Artificial Intelligence - IBM Project Build-a-Thon 2022

Fertilizers Recommendation System for Disease Prediction

Ghousiya Begum K, School of EEE, SASTRA University, Thanjavur-613401, India

ghousiyabegum@eie.sastra.edu

Simulation and Results:

1) Fruit Dataset CNN Sequential Model Building

For target_size = (128,128) and batch_size=32

odel: "sequential"		
Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 124, 124, 32)	
max_pooling2d (MaxPooling2)	D (None, 41, 41, 32)	0
conv2d_1 (Conv2D)	(None, 39, 39, 32)	9248
max_pooling2d_1 (MaxPooling 2D)	g (None, 19, 19, 32)	0
conv2d_2 (Conv2D)	(None, 17, 17, 64)	18496
max_pooling2d_2 (MaxPooling 2D)	g (None, 8, 8, 64)	0
flatten (Flatten)	(None, 4096)	0
dense (Dense)	(None, 512)	2097664
dropout (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 128)	65664
dense_2 (Dense)	(None, 6)	774

Non-trainable params: 0

```
model.fit_generator(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=52,epochs=15)
C:\Users\91978\AppData\Local\Temp/ipykernel_19608/3138067069.py:1: UserWarning: `Model.fit_generator` is deprecated and will be
removed in a future version. Please use `Model.fit', which supports generators.

model.fit_generator(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=52,epochs=15)
Epoch 1/15
169/169 [==========] - 102s 594ms/step - loss: 0.7194 - accuracy: 0.7407 - val loss: 0.2664 - val accuracy:
0.8984
Epoch 2/15
0.9477
Epoch 3/15
169/169 [==
         0.8906
Enoch 4/15
169/169 [===========] - 100s 587ms/step - loss: 0.2222 - accuracy: 0.9227 - val_loss: 0.1309 - val_accuracy:
Epoch 5/15
0.9537
Epoch 6/15
.
169/169 [===
       ============================ - 99s 585ms/step - loss: 0.1294 - accuracy: 0.9562 - val loss: 0.1674 - val accuracy:
0.9447
Epoch 7/15
0.9597
Epoch 8/15
0.9694
Epoch 9/15
0.9706
Epoch 10/15
169/169 [==========] - 100s 590ms/step - loss: 0.0861 - accuracy: 0.9707 - val_loss: 0.0559 - val_accuracy:
0.9856
Epoch 11/15
169/169 [===
         0.9802
Epoch 12/15
169/169 [===
        0.9694
Epoch 13/15
169/169 [===========] - 108s 640ms/step - loss: 0.0835 - accuracy: 0.9695 - val loss: 0.1395 - val accuracy:
0.9573
Epoch 14/15
169/169 [===
       0.9826
Epoch 15/15
0.9760
<keras.callbacks.Historv at 0x223fe0c5880>
Found 5384 images belonging to 6 classes.
Found 1686 images belonging to 6 classes.
x_train.class_indices
 {'Apple___Black_rot': 0,
  'Apple___healthy': 1,
  'Corn_(maize)___Northern_Leaf_Blight': 2,
  'Corn_(maize)___healthy': 3,
  'Peach Bacterial spot': 4,
  'Peach___healthy': 5}
```

```
In [24]: model=load_model('fruit.h5')
 In [25]: s\IBM Buildathon\\Project Building\\Dataset Plant Disease\\fruit-dataset\\fruit-dataset\\test\\Apple__Black_rot\\00e909aa-e3ae-
 In [26]: img
 Out[26]:
 In [27]: x=image.img_to_array(img)
                                   x=np.expand_dims(x,axis=0)
                                   y=np.argmax(model.predict(x),axis=1)
                                   #x_train.class_indices
