

In [1]:

```
ls
```

In [2]:

```
pwd
```

Out[2]: '/home/wsuser/work'

In [8]:

```
!pip install keras==2.7.0
!pip install tensorflow==2.5.0
```

```
Collecting keras==2.7.0
  Using cached keras-2.7.0-py2.py3-none-any.whl (1.3 MB)
Installing collected packages: keras
  Attempting uninstall: keras
    Found existing installation: Keras 2.2.4
    Uninstalling Keras-2.2.4:
      Successfully uninstalled Keras-2.2.4
  Successfully installed keras-2.7.0
Requirement already satisfied: tensorflow==2.5.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.5.0)
Requirement already satisfied: protobuf>=3.9.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (3.19.1)
Requirement already satisfied: h5py~=3.1.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (3.1.0)
Requirement already satisfied: astunparse~=1.6.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.6.3)
Requirement already satisfied: keras-nightly~=2.5.0.dev in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (2.5.0.dev2021032900)
Requirement already satisfied: termcolor~=1.1.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.1.0)
Requirement already satisfied: flatbuffers~=1.12.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.12)
Requirement already satisfied: wrapt~=1.12.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.12.1)
Requirement already satisfied: six~=1.15.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.15.0)
Requirement already satisfied: tensorflow-estimator<2.6.0,>=2.5.0rc0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (2.5.0)
Requirement already satisfied: typing-extensions~=3.7.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (3.7.4.3)
Requirement already satisfied: keras-preprocessing~=1.1.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.1.2)
Requirement already satisfied: absl-py~=0.10 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.12.0)
Requirement already satisfied: grpcio~=1.34.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.34.1)
Requirement already satisfied: numpy~=1.19.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (1.19.5)
Requirement already satisfied: google-pasta~=0.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.2.0)
Requirement already satisfied: wheel~=0.35 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.37.0)
Requirement already satisfied: opt-einsum~=3.3.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (3.3.0)
```

Requirement already satisfied: markdown>=2.6.8 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (3.3.3)

Requirement already satisfied: werkzeug>=0.11.15 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.0.2)

Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.6.1)

Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (1.6.0)

Requirement already satisfied: setuptools>=41.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (58.0.4)

Requirement already satisfied: requests<3,>=2.21.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (2.26.0)

Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard~=2.5->tensorflow==2.5.0) (0.4.4)

Requirement already satisfied: pyasn1-modules>=0.2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (0.2.8)

Requirement already satisfied: cachetools<5.0,>=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (4.2.2)

Requirement already satisfied: rsa<5,>=3.1.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (4.7.2)

Requirement already satisfied: requests-oauthlib>=0.7.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5->tensorflow==2.5.0) (1.3.0)

Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard~=2.5->tensorflow==2.5.0) (0.4.8)

Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2.0.4)

Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (2022.9.24)

Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (3.3)

Requirement already satisfied: urllib3<1.27,>=1.21.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard~=2.5->tensorflow==2.5.0) (1.26.7)

Requirement already satisfied: oauthlib>=3.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.5->tensorflow==2.5.0) (3.2.1)

Image Augmentation

```
In [9]: from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
In [10]: train_datagen=ImageDataGenerator(rescale=1./255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)
```

```
In [11]: test_datagen=ImageDataGenerator(rescale=1./255)
```

```
In [12]: ls
```

```
In [13]: pwd
```

```
Out[13]: '/home/wsuser/work'
```

```
In [14]: import os, types
import pandas as pd
from boto3.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
client_4ff9f1114db24196a9abd4f5c1f0b60a = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='j4lNXsstk5SxQiDx3pbNR_eFi1SMCDE6MFNBQ_EmNCDM',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

streaming_body_1 = client_4ff9f1114db24196a9abd4f5c1f0b60a.get_object(Bucket='trainmodel-donotdelete-pr-cbqe37eh8gzes', Key='fruit-dataset.zip')['Bod
```

```
In [15]: from io import BytesIO
import zipfile
unzip = zipfile.ZipFile(BytesIO(streaming_body_1.read()), "r")
file_paths = unzip.namelist()
for path in file_paths:
    unzip.extract(path)
```

```
In [16]: pwd
```

```
Out[16]: '/home/wsuser/work'
```

```
In [17]: import os
filenames = os.listdir('/home/wsuser/work/fruit-dataset/train')
```

```
In [18]: x_train=train_datagen.flow_from_directory("/home/wsuser/work/fruit-dataset/train",target_size=(128,128),class_mode='categorical',batch_size=24)

Found 5384 images belonging to 6 classes.
```

```
In [ ]:
```

```
In [19]: x_test=test_datagen.flow_from_directory(r"/home/wsuser/work/fruit-dataset/test",target_size=(128,128),
class_mode='categorical',batch_size=24)

Found 1686 images belonging to 6 classes.
```

```
In [20]: x_train.class_indices
```

```
Out[20]: {'Apple__Black_rot': 0,
'Apple_healthy': 1,
```

