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

    Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True)

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, (299, 299))
    x.append(img)
print(i)#Ensure all images are loaded
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print(img.shape)

(299, 299, 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, (299, 299))
    x.append(img)#Ensure all images are loaded
    print(i)
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data_x = np.asarray(x)

data_x.shape

(1400, 299, 299, 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.InceptionV3(include_top=False,input_shape=(299,299,3))
# 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/inception\_v3/inception\_v3\_weights\_tf\_c87910968/87910968 [=====] - 1s 0us/step
Epoch 1/5
5/5 [=====] - 300s 60s/step - loss: 209.3004 - accuracy: 0.5255 - val_loss: 43.2029 - val_accu:

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Epoch 2/5
5/5 [=====] - 292s 60s/step - loss: 24.2418 - accuracy: 0.8969 - val_loss: 104.8813 - val_accu
Epoch 3/5
5/5 [=====] - 292s 59s/step - loss: 25.6197 - accuracy: 0.8969 - val_loss: 9.7148 - val_accu
Epoch 4/5
5/5 [=====] - 293s 60s/step - loss: 4.1471 - accuracy: 0.9796 - val_loss: 15.2920 - val_accu
Epoch 5/5
5/5 [=====] - 293s 61s/step - loss: 11.8202 - accuracy: 0.9633 - val_loss: 15.1502 - val_accu
<keras.callbacks.History at 0x7f202ed4c8e0>

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)

0.9678571224212646
9/9 [=====] - 71s 8s/step

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

confusion matrix
[[128   9]
 [  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)

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	precision	recall	f1-score	support
0.0	1.000000	0.934307	0.966038	137.000000
1.0	0.940789	1.000000	0.969492	143.000000
accuracy	0.967857	0.967857	0.967857	0.967857
macro avg	0.970395	0.967153	0.967765	280.000000
weighted avg	0.969760	0.967857	0.967802	280.000000

Kappa= 0.9355959926395421