                                  index=['Apple_
                                                                                            _Black_rot','Apple___healthy','Corn_(maize)___Northern_Leaf_Blight','Corn_(maize)___healthy','Peach_
                                  index[y[0]]
 Out[27]: 'Apple___Black_rot'
 In [28]: img=image.load_img("C:\\Users\\91978\\Desktop\\Python Projects\\IBM Buildathon\\Project Building\\Dataset Plant Disease\\fruit-dataset Plant Disease\\fr
                                     x=image.img_to_array(img)
                                    x=np.expand_dims(x,axis=0)
                                    y=np.argmax(model.predict(x),axis=1)
                                      #x_train.class_indices
                                    index=['Apple__Black_rot','Apple__healthy','Corn_(maize)__Northern_Leaf_Blight','Corn_(maize)__healthy','Peach__Bacterial_sp
                                   index[y[0]]
                                     4
 Out[28]: 'Apple___healthy'
  In [29]: img=image.load_img("C:\\Users\\91978\\Desktop\\Python Projects\\IBM Buildathon\\Project Building\\Dataset Plant Disease\\fruit-dataset Plant Diseaset Plant Di
                                     x=image.img to array(img)
                                     x=np.expand_dims(x,axis=0)
                                     y=np.argmax(model.predict(x),axis=1)
                                                                 Apple__Black_rot','Apple__healthy','Corn_(maize)__Northern_Leaf_Blight','Corn_(maize)__healthy','Peach__Bacterial_sk
                                   index[y[0]]
                                    4
 Out[29]: 'Corn_(maize)___healthy'
In [30]: img=image.load_img("C:\\Users\\91978\\Desktop\\Python Projects\\IBM Buildathon\\Project Building\\Dataset Plant Disease\\fruit-dataset Plant Disease\fruit-dataset Plant Disease\\fruit-dataset Plant Disease\fruit-dataset Plant Dise
                                  x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
                                  y=np.argmax(model.predict(x),axis=1)
                                  #x_train.class_indices
                                 index=['Apple__Black_rot','Apple__healthy','Corn_(maize)__Northern_Leaf_Blight','Corn_(maize)__healthy','Peach__Bacterial_sg
                                 index[y[0]]
Out[30]: 'Peach___Bacterial_spot'
 In [31]: Building\Dataset Plant Disease\\fruit-dataset\\fruit-dataset\\test\\Corn_(maize)___Northern_Leaf_Blight\\0d0f6d14-be5c-4cb8-adb4
                                  _(maize)___healthy','Peach___Bacterial_spot','Peach___healthy']
 Out[31]: 'Corn_(maize)___Northern_Leaf_Blight'
 In [32]: pject Building\Dataset Plant Disease\\fruit-dataset\\fruit-dataset\\test\\Peach__healthy\\4a87f671-1b68-49cb-bb69-7be29499caba_
                                  ,'Corn_(maize)___healthy','Peach___Bacterial_spot','Peach___healthy']
 Out[32]: 'Peach___healthy'
```

