DATA COLLECTION AND PREPROCESSING

Nutrition image Analysis using CNN

In [ ]:
```
!unzip '/content/Dataset-Fruit.zip'
```

```
Archive:  /content/Dataset-Fruit.zip
replace Dataset/TRAIN_SET/PINEAPPLE/25_100.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
```

Importing Necessary Libraries

In [ ]:
```
import numpy as np#used for numerical analysis
import tensorflow #open source used for both ML and DL for computation
from tensorflow.keras.models import Sequential #it is a plain stack of layers
from tensorflow.keras import layers #A layer consists of a tensor-in tensor-out computation function
#Dense layer is the regular deeply connected neural network layer
from tensorflow.keras.layers import Dense,Flatten
#Faltten-used fot flattening the input or change the dimension
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout #Convolutional layer
#MaxPooling2D-for downsampling the image
from keras.preprocessing.image import ImageDataGenerator
```

Image Data Augmentation

In [ ]:
```
#setting parameter for Image Data agumentation to the training data
train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
#Image Data agumentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)
```

Loading our data and performing data augmentation

In [ ]:
```
#performing data agumentation to train data
x_train = train_datagen.flow_from_directory(
    r'/content/Dataset/TRAIN_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
#performing data agumentation to test data
x_test = test_datagen.flow_from_directory(
    r'/content/Dataset/TEST_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

```
Found 4118 images belonging to 5 classes.
Found 1500 images belonging to 5 classes.
```

In [ ]:
```
print(x_train.class_indices)#checking the number of classes
```

```
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

In [ ]:
```
print(x_test.class_indices)#checking the number of classes
```

```
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

In [ ]:
```
from collections import Counter as c
c(x_train .labels)
```

Out[ ]:
```
Counter({0: 995, 1: 1354, 2: 1019, 3: 275, 4: 475})
```

In [ ]:
```
from collections import Counter as c
c(x_test .labels)
```

Out[ ]:
```
Counter({0: 266, 1: 415, 2: 248, 3: 224, 4: 347})
```

Creating the Model

In [ ]:

```
# Initializing the CNN
classifier = Sequential()

# First convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Second convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), activation='relu'))

# input_shape is going to be the pooled feature maps from the previous convolution layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Flattening the layers
classifier.add(Flatten())

# Adding a fully connected layer
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax')) # softmax for more than 2
```

In [ ]:

```
classifier.summary()#summary of our model
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 62, 62, 32)        896

 max_pooling2d (MaxPooling2D  (None, 31, 31, 32)       0
 )

 conv2d_1 (Conv2D)           (None, 29, 29, 32)        9248

 max_pooling2d_1 (MaxPooling  (None, 14, 14, 32)       0
 2D)

 flatten (Flatten)           (None, 6272)              0

 dense (Dense)               (None, 128)               802944

 dense_1 (Dense)             (None, 5)                 645

=================================================================
Total params: 813,733
Trainable params: 813,733
Non-trainable params: 0
_________________________________________________________________
```

Compiling The Model

In [ ]:

```
# Compiling the CNN
# categorical_crossentropy for more than 2
classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

Fitting the Model

In [ ]:

```
classifier.fit_generator(
        generator=x_train,steps_per_epoch = len(x_train),
        epochs=10, validation_data=x_test,validation_steps = len(x_test))# No of images in test set
```

```
Epoch 1/10
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future ver
sion. Please use `Model.fit`, which supports generators.
  This is separate from the ipykernel package so we can avoid doing imports until
824/824 [==============================] - 21s 15ms/step - loss: 0.5833 - accuracy: 0.7763 - val_loss: 0.3058 - val_accuracy: 0.8800
Epoch 2/10
824/824 [==============================] - 12s 14ms/step - loss: 0.4275 - accuracy: 0.8397 - val_loss: 0.3872 - val_accuracy: 0.8607
Epoch 3/10
824/824 [==============================] - 12s 15ms/step - loss: 0.3700 - accuracy: 0.8592 - val_loss: 0.2694 - val_accuracy: 0.8953
Epoch 4/10
824/824 [==============================] - 12s 14ms/step - loss: 0.3420 - accuracy: 0.8757 - val_loss: 0.2661 - val_accuracy: 0.9073
Epoch 5/10
824/824 [==============================] - 12s 14ms/step - loss: 0.3328 - accuracy: 0.8686 - val_loss: 0.2589 - val_accuracy: 0.9047
Epoch 6/10
824/824 [==============================] - 12s 14ms/step - loss: 0.2955 - accuracy: 0.8849 - val_loss: 0.2387 - val_accuracy: 0.9153
Epoch 7/10
824/824 [==============================] - 12s 14ms/step - loss: 0.2863 - accuracy: 0.8864 - val_loss: 0.2547 - val_accuracy: 0.9087
Epoch 8/10
824/824 [==============================] - 16s 19ms/step - loss: 0.2620 - accuracy: 0.8980 - val_loss: 0.2273 - val_accuracy: 0.9160
Epoch 9/10
824/824 [==============================] - 12s 14ms/step - loss: 0.2456 - accuracy: 0.9041 - val_loss: 0.2191 - val_accuracy: 0.9227
Epoch 10/10
824/824 [==============================] - 12s 14ms/step - loss: 0.2408 - accuracy: 0.9114 - val_loss: 0.2333 - val_accuracy: 0.9233
```

t[ ]:

