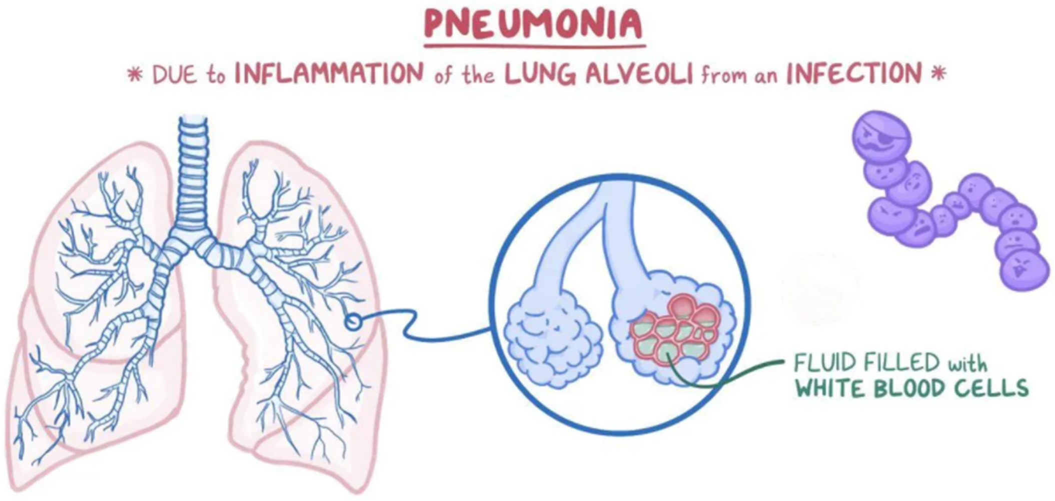
Pneumonia detection using Multi-layer perceptron model

Objective: The object of this project is detect pneumonia in lungs by scanning X-ray images

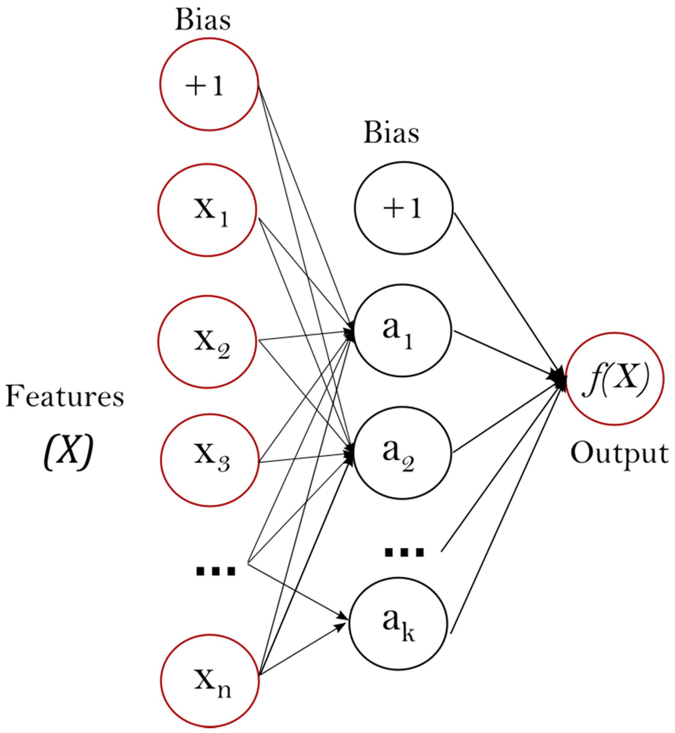
Abstract: Pneumonia is an infection in one or both lungs. Bacteria, viruses, and fungi cause it. The infection causes inflammation in the air sacs in your lungs, which are called alveoli. The alveoli fill with fluid or pus, making it difficult to breathe.


PNEUMONIA
* DUE to INFLAMMATION of the LUNG ALVEOLI from an INFECTION *
FLUID FILLED with WHITE BLOOD CELLS

In this project X-ray images will be scanned and model will be trained for detecting lungs showing infections in their x-rays.