CNN

```
In [21]: from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Convolution2D, MaxPooling2D, Flatten
```

```
In [24]: model=Sequential()
```

```
In [25]: model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

```
In [26]: model.add(MaxPooling2D(pool_size=(2,2)))
```

```
In [27]: model.add(Flatten())
```

```
In [28]: model.summary()
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d (MaxPooling2D)	(None, 63, 63, 32)	0
flatten (Flatten)	(None, 127008)	0

=====
Total params: 896
Trainable params: 896
Non-trainable params: 0
=====

```
In [29]: 32*(3*3*3+1)
```

```
Out[29]: 896
```

Hidden Layers

```
In [30]: model.add(Dense(300,activation='relu'))
         model.add(Dense(150,activation='relu'))
```

Output Layer

```
In [31]: model.add(Dense(6,activation='softmax'))
```

```
In [32]: model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
```

```
In [33]: len(x_train)
```

```
Out[33]: 225
```

```
In [34]: 1238/24
```

```
Out[34]: 51.583333333333336
```

```
In [35]: model.fit_generator(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test),epochs=10)
```

```
/tmp/wsuser/ipykernel_164/1582812018.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=len(x_test),epochs=10)
```

```
Epoch 1/10
```

```
225/225 [=====] - 118s 520ms/step - loss: 0.8920 - accuracy: 0.8094 - val_loss: 0.2273 - val_accuracy: 0.9235
```

```
Epoch 2/10
```

```
225/225 [=====] - 116s 515ms/step - loss: 0.2367 - accuracy: 0.9179 - val_loss: 0.2056 - val_accuracy: 0.9324
```

```
Epoch 3/10
```

```
225/225 [=====] - 116s 517ms/step - loss: 0.1970 - accuracy: 0.9337 - val_loss: 0.4972 - val_accuracy: 0.8754
```

```
Epoch 4/10
```

```
225/225 [=====] - 117s 521ms/step - loss: 0.1688 - accuracy: 0.9422 - val loss: 0.2279 - val accuracy: 0.9217
```


Saving Model

In [36]: `ls`

`fruit-dataset/`

In [37]: `model.save('fruit.h5')`

In [40]: `!tar -zcvf Train-model_new.tgz fruit.h5`

`fruit.h5`

In [39]: `ls -l`

`fruit-dataset/`

`fruit.h5`

`Train-model_new.tgz`

IBM Cloud Deployment Model

In [41]: `!pip install watson-machine-learning-client --upgrade`

```
In [43]: from ibm_watson_machine_learning import APIClient

wml_credentials = {
    "url": "https://us-south.ml.cloud.ibm.com",
    "apikey": "0P3XkyCFYqABnc48BNG2ReoGAJy-oDXDRuULl4Y_zFxa"
}

client = APIClient(wml_credentials)
```

```
In [44]: client = APIClient(wml_credentials)
```

```
In [45]: def guid_from_space_name(client, space_name):
    space = client.spaces.get_details()
    return(next(item for item in space['resources'] if item['entity']['name']==space_name)['metadata']['id'])
```

```
In [46]: space_uid = guid_from_space_name(client, 'Trainmodel')
print("Space UID = " + space_uid)
```