2) Vegetable Dataset- CNN Sequential Model Building

Model: "sequential_6"

Layer (type)	Output Shape	Param #
conv2d_13 (Conv2D)	(None, 126, 126, 32)	896
<pre>max_pooling2d_6 (MaxPooling 2D)</pre>	(None, 63, 63, 32)	0
flatten_6 (Flatten)	(None, 127008)	0
dense_18 (Dense)	(None, 300)	38102700
dense_19 (Dense)	(None, 150)	45150
dense_20 (Dense)	(None, 75)	11325
dense_21 (Dense)	(None, 9)	684

Total params: 38,160,755 Trainable params: 38,160,755 Non-trainable params: 0

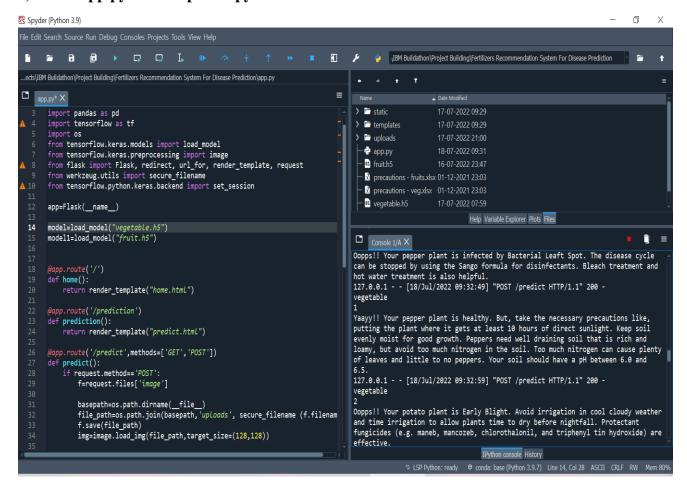
Epoch 12/20
356/356 [====================================
0.8741
Epoch 13/20
356/356 [====================================
0.9163
Epoch 14/20
356/356 [=============] - 194s 546ms/step - loss: 0.1344 - accuracy: 0.9524 - val_loss: 0.0790 - val_accuracy:
0.9722
Epoch 15/20
356/356 [====================================
0.9502
Epoch 16/20
356/356 [====================================
0.9508
Epoch 17/20
356/356 [====================================
0.9669
Epoch 18/20
356/356 [====================================
0.9672
Epoch 19/20
356/356 [====================================
0.9508
Epoch 20/20
356/356 [====================================
0.9833

Found 11386 images belonging to 9 classes. Found 3416 images belonging to 9 classes.

```
x_train.class_indices
   {'Pepper,_bell___Bacterial_spot': 0,
       'Pepper,_bell___healthy': 1,
       'Potato___Early_blight': 2,
        'Potato___Late_blight': 3,
       'Potato___healthy': 4,
       'Tomato Bacterial spot': 5,
        'Tomato___Late_blight': 6,
        'Tomato___Leaf_Mold': 7,
        'Tomato___Septoria_leaf_spot': 8}
In [13]: model=load_model('vegetable.h5')
In [14]: iilding\\Dataset Plant Disease\\Veg-dataset\\Veg-dataset\\test set\\Tomato Septoria leaf spot\\c551c562-b93a-4b2e-9058-12519414
In [15]: img
Out[15]:
In [16]: x=image.img_to_array(img)
                 x=np.expand_dims(x,axis = 0)
In [17]: y=model.predict(x)
In [18]: y
Out[18]: array([[0., 0., 0., 0., 0., 0., 0., 1.]], dtype=float32)
In [19]: x=image.img_to_array(img)
                  x=np.expand_dims(x,axis=0)
                  y=np.argmax(model.predict(x),axis=1)
                  #x_train.class_indices
                 index=['Pepper,_bell__Bacterial_spot','Pepper,_bell__healthy','Potato__Early_blight','Potato__Late_blight','Potato__healthy
                 index[y[0]]
                 4
Out[19]: 'Tomato___Septoria_leaf_spot'
In [26]: thon\\Project Building\\Dataset Plant Disease\\Veg-dataset\\Veg-dataset\\Test_set\\Pepper,_bell__Bacterial_spot\\afd0c913-1e90-4
                Early_blight','Potato__Late_blight','Potato__healthy','Tomato__Bacterial_spot','Tomato__Late_blight','Tomato__Leaf_Mold','To
Out[26]: 'Pepper,_bell___Bacterial_spot'
In [10]: \IBM Buildathon\\Project Building\\Dataset Plant Disease\\Veg-dataset\\Veg-dataset\\test_\Set\\Pepper,_bell__healthy\\b91d515b-9for the state of the sta
                ,'Potato___Early_blight','Potato___Late_blight','Potato___healthy','Tomato___Bacterial_spot','Tomato___Late_blight','Tomato___Lea
Out[10]: 'Pepper,_bell___healthy'
```