For creating machine learning model scikit learns MLP classifier has been used

Multi-Layer Perceptron Classifier: It is a supervised learning algorithm that learns a function f(·):Rm→Ro by training on a dataset, where m is the number of dimensions for input and o is the number of dimensions for output. Given a set of features X=x1,x2,...,xm and a target y, it can learn a non-linear function approximator for either classification or regression. It is different from logistic regression, in that between the input and the output layer, there can be one or more non-linear layers, called hidden layers. Figure 1 shows a one hidden layer MLP with scalar output.



Class MLPClassifier implements a multi-layer perceptron (MLP) algorithm that trains using Backpropagation. MLPClassifier trains iteratively since at each time step the partial derivatives of the loss function with respect to the model parameters are computed to update the parameters.It can also have a regularization term added to the loss function that shrinks model parameters to prevent overfitting.This implementation works with data represented as dense numpy arrays or sparse scipy arrays of floating point values.

Code:

```
#importing required libraries
import numpy as np
import pandas as pd
import os
from tensorflow.keras.preprocessing.image import load_img, img_to_array
from tensorflow import keras
from tensorflow.keras import Input
from keras.preprocessing.image import ImageDataGenerator, load_img
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
dir1 = '../input/chest-xray-pneumonia/chest_xray/train'
dir2 = '../input/chest-xray-pneumonia/chest_xray/test'
```

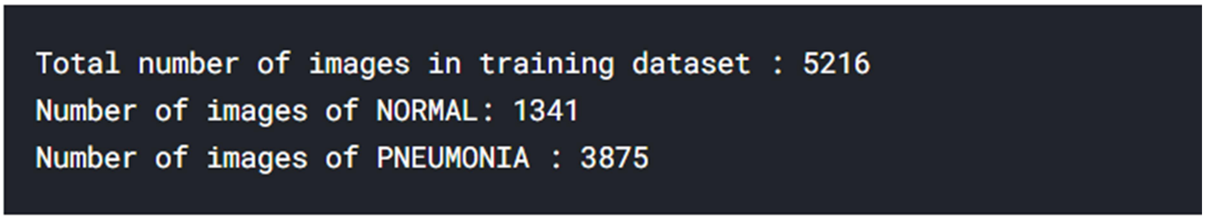
```
dataset=[]
mapping={"PNEUMONIA":0,"NORMAL":1}
count=0

for file in os.listdir(dir1):
    path=os.path.join(dir1,file)
    for im in os.listdir(path):
        image=load_img(os.path.join(path,im), grayscale=False, color_mode='grayscale', target_size=(150,150))
        image=img_to_array(image)
        image=image/255.0
        dataset.append([image,count])
    count=count+1
testset=[]
mapping={"PNEUMONIA":0,"NORMAL":1}
count=0

for file in os.listdir(dir2):
    path=os.path.join(dir2,file)
    for im in os.listdir(path):
        image=load_img(os.path.join(path,im), grayscale=False, color_mode='grayscale', target_size=(150,150))
        image=img_to_array(image)
        image=image/255.0
        testset.append([image,count])
    count=count+1
```

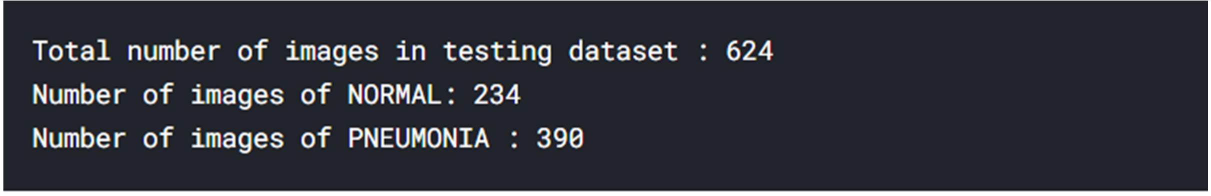
```
In [18]:
data,labels0=zip(*dataset)
test,testlabels0=zip(*testset)
```

```
In [19]:
print('Total number of images in training dataset :',len(data))
print('Number of images of NORMAL:',sum(labels0))
print('Number of images of PNEUMONIA :',len(data)-sum(labels0))
```



```
Total number of images in training dataset : 5216
Number of images of NORMAL: 1341
Number of images of PNEUMONIA : 3875
```

```
print('Total number of images in testing dataset :',len(test))
print('Number of images of NORMAL:',sum(testlabels0))
print('Number of images of PNEUMONIA :',len(test)-sum(testlabels0))
```



```
Total number of images in testing dataset : 624
Number of images of NORMAL: 234
Number of images of PNEUMONIA : 390
```

