tomato-leap-disease-classifier

October 14, 2024

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow import keras
from keras import layers,Sequential
from keras.layers import␣
 ↪Conv2D,MaxPooling2D,Flatten,Dense,Dropout,BatchNormalization
import os
import cv2 as cv
```

[2]:
```
path=r"C:\Users\vidya\Downloads\Tomato\tomato\train"
```

[3]:
```
dis=os.listdir(path)
dis
```

[3]:
```
['Tomato___Bacterial_spot',
 'Tomato___Early_blight',
 'Tomato___healthy',
 'Tomato___Late_blight',
 'Tomato___Leaf_Mold',
 'Tomato___Septoria_leaf_spot',
 'Tomato___Spider_mites Two-spotted_spider_mite',
 'Tomato___Target_Spot',
 'Tomato___Tomato_mosaic_virus',
 'Tomato___Tomato_Yellow_Leaf_Curl_Virus']
```

[4]:
```
dis.index("Tomato___Target_Spot")
```

[4]:
```
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```

[5]:
```
Data=[]
for i in dis:# ALL FOLDERS INSIDE PARENT PATH
    A=os.path.join(path,i) #FOR JOINING PATHS
    for j in os.listdir(A):# FOR GETTING ALL CONTENT FROM FOLDER
        B=os.path.join(A,j)#JOIN
        img=cv.imread(B)#CONVERTING IMAGE TO PIXEL INTENSITY MATRIX
```

```
        C=cv.resize(img,(50,50))# RESIZING PIXEL INTENSITY MATRIX
        T=dis.index(i) #FOR GETTING TARGET VARIABLE
        Data.append([C,T]) #TO STORE
```

[6]:
```
i=cv.imread(r"C:
↪\Users\vidya\Downloads\Tomato\tomato\train\Tomato___Tomato_mosaic_virus\5ab64087-b61c-48b9-
↪2299.JPG")
```

[7]:
```
i.shape
```

[7]:
```
(256, 256, 3)
```

[8]:
```
Data[1]
```

[8]:
```
[array([[[114, 117, 132],
         [109, 112, 127],
         [101, 104, 119],
         …,
         [105, 112, 127],
         [108, 115, 130],
         [102, 109, 124]],

        [[103, 106, 121],
         [114, 117, 132],
         [109, 112, 127],
         …,
         [101, 108, 123],
         [111, 118, 133],
         [ 97, 104, 119]],

        [[115, 118, 133],
         [107, 110, 125],
         [ 93,  96, 111],
         …,
         [ 94, 101, 116],
         [ 91,  98, 113],
         [ 97, 104, 119]],

        …,

        [[147, 149, 160],
         [149, 151, 162],
         [160, 162, 173],
         …,
         [153, 157, 168],
         [144, 147, 159],
         [134, 138, 149]],
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          [[144, 146, 157],
           [139, 141, 152],
           [145, 147, 158],
           …,
           [151, 155, 166],
           [150, 154, 165],
           [135, 139, 150]],

          [[145, 147, 158],
           [146, 147, 159],
           [153, 155, 166],
           …,
           [147, 151, 162],
           [148, 152, 163],
           [141, 145, 156]]], dtype=uint8),
    0]
```
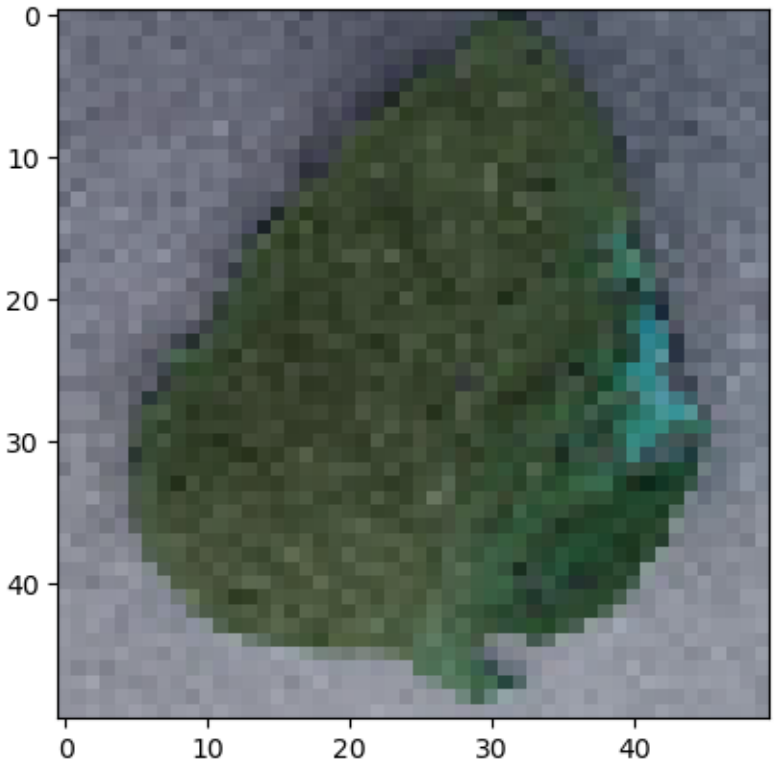