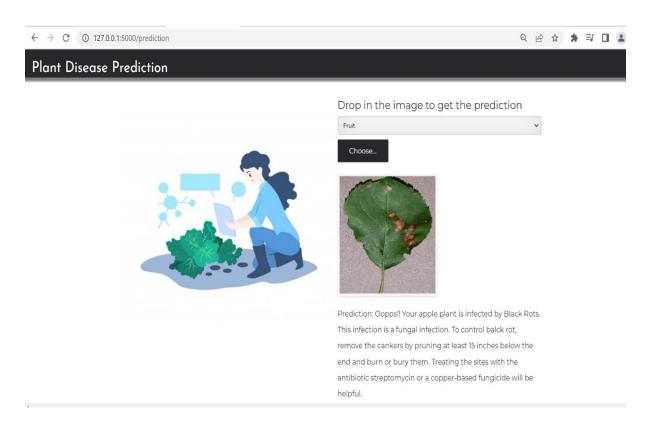
```
In [11]: Buildathon\\Project Building\\Dataset Plant Disease\\Veg-dataset\\Veg-dataset\\test_set\\Potato___Early_blight\\c03a3f69-00b7-4aa
         ato__Early_blight','Potato__Late_blight','Potato__healthy','Tomato__Bacterial_spot','Tomato__Late_blight','Tomato__Leaf_Mol
 Out[11]: 'Potato___Early_blight'
 In [13]: aset Plant Disease\Veg-dataset\Veg-dataset\\test_set\\Potato__healthy\\b42621c3-f751-46e1-a8d2-83ed85b90554__RS_HL 1740.jpg",
         e_blight','Potato__healthy','Tomato__Bacterial_spot','Tomato__Late_blight','Tomato__Leaf_Mold','Tomato__Septoria_leaf_spot']
 Out[13]: 'Potato__healthy'
In [26]: ject Building\Dataset Plant Disease\Veg-dataset\Veg-dataset\Tomato__Late_blight\b6a42b14-eb81-4e7b-9ca7-be9bed86c
        ght','Potato__Late_blight','Potato__healthy','Tomato__Bacterial_spot','Tomato__Late_blight','Tomato__Leaf_Mold','Tomato__Se
Out[26]: 'Tomato___Late_blight'
In [41]: img
Out[41]:
```

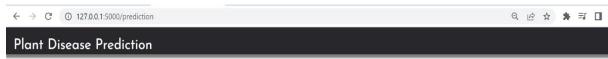
3) Flask App python script on Spyder IDE

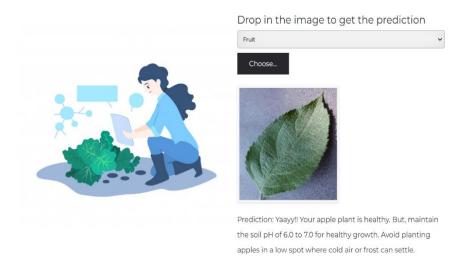


4) Prediction results on HTML page

For Fruits:



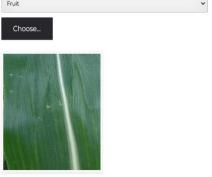




Plant Disease Prediction



Drop in the image to get the prediction



Prediction: Yaayy!! Your corn plant is healthy. But, maintain the soil consistently moist, but not soggy and only need fertilizer every 6 months. It prefers temperatures of 75 to 80 degrees F.

← → C ③ 127.0.0.1:5000/prediction



Plant Disease Prediction



Drop in the image to get the prediction



Fruit

Choose.

Prediction: Oopps!! Your corn plant is infected by Northern Leaf Blight. The primary management strategy to reduce the incidence and severity of NCLB is planting resistant products. Using fungicides is also helpful.

Plant Disease Prediction



Drop in the image to get the prediction



Choose...

Prediction: Oopps!! Your peach plant is infected by Bacterial Spots. This is a difficult disease to control when environmental conditions favor pathogen spread.

Compounds for the treatment include copper, oxytetracycline (Mycoshield and generic equivalents), and syllit+captan; however, repeated applications are typically necessary for even minimal disease control.

 \leftarrow \rightarrow \mathbf{C} (i) 127.0.0.1:5000/prediction



Plant Disease Prediction



Drop in the image to get the prediction

Fruit

Choose...

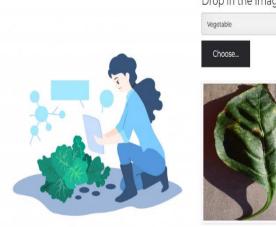
Prediction: Yaayy!! Your peach plant is healthy. But, you should have deep sandy soil that ranges from a loam to a clay loam for healthy growth. Poor drainage in the soil will kill the root system of growing peach trees, so make sure the soil is well drained. Growing peach trees prefer a soil pH of around 6.5.