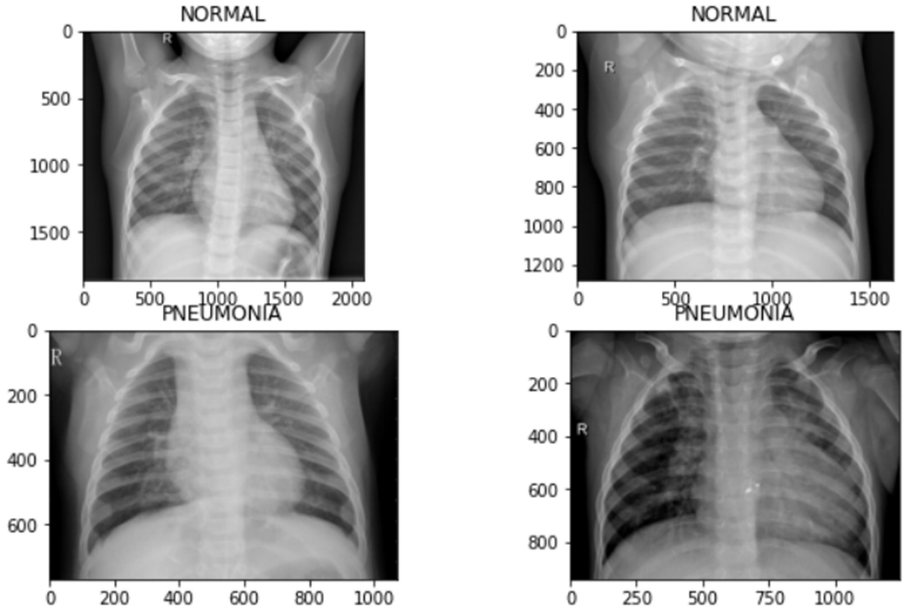
```
# Quick Look to the images

img_name = 'IM-0115-0001.jpeg'
img_normal = load_img('../input/chest-xray-pneumonia/chest_xray/train/NORMAL/' + img_name)
```

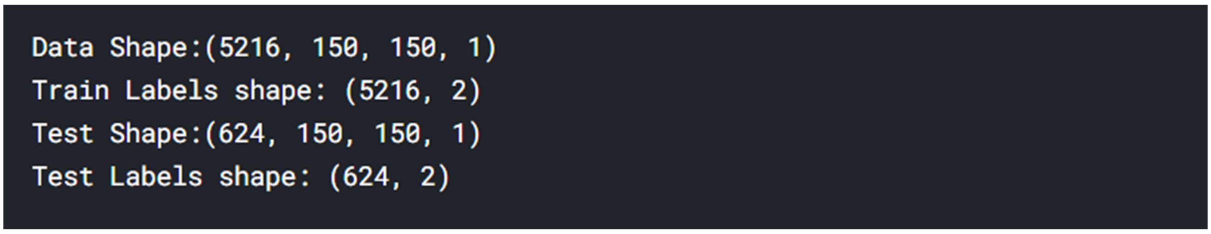
```
img_name1 = 'IM-0122-0001.jpeg'
img_normal1 = load_img('../input/chest-xray-pneumonia/chest_xray/train/NORMAL/
' + img_name1)

img_name_1 = 'person1000_virus_1681.jpeg'
img_pneumonia = load_img('../input/chest-xray-pneumonia/chest_xray/train/PNEUM
ONIA/' + img_name_1)
img_name_2 = 'person1002_bacteria_2933.jpeg'
img_pneumonia1 = load_img('../input/chest-xray-pneumonia/chest_xray/train/PNEU
MONIA/' + img_name_2)
fig, axs = plt.subplots(2,2,figsize=(10,6))
axs[0][0].imshow(img_normal)
axs[0][0].set_title("NORMAL")
axs[0][1].imshow(img_normal1)
axs[0][1].set_title("NORMAL")
axs[1][0].imshow(img_pneumonia)
axs[1][0].set_title("PNEUMONIA")
axs[1][1].imshow(img_pneumonia1)
axs[1][1].set_title("PNEUMONIA")
```

```
Text(0.5, 1.0, 'PNEUMONIA')
```