[9]:
```
plt.imshow(Data[1][0])
```

[9]:
```
<matplotlib.image.AxesImage at 0x2887fefd940>
```



[10]:
```
len(Data)
```

[10]: 2189

[11]:
```
len(Data[1][0])
```

[11]: 50

[12]:
```
Data[256][1]
```

[12]: 1

[13]:
```
import random
random.shuffle(Data)
```

[14]:
```
F=[]
T=[]
for i,j in Data:#FOR SEPERATING FEATURES AND TARGETS
    F.append(i)
    T.append(j)
```

[15]:
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len(F)
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[15]: 2189

[16]:
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[16]:
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```

[17]:
```
T1=pd.get_dummies(T).replace({True:1,False:0}) # THESE TARGETS ARE NOMINAL SO␣
↪GETTING DUMMIES FOR MAINTAING THE IN BETWEEN RELATION WITHOUT AFFECTING THE␣
↪MODEL
T1
```

```
C:\Users\vidya\AppData\Local\Temp\ipykernel_7888\4243940820.py:1: FutureWarning:
Downcasting behavior in `replace` is deprecated and will be removed in a future
version. To retain the old behavior, explicitly call
`result.infer_objects(copy=False)`. To opt-in to the future behavior, set
`pd.set_option('future.no_silent_downcasting', True)`
  T1=pd.get_dummies(T).replace({True:1,False:0}) # THESE TARGETS ARE NOMINAL SO
GETTING DUMMIES FOR MAINTAING THE IN BETWEEN RELATION WITHOUT AFFECTING THE
MODEL
```

[17]:

	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	1	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0
…	..	..	..	..	..	..	..	..	..	..
2184	0	0	1	0	0	0	0	0	0	0
2185	0	0	0	1	0	0	0	0	0	0
2186	0	0	0	0	0	0	0	0	0	1
2187	0	0	0	0	0	0	1	0	0	0
2188	0	0	0	0	0	0	1	0	0	0

[2189 rows x 10 columns]

[18]:
```
F=np.array(F)#FOR FASTER CALCULATION
```

[19]:
```
F1=F/255 #FOR MINMAX SCALER
```

[20]:
```
F[1]#FIRST IMAGE WITHOUT MINMAX
```

[20]:
```
array([[[138, 141, 139],
        [132, 135, 133],
        [135, 138, 136],
        …,
        [126, 127, 127],
        [124, 126, 126],
        [128, 130, 130]],

       [[128, 131, 128],
        [134, 137, 135],
        [134, 137, 135],
        …,
        [125, 127, 127],
        [122, 125, 125],
        [125, 127, 127]],

       [[131, 134, 132],
```

```
        [125, 128, 126],
        [138, 141, 139],
        …,
        [128, 130, 130],
        [125, 127, 127],
        [120, 122, 122]],

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       [[ 90,  93,  91],
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        …,
        [ 77,  77,  77],
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        [ 74,  74,  74]],

       [[ 95,  98,  96],
        [ 89,  92,  90],
        [ 97, 100,  98],
        …,
        [ 79,  79,  79],
        [ 80,  80,  80],
        [ 77,  77,  77]],

       [[ 87,  91,  88],
        [ 89,  92,  90],
        [ 96,  99,  97],
        …,
        [ 82,  82,  82],
        [ 76,  76,  76],
        [ 81,  81,  81]]], dtype=uint8)
```

