In [1]:
```
pwd
```

Out[1]:
```
'/home/wsuser/work'
```

In [2]:
```
!pip install keras
!pip install tensorflow
```

```
Requirement already satisfied: keras in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.7.0)
Requirement already satisfied: tensorflow in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.7.2)
Requirement already satisfied: opt-einsum>=2.3.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflo
w) (3.3.0)
Requirement already satisfied: flatbuffers<3.0,>=1.12 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tens
orflow) (2.0)
Requirement already satisfied: numpy>=1.14.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow)
(1.20.3)
Requirement already satisfied: protobuf>=3.9.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow)
(3.19.1)
Requirement already satisfied: h5py>=2.9.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow) (3.
2.1)
Requirement already satisfied: termcolor>=1.1.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflo
w) (1.1.0)
Requirement already satisfied: typing-extensions>=3.6.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from te
nsorflow) (4.1.1)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.21.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packa
ges (from tensorflow) (0.23.1)
Requirement already satisfied: tensorflow-estimator<2.8,~=2.7.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages
```

In [3]:
```
from keras_preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Convolution2D,MaxPool2D,Flatten
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import glob
from keras.layers import Dense,Dropout,Flatten
from tensorflow.keras.utils import load_img
from tensorflow.keras.utils import img_to_array
import matplotlib.pyplot as plt
from tensorflow import keras
```

In [4]:
```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
test_datagen=ImageDataGenerator(rescale=1./255)
```

In [5]:
```
ls
```

```
fruit-dataset/  fruit.h5  Train-model_new.tgz
```

In [6]:
```
pwd
```

Out[6]:
```
'/home/wsuser/work'
```

Out[6]: '/home/wsuser/work'

In [7]:

```
import os, types
import pandas as pd
from botocore.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.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='VXwJbBVwSo3eCCTSUtoXhBDOe2pwYmY8t8_BVHJUmXq_',
    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')

bucket = 'fertilizersrecommendationsystemfo-donotdelete-pr-hj0oq6vtl4tkzv'
object_key = 'fruit-dataset.zip'

streaming_body_1 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']

# Your data file was loaded into a botocore.response.StreamingBody object.
# Please read the documentation of ibm_boto3 and pandas to learn more about the possibilities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/
# pandas documentation: http://pandas.pydata.org/
```

In [8]:
```
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 [9]:
```
pwd
```

Out[9]:
```
'/home/wsuser/work'
```

In [10]:
```
import os
filenames = os.listdir('/home/wsuser/work/fruit-dataset/train')
```

In [11]:
```
x_train=train_datagen.flow_from_directory("/home/wsuser/work/fruit-dataset/train",target_size=(128,128),class_mode='categ
```

```
Found 5384 images belonging to 6 classes.
```

In [12]:
```
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 [13]:
```
x_train.class_indices
```

In [14]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
```

In [15]:
```
model=Sequential()
```

In [16]:
```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (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 [17]:
```
32*(3*3*3+1)
```

Out[17]: 896

In [18]:
```
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
```

In [19]:
```
model.add(Dense(6,activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)
```

Out[19]: 225

In [20]:
```
1238/24
```

Out[20]: 51.583333333333336

In [21]:
```
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_2332/1582812018.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a futu
re 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 [==============================] - 147s 651ms/step - loss: 1.2149 - accuracy: 0.7769 - val_loss: 0.2250 - val_accu
```

In [22]:
```
ls
```

```
fruit-dataset/  fruit.h5  Train-model_new.tgz
```

In [23]:
```
model.save('fruit.h5')
!tar -zcvf Train-model_new.tgz fruit.h5
```

```
fruit.h5
```