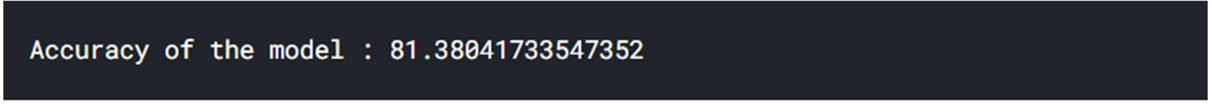


```
labels1=to_categorical(labels0)
X_train=np.array(data)
y_train=np.array(labels1)
print("Data Shape:{}\nTrain Labels shape: {}".format(X_train.shape,y_train.sha
pe))
testlabels1=to_categorical(testlabels0)
X_test=np.array(test)
y_test=np.array(testlabels1)
print("Test Shape:{}\nTest Labels shape: {}".format(X_test.shape,y_test.shape)
)
```

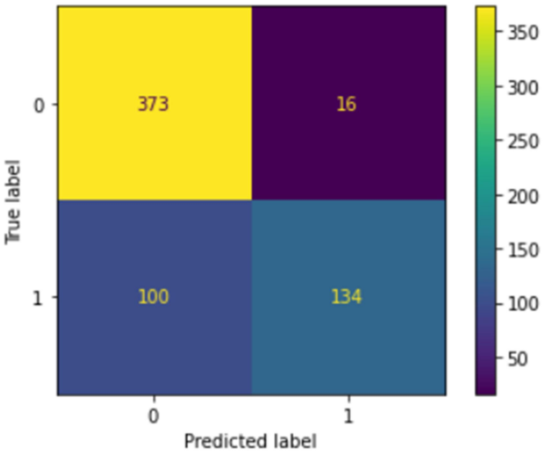


```
Data Shape:(5216, 150, 150, 1)
Train Labels shape: (5216, 2)
Test Shape:(624, 150, 150, 1)
Test Labels shape: (624, 2)
```

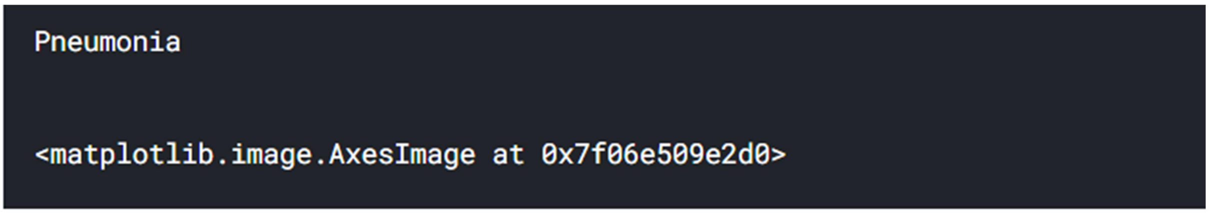
```
trainx,k,trainy,k1=train_test_split(X_train,y_train,test_size=0.0001,random_state=44)
testx,k2,testy,k3=train_test_split(X_test,y_test,test_size=0.001,random_state=44)
trainx.resize(5215,22500)
testx.resize(623,22500)
from sklearn.neural_network import MLPClassifier
clf = MLPClassifier(random_state=1,max_iter=50,learning_rate='adaptive').fit(trainx,trainy)
predy = clf.predict(testx)
from sklearn.metrics import confusion_matrix,ConfusionMatrixDisplay
cm=confusion_matrix(testy.argmax(axis=1),predy.argmax(axis=1))
disp = ConfusionMatrixDisplay(confusion_matrix=cm,display_labels=clf.classes_)
disp.plot()
print("Accuracy of the model :",100*clf.score(testx,testy))
```



```
Accuracy of the model : 81.38041733547352
```

