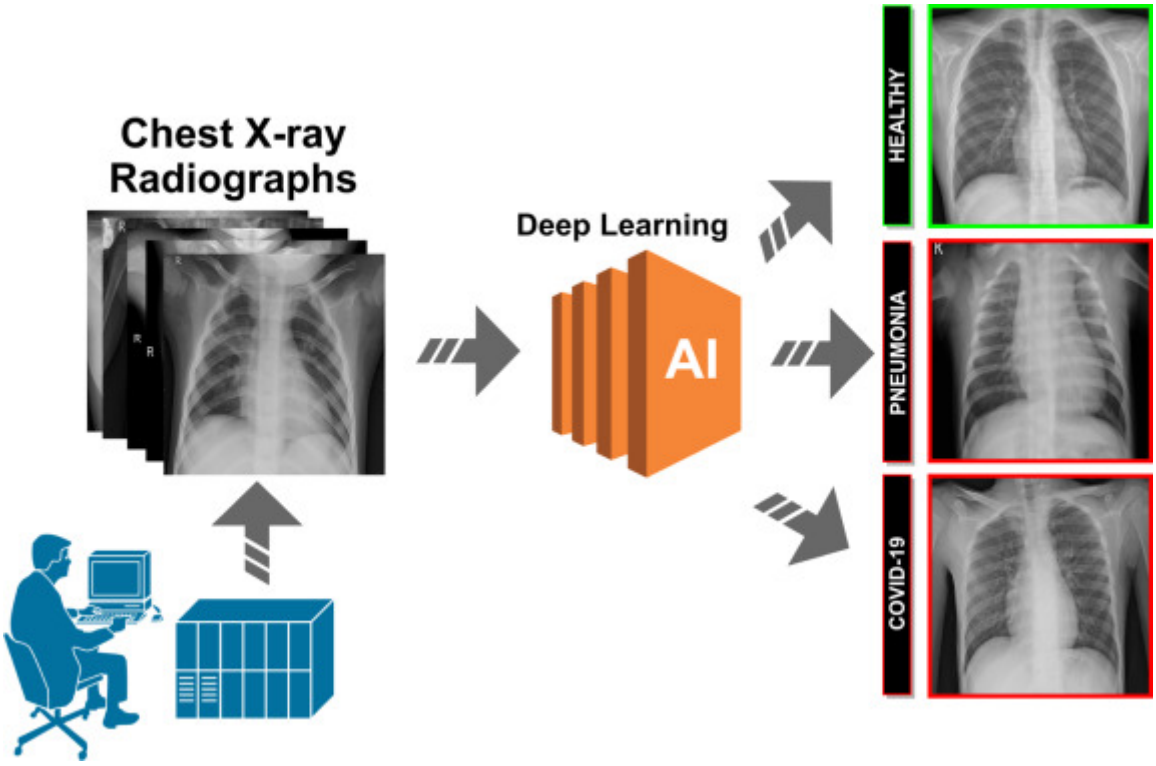
In [ ]:

```

```

MODEL(CNN)

In [14]:

```
Xray_model = Sequential()

Xray_model.add(Conv2D(filters=32, kernel_size=(3,3), activation="relu",input_shape=(
Xray_model.add(MaxPool2D())
Xray_model.add(Dropout(rate=0.23))#Dropout is use to prevent overfitting

Xray_model.add(Conv2D(filters=64, kernel_size=(3,3), activation="relu"))
Xray_model.add(MaxPool2D())
Xray_model.add(Dropout(rate=0.25))

Xray_model.add(Conv2D(filters=128, kernel_size=(3,3), activation="relu"))
Xray_model.add(MaxPool2D())
Xray_model.add(Dropout(rate=0.25))

Xray_model.add(Flatten())
Xray_model.add(Dense(units = 64, activation="relu"))
Xray_model.add(Dropout(rate=0.40))
Xray_model.add(Dense(units=3, activation="softmax"))# 3 inits is used because we hav

Xray_model.compile(loss="categorical_crossentropy", optimizer= "adam",metrics= ["acc
```



Model summary

In [15]:

```
1 Xray_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 254, 254, 32)      896

 max_pooling2d (MaxPooling2D  (None, 127, 127, 32)     0
 )

 dropout (Dropout)           (None, 127, 127, 32)      0

 conv2d_1 (Conv2D)           (None, 125, 125, 64)      18496

 max_pooling2d_1 (MaxPooling  (None, 62, 62, 64)       0
 2D)

 dropout_1 (Dropout)         (None, 62, 62, 64)        0

 conv2d_2 (Conv2D)           (None, 60, 60, 128)       73856
```