For Vegetatbles:



日 ☆ ★ 司 □

Plant Disease Prediction



Drop in the image to get the prediction



Prediction: Oopps!! Your pepper plant is infected by Bacterial Leaft Spot. The disease cycle can be stopped by using the Sango formula for disinfectants. Bleach treatment and hot water treatment is also helpful.

의 순 ☆ # 및 □

Plant Disease Prediction



Drop in the image to get the prediction

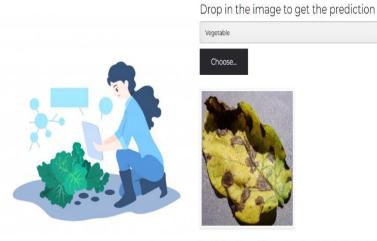


Choose..

Prediction: Yaayy!! Your pepper plant is healthy. But, take the necessary precautions like, putting the plant where it gets at $% \left(1\right) =\left(1\right) \left(1\right) +\left(1\right) \left(1\right) \left(1\right) +\left(1\right) \left(1\right) \left($ least 10 hours of direct sunlight. Keep soil evenly moist for good growth. Peppers need well draining soil that is rich and loamy, but avoid too much nitrogen in the soil. Too much nitrogen can cause plenty of leaves and little to no peppers. Your soil should have a pH between 6.0 and 6.5.

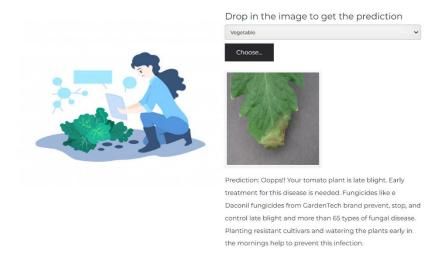


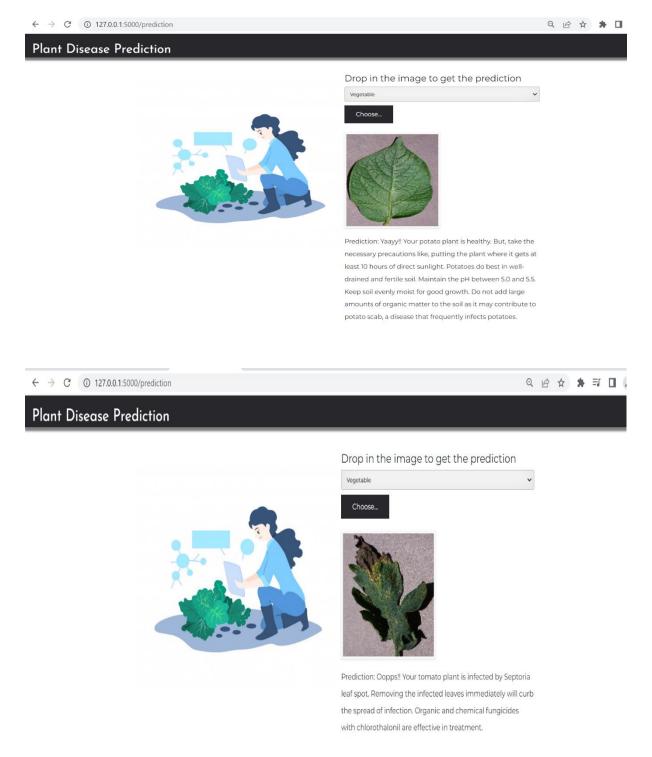
Plant Disease Prediction



Prediction: Oopps!! Your potato plant is Early Blight. Avoid irrigation in cool cloudy weather and time irrigation to allow plants time to dry before nightfall. Protectant fungicides (e.g. maneb, mancozeb, chlorothalonil, and triphenyl tin hydroxide) are effective.







As CUH is 0, instead of IBM cloud deployment, local deployment is done and integrated with Flask App for prediction.