[21]:
```
F1[1]#FIRST IMAGE AFTER MINMAX
```

[21]:
```
array([[[0.54117647, 0.55294118, 0.54509804],
        [0.51764706, 0.52941176, 0.52156863],
        [0.52941176, 0.54117647, 0.53333333],
        …,
        [0.49411765, 0.49803922, 0.49803922],
        [0.48627451, 0.49411765, 0.49411765],
        [0.50196078, 0.50980392, 0.50980392]],

       [[0.50196078, 0.51372549, 0.50196078],
        [0.5254902 , 0.5372549 , 0.52941176],
        [0.5254902 , 0.5372549 , 0.52941176],
        …,
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```
        [0.49019608, 0.49803922, 0.49803922],
        [0.47843137, 0.49019608, 0.49019608],
        [0.49019608, 0.49803922, 0.49803922]],

       [[0.51372549, 0.5254902 , 0.51764706],
        [0.49019608, 0.50196078, 0.49411765],
        [0.54117647, 0.55294118, 0.54509804],
        …,
        [0.50196078, 0.50980392, 0.50980392],
        [0.49019608, 0.49803922, 0.49803922],
        [0.47058824, 0.47843137, 0.47843137]],

       …,

       [[0.35294118, 0.36470588, 0.35686275],
        [0.35294118, 0.36470588, 0.35686275],
        [0.35294118, 0.36470588, 0.35686275],
        …,
        [0.30196078, 0.30196078, 0.30196078],
        [0.29019608, 0.29019608, 0.29019608],
        [0.29019608, 0.29019608, 0.29019608]],

       [[0.37254902, 0.38431373, 0.37647059],
        [0.34901961, 0.36078431, 0.35294118],
        [0.38039216, 0.39215686, 0.38431373],
        …,
        [0.30980392, 0.30980392, 0.30980392],
        [0.31372549, 0.31372549, 0.31372549],
        [0.30196078, 0.30196078, 0.30196078]],

       [[0.34117647, 0.35686275, 0.34509804],
        [0.34901961, 0.36078431, 0.35294118],
        [0.37647059, 0.38823529, 0.38039216],
        …,
        [0.32156863, 0.32156863, 0.32156863],
        [0.29803922, 0.29803922, 0.29803922],
        [0.31764706, 0.31764706, 0.31764706]]])
```