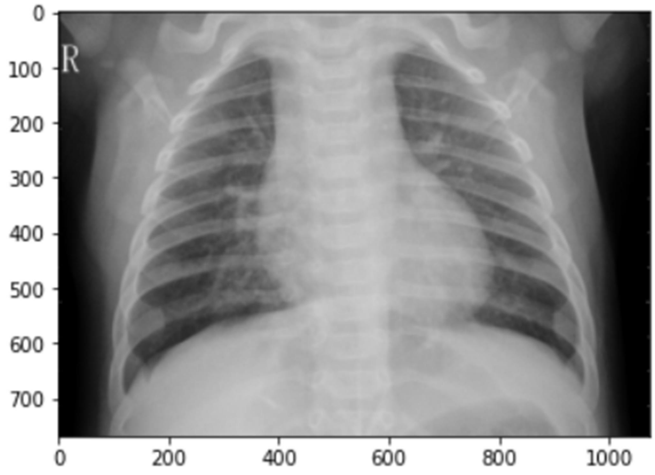


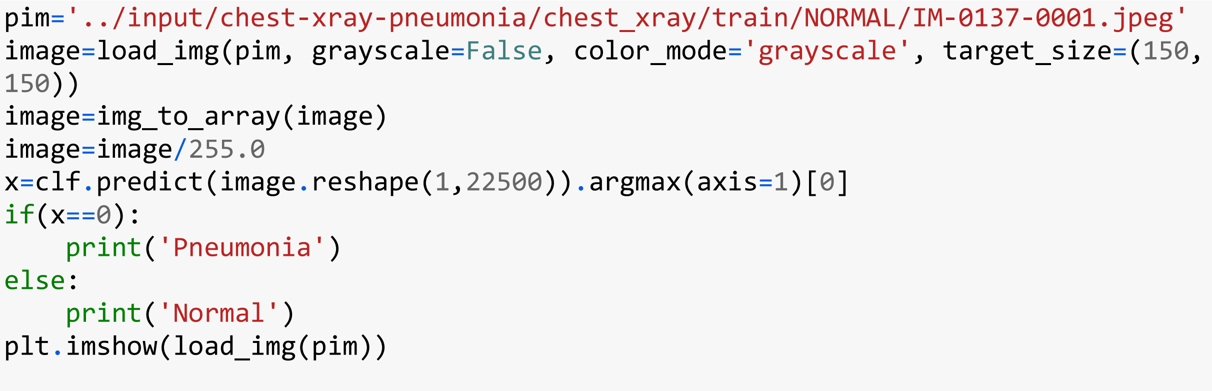
```
pim='../input/chest-xray-pneumonia/chest_xray/train/PNEUMONIA/person1000_virus_1681.jpeg'
image=load_img(pim, grayscale=False, color_mode='grayscale', target_size=(150,150))
image=img_to_array(image)
image=image/255.0
x=clf.predict(image.reshape(1,22500)).argmax(axis=1)[0]
if(x==0):
    print('Pneumonia')
else:
    print('Normal')
plt.imshow(load_img(pim))
```



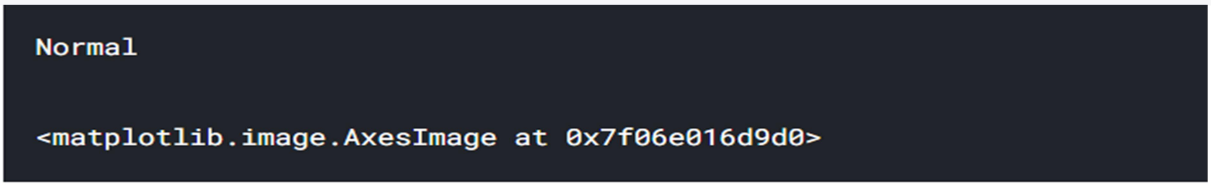
```
Pneumonia

<matplotlib.image.AxesImage at 0x7f06e509e2d0>
```





```
pim='../input/chest-xray-pneumonia/chest_xray/train/NORMAL/IM-0137-0001.jpeg'
image=load_img(pim, grayscale=False, color_mode='grayscale', target_size=(150,
150))
image=img_to_array(image)
image=image/255.0
x=clf.predict(image.reshape(1,22500)).argmax(axis=1)[0]
if(x==0):
    print('Pneumonia')
else:
    print('Normal')
plt.imshow(load_img(pim))
```



```
Normal

<matplotlib.image.AxesImage at 0x7f06e016d9d0>
```