```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
from numpy import mean
from numpy import std
from matplotlib import pyplot
from sklearn.model_selection import KFold
from keras.datasets import mnist
from keras.utils import to_categorical
from keras.models import Sequential
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Dense
from keras.layers import Flatten
from keras.optimizers import SGD
from keras.layers import Dropout
from keras.layers import BatchNormalization
import keras
from keras import backend as K
import matplotlib.pyplot as plt
import sklearn
```

```
path_normal = '/content/drive/MyDrive/Deep learning demo project/Normal/'
path_pneumonia = '/content/drive/MyDrive/Deep learning demo project/pneumonia/'
```

```
##Import necessary libraries
import numpy as np
import PIL
import cv2
import os
data1 = list()
data2 = list()
x = list()
```

```
##Class-1 images##

for image in os.walk(path_normal):
  data1.append(image[2])

for i in range(len(data1[0])):
  str_complete = path_normal + data1[0][i]
  img = cv2.imread(str_complete)
  img = cv2.resize(img, (224, 224))
  x.append(img)
  print(i)#Ensure all images are loaded
```

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```

```
print(img.shape)
```

```
(224, 224, 3)
```

```
##Class-2 images##

for image in os.walk(path_pneumonia):
  data2.append(image[2])

for i in range(len(data2[0])):
  str_complete = path_pneumonia + data2[0][i]
  img = cv2.imread(str_complete)
  img = cv2.resize(img, (224, 224))
  x.append(img)#Ensure all images are loaded
  print(i)
```

```
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```

```
data_x = np.asarray(x)
```

```
data_x.shape
```

```
(1400, 224, 224, 3)
```

```
x=data_x
```

```
y = np.zeros(1400)
y[:700] =1
y[700:1400]=2
```

```
from sklearn.model_selection import train_test_split
```

```
##Dataset Split##
from sklearn.model_selection import train_test_split
from keras.utils import to_categorical
#y = to_categorical(y)
x_train, x_test, y_train, y_test = train_test_split(data_x, y, test_size=0.2, random_state=1)
x_train, x_val, y_train, y_val = train_test_split(x_train, y_train, test_size=1/8, random_state=1)

y_tr_one_hot  = np.zeros((np.array(y_train).shape[0],2))

for i in range(np.array(y_train).shape[0]):
  label = y_train[i]-1
  y_tr_one_hot[i][int(label)] = 1
```

```
y_val_one_hot  = np.zeros((np.array(y_val).shape[0],2))

for i in range(np.array(y_val).shape[0]):
  label = y_val[i]-1
  y_val_one_hot[i][int(label)] = 1
```

```
y_te_one_hot  = np.zeros((np.array(y_test).shape[0],2))

for i in range(np.array(y_test).shape[0]):
  label = y_test[i]-1
  y_te_one_hot[i][int(label)] = 1
```

```
from keras.models import load_model
from keras.layers import Lambda
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import GlobalAveragePooling2D, Dense
```

```
model = tf.keras.applications.EfficientNetV2B1(include_top=False,input_shape=(224,224,3))
# mark loaded layers as not trainable
for layer in model.layers:
    layer.trainable = False
# add new classifier layers
flat1 = Flatten()(model.layers[-1].output)
#x=Dense(1024,activation='relu')(flat1) # FC layer 1
#x=Dense(64,activation='relu')(x)   # FC layer 2
output = Dense(2, activation='softmax')(flat1)
model = Model(inputs=model.inputs, outputs=output)

optimizer = tf.keras.optimizers.Adam(learning_rate=0.01)
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
model.fit(x_train, y_tr_one_hot, validation_data=(x_val, y_val_one_hot), epochs=5, batch_size=200,verbose=1)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/efficientnet_v2/efficientnetv2-b1_notc
28456008/28456008 [==============================] - 1s 0us/step
Epoch 1/5
5/5 [==============================] - 122s 23s/step - loss: 0.1450 - accuracy: 0.9163 - val_loss: 0.0625 - val_accuracy:
Epoch 2/5
```

```
5/5 [==============================] - 106s 22s/step - loss: 2.0930e-05 - accuracy: 1.0000 - val_loss: 0.1148 - val_accur
Epoch 3/5
5/5 [==============================] - 104s 22s/step - loss: 9.9769e-04 - accuracy: 0.9990 - val_loss: 0.1711 - val_accur
Epoch 4/5
5/5 [==============================] - 97s 20s/step - loss: 0.0027 - accuracy: 0.9990 - val_loss: 0.1796 - val_accuracy:
Epoch 5/5
5/5 [==============================] - 101s 21s/step - loss: 1.6027e-06 - accuracy: 1.0000 - val_loss: 0.1606 - val_accur
<keras.callbacks.History at 0x7f5dad867520>
```

```
import sklearn
from sklearn.metrics import confusion_matrix


test_loss, test_acc = model.evaluate(np.array(x_test), np.array(y_te_one_hot), verbose=0)
print(test_acc)
##Evaluating Sensitivity, Accuracy and Kappa scores
y_prob = model.predict(x_test)
Y_pred = y_prob.argmax(axis=-1)
```

```
1.0
9/9 [==============================] - 21s 2s/step
```

```
cm1 = confusion_matrix(y_test-1,Y_pred)
print("confusion matrix \n",cm1)
```

```
confusion matrix
 [[137   0]
 [  0 143]]
```

```
from sklearn.metrics import classification_report


import pandas as pd


print(pd.DataFrame(classification_report(y_test-1,Y_pred,output_dict=True)).T)
Kappa=sklearn.metrics.cohen_kappa_score(y_test-1,Y_pred)
print('Kappa=',Kappa)
```

```
                precision  recall  f1-score  support
0.0                   1.0     1.0       1.0    137.0
1.0                   1.0     1.0       1.0    143.0
accuracy              1.0     1.0       1.0      1.0
macro avg             1.0     1.0       1.0    280.0
weighted avg          1.0     1.0       1.0    280.0
Kappa= 1.0
```

✓ 0s completed at 15:54