[22]:
```
F1.shape#10000 IMAGES HAVING WIDTH OF 150 ,HEIGHT OF 150 AND 3 RGB CHANNEL
```

[22]:
```
(2189, 50, 50, 3)
```

[23]:
```
T1.shape #TARGET VARIABLE SHAPE
```

[23]:
```
(2189, 10)
```

[24]:
```
T=np.array(T)
```

1 MODEL BUILDING

[26]:
```
model=Sequential()
#DATA AUGMENTATION
#model.add(layers.experimental.preprocessing.RandomFlip('horizontal'))
#model.add(layers.experimental.preprocessing.RandomRotation(0.1))
#model.add(layers.experimental.preprocessing.RandomZoom(0.1))
#model.add(layers.experimental.preprocessing.RandomContrast(0.1))


model.add(  Conv2D(5,   (5,5),  activation='relu')  )#120 IS FILTER COUNT␣
 ↪,(5*5) IS FILTER SIZE
model.add(  MaxPooling2D(  (2,2)  ,strides=(1,1)))#(2*2)IS THE MAXPOOLING MATRIX

model.add(Conv2D(5,(3,3),activation='relu'))
model.add(MaxPooling2D((2,2),strides=(2,2)))


model.add(Flatten())

model.add(Dense(3,input_shape=(150,150,3),activation='relu'))
model.add(Dense(3,activation='relu'))
model.add(Dense(1,activation='softmax'))

model.compile(optimizer='adam',
              loss='categorical_crossentropy',
              metrics=['accuracy'],)
```

```
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\layers\core\dense.py:87:
UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When
using Sequential models, prefer using an `Input(shape)` object as the first
layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

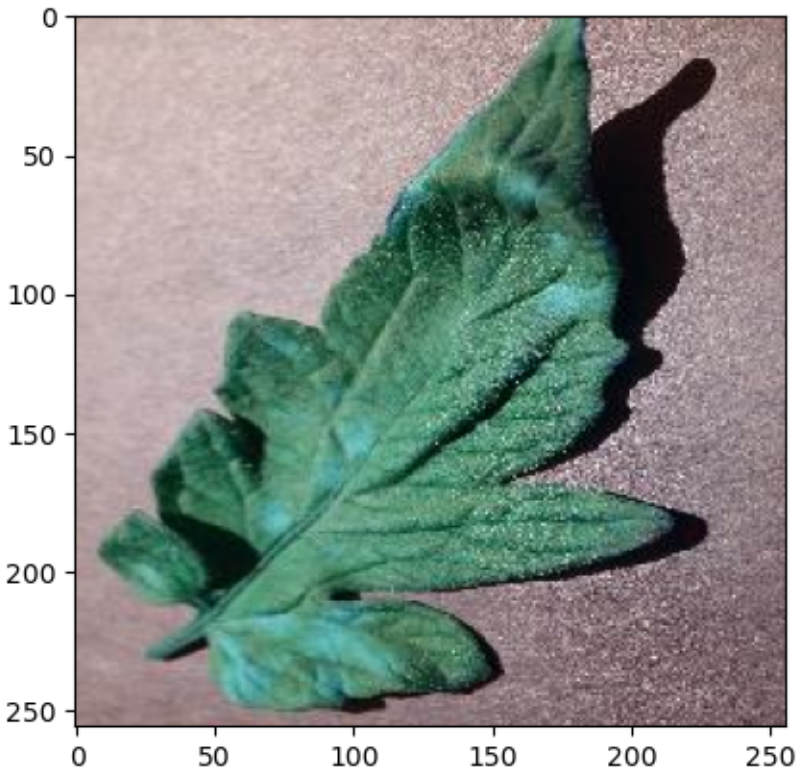
[27]:
```
model.fit(F1,T, epochs=1, validation_split=0.2, batch_size=2)
```

```
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\ops\nn.py:545: UserWarning:
You are using a softmax over axis -1 of a tensor of shape (None, 1). This axis
has size 1. The softmax operation will always return the value 1, which is
likely not what you intended. Did you mean to use a sigmoid instead?
  warnings.warn(
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\losses\losses.py:27:
SyntaxWarning: In loss categorical_crossentropy, expected y_pred.shape to be
(batch_size, num_classes) with num_classes > 1. Received: y_pred.shape=(None,
1). Consider using 'binary_crossentropy' if you only have 2 classes.
  return self.fn(y_true, y_pred, **self._fn_kwargs)
872/876            0s 9ms/step -
```

```
accuracy: 0.0931 - loss: 0.0000e+00

C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\ops\nn.py:545: UserWarning:
You are using a softmax over axis -1 of a tensor of shape (2, 1). This axis has
size 1. The softmax operation will always return the value 1, which is likely
not what you intended. Did you mean to use a sigmoid instead?
  warnings.warn(
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\losses\losses.py:27:
SyntaxWarning: In loss categorical_crossentropy, expected y_pred.shape to be
(batch_size, num_classes) with num_classes > 1. Received: y_pred.shape=(2, 1).
Consider using 'binary_crossentropy' if you only have 2 classes.
  return self.fn(y_true, y_pred, **self._fn_kwargs)

876/876             14s 10ms/step -
accuracy: 0.0931 - loss: 0.0000e+00 - val_accuracy: 0.1073 - val_loss:
0.0000e+00
```

[27]:
```
<keras.src.callbacks.history.History at 0x2880c317080>
```

[28]:
```
img_path = r"C:
 ↪\Users\vidya\Downloads\Tomato\tomato\train\Tomato___Leaf_Mold\6a72d24d-5705-4647-8a8c-77d2f
 ↪Mold 8708.JPG"
img = cv.imread(img_path,)

img_resized = cv.resize(img, (50, 50))
img_resized=img_resized.reshape(1, 50, 50, 3)

plt.imshow(img,)
plt.show()
```



[29]:
```
prediction = model.predict(img_resized)
prediction
```

```
1/1             0s 184ms/step
```

```
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\ops\nn.py:545: UserWarning:
You are using a softmax over axis -1 of a tensor of shape (1, 1). This axis has
size 1. The softmax operation will always return the value 1, which is likely
not what you intended. Did you mean to use a sigmoid instead?
  warnings.warn(
```

[29]:
```
array([[1.]], dtype=float32)
```

[30]:
```
dis[1]
```

[30]:
```
'Tomato___Early_blight'
```

[31]:
```
p1=r"C:\Users\vidya\Downloads\Tomato\tomato\val"
```

[32]:
```
Data1=[]
for i in dis:# ALL FOLDERS INSIDE PARENT PATH
    A=os.path.join(p1,i) #FOR JOINING PATHS
```