Model fitting

In [21]:

```
1 Xray_model.fit(train_generator,epochs=20,steps_per_epoch= 8,validation_steps=2)
```

```
Epoch 1/20
8/8 [==============================] - 18s 2s/step - loss: 0.3742 - accura
cy: 0.8594
Epoch 2/20
8/8 [==============================] - 16s 2s/step - loss: 0.3279 - accura
cy: 0.8750
Epoch 3/20
8/8 [==============================] - 17s 2s/step - loss: 0.2922 - accura
cy: 0.8750
Epoch 4/20
8/8 [==============================] - 17s 2s/step - loss: 0.3036 - accura
cy: 0.8906
Epoch 5/20
8/8 [==============================] - 17s 2s/step - loss: 0.3289 - accura
cy: 0.8537
Epoch 6/20
8/8 [==============================] - 17s 2s/step - loss: 0.3425 - accura
cy: 0.8984
Epoch 7/20
8/8 [==============================] - 17s 2s/step - loss: 0.2139 - accura
cy: 0.9106
Epoch 8/20
8/8 [==============================] - 17s 2s/step - loss: 0.3018 - accura
cy: 0.8780
Epoch 9/20
8/8 [==============================] - 17s 2s/step - loss: 0.3151 - accura
cy: 0.8906
Epoch 10/20
8/8 [==============================] - 17s 2s/step - loss: 0.4197 - accura
cy: 0.9024
Epoch 11/20
8/8 [==============================] - 16s 2s/step - loss: 0.3732 - accura
cy: 0.9106
Epoch 12/20
8/8 [==============================] - 17s 2s/step - loss: 0.4382 - accura
cy: 0.8374
Epoch 13/20
8/8 [==============================] - 16s 2s/step - loss: 0.3878 - accura
cy: 0.8699
Epoch 14/20
8/8 [==============================] - 17s 2s/step - loss: 0.3197 - accura
cy: 0.8984
Epoch 15/20
8/8 [==============================] - 17s 2s/step - loss: 0.3241 - accura
cy: 0.8594
Epoch 16/20
8/8 [==============================] - 17s 2s/step - loss: 0.4894 - accura
cy: 0.8438
Epoch 17/20
8/8 [==============================] - 17s 2s/step - loss: 0.3203 - accura
cy: 0.8862
Epoch 18/20
8/8 [==============================] - 17s 2s/step - loss: 0.2996 - accura
cy: 0.9268
Epoch 19/20
8/8 [==============================] - 17s 2s/step - loss: 0.2674 - accura
cy: 0.9024
Epoch 20/20
8/8 [==============================] - 17s 2s/step - loss: 0.3468 - accura
cy: 0.9106
```

Out[21]:

```
<keras.callbacks.History at 0x185494ec130>
```

In [ ]:

```
# our model is giving  final accuracy of 91.06
#which is fine
#we can optimize model further but it is not always necessary to complicate models
# if it is working perfectly consuming less computational power
# if while validating it dosent poerform well well optimize it further
```

In [22]:

```
y_pred = Xray_model.predict(test_generator)
```

```
5/5 [==============================] - 5s 864ms/step
```

Validating Model

We'll do this by passing images of different categories

Labels

{'Covid': 0, 'Normal': 1, 'Viral Pneumonia': 2}

In [30]:

```
test_path= "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/tra
img= image.load_img(test_path, target_size=(256,256))
img = image.img_to_array(img)/255
img= np.array([img])
print(img.shape)
```

```
(1, 256, 256, 3)
```

In [32]:

```
# Predict the class probabilities for the image
class_probabilities = Xray_model.predict(img)

# Get the predicted class label
predicted_class = np.argmax(class_probabilities, axis=1)[0]

print("Class Probabilities:", class_probabilities)
print("Predicted Class:", predicted_class)
```

```
1/1 [==============================] - 0s 276ms/step
Class Probabilities: [[0.98729765 0.01164208 0.00106034]]
Predicted Class: 0
```

In [34]:

```
# we can see name in path its normal
test_path= "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/tes
img= image.load_img(test_path, target_size=(256,256))
img = image.img_to_array(img)/255
img= np.array([img])
print(img.shape)

# Predict the class probabilities for the image
class_probabilities = Xray_model.predict(img)

# Get the predicted class label
predicted_class = np.argmax(class_probabilities, axis=1)[0]

print("Class Probabilities:", class_probabilities)
print("Predicted Class:", predicted_class)
```

```
(1, 256, 256, 3)
1/1 [==============================] - 0s 28ms/step
Class Probabilities: [[4.7880650e-04 6.5907425e-01 3.4044698e-01]]
Predicted Class: 1
```

In [35]:

```
# we can see name in path its pneunomia
test_path= "C:/Users/Shivam Ranshur/ANACONDA JUPYTER PROGRAMMING/Covid19-dataset/tes
img= image.load_img(test_path, target_size=(256,256))
img = image.img_to_array(img)/255
img= np.array([img])
print(img.shape)

# Predict the class probabilities for the image
class_probabilities = Xray_model.predict(img)

# Get the predicted class label
predicted_class = np.argmax(class_probabilities, axis=1)[0]

print("Class Probabilities:", class_probabilities)
print("Predicted Class:", predicted_class)
```

```
(1, 256, 256, 3)
1/1 [==============================] - 0s 26ms/step
Class Probabilities: [[0.00521721 0.38212913 0.6126536 ]]
Predicted Class: 2
```

For all 3 categories its working perfectely as we wanted its classifying perfectly

RESULT

Proposed CNN model achieves 91% accuracy in X-ray image classification, effectively detecting COVID-19, normal, and pneumonia cases with high precision.

Feel free to use this project and tune it further for your personal projects