Space UID = 616c7d74-e99b-4c09-9922-27394a62c2d0

```
In [47]: client.set_default_space(space_uid)
```

Out[47]: 'SUCCESS'

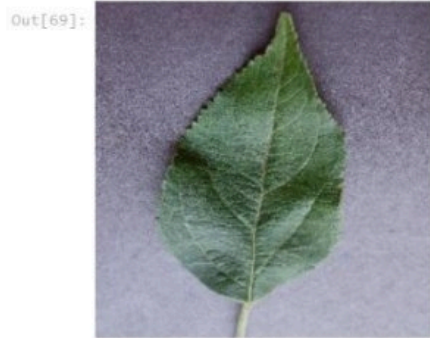
```
In [48]: client.software_specifications.list()
```

NAME	ASSET_ID	TYPE
default_py3.6	0062b8c9-8b7d-44a0-a9b9-46c416adcdbd9	base
kernel-spark3.2-scala2.12	020d69ce-7ac1-5e68-ac1a-31189867356a	base
pytorch-onnx_1.3-py3.7-edt	069ea134-3346-5748-b513-49120e15d288	base
scikit-learn_0.20-py3.6	09c5a1d0-9c1e-4473-a344-eb7b665ff687	base
spark-mllib_3.0-scala_2.12	09f4cff0-90a7-5899-b9ed-1ef348aebdee	base
pytorch-onnx_rt22.1-py3.9	0b848dd4-e681-5599-be41-b5f6fccc6471	base
ai-function_0.1-py3.6	0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda	base
shiny-r3.6	0e6e79df-875e-4f24-8ae9-62dcc2148306	base
tensorflow_2.4-py3.7-horovod	1092590a-307d-563d-9b62-4eb7d64b3f22	base
pytorch_1.1-py3.6	10ac12d6-6b30-4ccd-8392-3e922c096a92	base


```
In [55]: model=load_model('fruit.h5')
```

```
In [68]: img=image.load_img(r"C:\Users\Sree Ram\Desktop\ibm\Dataset Plant Disease\fruit-dataset\fruit-dataset\test\Apple___healthy\0adc1c5b-8958-47c0-a152-f280
```

```
In [69]: img
```



```
In [70]: img=image.load_img(r"C:\Users\Sree Ram\Desktop\ibm\Dataset Plant Disease\fruit-dataset\fruit-dataset\test\Apple___healthy\0adc1c5b-8958-47c0-a152-f280  
img
```



```
In [71]: x=image.img_to_array(img)
```

```
In [78]: index[y[0]]
```

```
Out[78]: 'Apple__healthy'
```

```
In [82]: img=image.load_img(r"C:\Users\Sree Ram\Desktop\libm\Dataset Plant Disease\fruit-dataset\fruit-dataset\test\Peach__healthy\0a2ed402-5d23-4e8d-bc98-b264
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['Apple__Black_rot','Apple__healthy','Corn_(maize)__Northern_Leaf_Blight','Corn_(maize)__healthy','Peach__Bacterial_spot','Peach__healthy']
index[y[0]]
```

```
1/1 [=====] - 0s 26ms/step
```

```
Out[82]: 'Corn_(maize)__healthy'
```

```
In [83]: import os
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask,render_template,request
```

```
In [61]: app=Flask(__name__)

model=load_model("fruit.h5")

@app.route('/')
def index():
    return render_template("index.html")

@app.route('/predict',methods=['GET','POST'])
def upload():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname('__file__')
        filepath=os.path.join(basepath,'uploads',f.filename)
        f.save(filepath)
        img=image.load_img(filepath,target_size=(128,128))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
        pred=np.argmax(model.predict(x),axis=1)
        index=['Apple__Black_rot','Apple__healthy','Corn_(maize)__Northern_Leaf_Blight','Corn_(maize)__healthy','Peach__Bacterial_spot','Peach__
        text="The Classified Fruit disease is : " +str(index[pred[0]])
```