```
    for j in os.listdir(A):# FOR GETTING ALL CONTENT FROM FOLDER
        B=os.path.join(A,j)#JOIN
        img=cv.imread(B)#CONVERTING IMAGE TO PIXEL INTENSITY MATRIX
        C=cv.resize(img,(50,50))# RESIZING PIXEL INTENSITY MATRIX
        T=dis.index(i) #FOR GETTING TARGET VARIABLE
        Data1.append([C,T]) #TO STORE
```

[33]:
```
import random
random.shuffle(Data1)
```

[34]:
```
Data1[1]
```

[34]:
```
[array([[[ 81,  81,  87],
         [ 84,  84,  90],
         [ 87,  87,  93],
         …,
         [110, 106, 111],
         [117, 113, 118],
         [113, 109, 114]],

        [[ 69,  69,  75],
         [ 86,  86,  92],
         [ 79,  79,  85],
         …,
         [ 92,  88,  93],
         [108, 104, 109],
         [119, 115, 120]],

        [[ 81,  81,  87],
         [ 83,  83,  89],
         [ 83,  83,  88],
         …,
         [118, 114, 119],
         [117, 113, 118],
         [127, 123, 128]],

        …,

        [[ 95,  93,  92],
         [ 95,  93,  92],
         [ 98,  96,  95],
         …,
         [117, 115, 115],
         [117, 115, 115],
         [118, 117, 117]],

        [[ 94,  92,  91],
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```
          [ 97,  95,  94],
          [ 93,  91,  90],
          …,
          [116, 114, 114],
          [116, 114, 114],
          [116, 114, 114]],

         [[ 94,  92,  91],
          [ 87,  85,  84],
          [ 89,  87,  86],
          …,
          [119, 116, 116],
          [116, 114, 114],
          [116, 114, 114]]], dtype=uint8),
 3]
```

[35]:
```
F1=[]
T1=[]
for i,j in Data1:
    F1.append(i)
    T1.append(j)
```

[36]:
```
T1
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[36]:
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```

[37]:
```
F1=np.array(F1)
F1=F1/255  # for minmax scaler
```

[38]:
```
pred=model.predict(F1)
pred
```

```
 5/32              0s 27ms/step
```

```
C:\Users\vidya\anaconda3\Lib\site-packages\keras\src\ops\nn.py:545: UserWarning:
You are using a softmax over axis -1 of a tensor of shape (32, 1). This axis has
```

```
size 1. The softmax operation will always return the value 1, which is likely
not what you intended. Did you mean to use a sigmoid instead?
  warnings.warn(
```

```
32/32            1s 31ms/step
```

[38]:
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array([[1.],
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```

[39]:
```
from sklearn.metrics import confusion_matrix, accuracy_score,␣
↪classification_report
```

[40]:
```
print(confusion_matrix(T1,pred))
```

```
[[  0 100   0   0   0   0   0   0   0   0]
 [  0 100   0   0   0   0   0   0   0   0]
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[41]:
```
print(classification_report(T1,pred))
```

```
              precision    recall  f1-score   support

           0       0.00      0.00      0.00       100
           1       0.10      1.00      0.18       100
           2       0.00      0.00      0.00       100
           3       0.00      0.00      0.00       100
           4       0.00      0.00      0.00       100
           5       0.00      0.00      0.00       100
           6       0.00      0.00      0.00       100
           7       0.00      0.00      0.00       100
```

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           8       0.00      0.00      0.00       100
           9       0.00      0.00      0.00       100

    accuracy                           0.10      1000
   macro avg       0.01      0.10      0.02      1000
weighted avg       0.01      0.10      0.02      1000

C:\Users\vidya\anaconda3\Lib\site-
packages\sklearn\metrics\_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\vidya\anaconda3\Lib\site-
packages\sklearn\metrics\_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\vidya\anaconda3\Lib\site-
packages\sklearn\metrics\_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

[87]:
```
accuracy_score(T1,pred)*100
```

[87]: 10.0

[ ]:
```

```