In [24]:
```
ls -1
```

```
fruit-dataset/
fruit.h5
Train-model_new.tgz
```

In [25]:
```
!pip install watson-machine-learning-client --upgrade
```

```
Requirement already satisfied: watson-machine-learning-client in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages
(1.0.391)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-lear
ning-client) (2022.9.24)
Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learn
ing-client) (1.3.4)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-lear
ning-client) (1.26.7)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learn
ing-client) (0.3.3)
Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learni
ng-client) (1.18.21)
```

```
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watso
n-machine-learning-client) (1.20.3)
```

In [26]:
```
from ibm_watson_machine_learning import APIClient

wml_credentials = {
                    "url": "https://us-south.ml.cloud.ibm.com",
                   "apikey":"cEntwwiS8tR7_sNwMuuHeAjSopI2Usjj8Z0jH-ODosr9"
                  }

client = APIClient(wml_credentials)
```

In [27]:
```
client = APIClient(wml_credentials)
```

In [46]:
```
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 [48]:
```
space_uid = guid_from_space_name(client,'fruit')
print('Space UID='+ space_uid)
```

```
Space UID=3be55de8-a04a-4392-bc86-79c17ceae9ac
```

In [49]:
```
client.set.default_space(space_uid)
```

Out[49]:
```
'SUCCESS'
```

In [57]:
```
client.software_specifications.list()
```

NAME	ASSET_ID	TYPE
default_py3.6	0062b8c9-8b7d-44a0-a9b9-46c416adcbd9	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
tensorflow_1.15-py3.6-ddl	111e41b3-de2d-5422-a4d6-bf776828c4b7	base
autoai-kb_rt22.2-py3.10	125b6d9a-5b1f-5e8d-972a-b251688ccf40	base
runtime-22.1-py3.9	12b83a17-24d8-5082-900f-0ab31fbfd3cb	base
scikit-learn_0.22-py3.6	154010fa-5b3b-4ac1-82af-4d5ee5abbc85	base
default_r3.6	1b70aec3-ab34-4b87-8aa0-a4a3c8296a36	base
pytorch-onnx_1.3-py3.6	1bc6029a-cc97-56da-b8e0-39c3880dbbe7	base
kernel-spark3.3-r3.6	1c9e5454-f216-59dd-a20e-474a5cdf5988	base
pytorch-onnx_rt22.1-py3.9-edt	1d362186-7ad5-5b59-8b6c-9d0880bde37f	base
tensorflow_2.1-py3.6	1eb25b84-d6ed-5dde-b6a5-3fbdf1665666	base
spark-mllib_3.2	20047f72-0a98-58c7-9ff5-a77b012eb8f5	base
tensorflow_2.4-py3.8-horovod	217c16f6-178f-56bf-824a-b19f20564c49	base
runtime-22.1-py3.9-cuda	26215f05-08c3-5a41-a1b0-da66306ce658	base
do_py3.8	295addb5-9ef9-547e-9bf4-92ae3563e720	base
autoai-ts_3.8-py3.8	2aa0c932-798f-5ae9-abd6-15e0c2402fb5	base
tensorflow_1.15-py3.6	2b73a275-7cbf-420b-a912-eae7f436e0bc	base
kernel-spark3.3-py3.9	2b7961e2-e3b1-5a8c-a491-482c8368839a	base
pytorch_1.2-py3.6	2c8ef57d-2687-4b7d-acce-01f94976dac1	base

In [69]:
```
software_space_uid = client.software_specifications.get_uid_by_name('tensorflow_rt22.1-py3.9')
print="software_spec_uid"
```

In [70]:
```
 ls
```

```
fruit-dataset/  fruit.h5  Train-model_new.tgz
```

In [71]:
```
model_details = client.repository.store_model(model= 'Train-model_new.tgz',
    meta_props={
        client.repository.ModelMetaNames.NAME:"CNN",
        client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
        client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid}
    )
```

In [72]:
```
model_id = client.repository.get_model_id(model_details)
```

In [73]:
```
model_id
```

Out[73]:
```
'434bfd2d-7969-4cce-ae01-68518db6877b'
```

In [116…
```
ls
```

```
fruit-dataset/  fruit.h5  Train-model_new.tgz
```