Saving Our Model

```
[ ]: # Save the model
     classifier.save('nutrition.h5')
```

```
[ ]: !tar -zcvf nutrition-analysis.tgz nutrition.h5
```

```
nutrition.h5
```

IBM Deployment

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

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting watson-machine-learning-client
  Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)
     |████████████████████████████████| 538 kB 40.7 MB/s
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (4.64.1)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2022.9.24)
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.3.5)
Collecting boto3
  Downloading boto3-1.26.3-py3-none-any.whl (132 kB)
     |████████████████████████████████| 132 kB 74.7 MB/s
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (2.23.0)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (0.8.10)
Collecting lomond
  Downloading lomond-0.3.3-py2.py3-none-any.whl (35 kB)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from watson-machine-learning-client) (1.24.3)
Collecting ibm-cos-sdk
  Downloading ibm-cos-sdk-2.12.0.tar.gz (55 kB)
     |████████████████████████████████| 55 kB 4.5 MB/s
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
Collecting s3transfer<0.7.0,>=0.6.0
  Downloading s3transfer-0.6.0-py3-none-any.whl (79 kB)
     |████████████████████████████████| 79 kB 9.5 MB/s
Collecting botocore<1.30.0,>=1.29.3
  Downloading botocore-1.29.3-py3-none-any.whl (9.8 MB)
```

```
     |████████████████████████████████| 9.8 MB 55.1 MB/s
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/li
b/python3.7/dist-packages (from botocore<1.30.0,>=1.29.3->boto3->watson-mac
hine-learning-client) (2.8.2)
Collecting urllib3
  Downloading urllib3-1.26.12-py2.py3-none-any.whl (140 kB)
     |████████████████████████████████| 140 kB 72.7 MB/s
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-pa
ckages (from python-dateutil<3.0.0,>=2.1->botocore<1.30.0,>=1.29.3->boto3->
watson-machine-learning-client) (1.15.0)
Collecting ibm-cos-sdk-core==2.12.0
  Downloading ibm-cos-sdk-core-2.12.0.tar.gz (956 kB)
     |████████████████████████████████| 956 kB 64.8 MB/s
Collecting ibm-cos-sdk-s3transfer==2.12.0
  Downloading ibm-cos-sdk-s3transfer-2.12.0.tar.gz (135 kB)
     |████████████████████████████████| 135 kB 70.2 MB/s


     |████████████████████████████████| 135 kB 70.2 MB/s
Collecting jmespath<2.0.0,>=0.7.1
  Downloading jmespath-0.10.0-py2.py3-none-any.whl (24 kB)
Collecting requests
  Downloading requests-2.28.1-py3-none-any.whl (62 kB)
     |████████████████████████████████| 62 kB 1.4 MB/s
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dis
t-packages (from requests->watson-machine-learning-client) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/p
ython3.7/dist-packages (from requests->watson-machine-learning-client) (2.1
.1)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dis
t-packages (from pandas->watson-machine-learning-client) (2022.5)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/di
st-packages (from pandas->watson-machine-learning-client) (1.21.6)
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-
cos-sdk-s3transfer
  Building wheel for ibm-cos-sdk (setup.py) ... done
  Created wheel for ibm-cos-sdk: filename=ibm_cos_sdk-2.12.0-py3-none-any.w
hl size=73930 sha256=5a654d2d0a1c0d22dec4f9c66713861e46016547e25613fa5ceb06
203ada9a15
  Stored in directory: /root/.cache/pip/wheels/ec/94/29/2b57327cf00664b6614
304f7958abd29d77ea0e5bbece2ea57
  Building wheel for ibm-cos-sdk-core (setup.py) ... done
  Created wheel for ibm-cos-sdk-core: filename=ibm_cos_sdk_core-2.12.0-py3-
none-any.whl size=562962 sha256=3336cef3e85aa6bba0b3d73be5a6d6cc4d08b22f163
0e12a3625b56b11590a1d
  Stored in directory: /root/.cache/pip/wheels/64/56/fb/5cd6f4f40406c828a52
89b95b2752a4d142a9afb359244ed8d
  Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done
  Created wheel for ibm-cos-sdk-s3transfer: filename=ibm_cos_sdk_s3transfer
-2.12.0-py3-none-any.whl size=89778 sha256=c45ff7c36bbf526020a089fc8e985cb2
107b396886588c14e2ae0edcd4c1f7b1
  Stored in directory: /root/.cache/pip/wheels/57/79/6a/ffe3370ed7ebc00604f
9f76766e1e0348dcdcad2b2e32df9e1
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
Installing collected packages: urllib3, requests, jmespath, ibm-cos-sdk-cor
e, botocore, s3transfer, ibm-cos-sdk-s3transfer, lomond, ibm-cos-sdk, boto3
, watson-machine-learning-client
```

```
  Attempting uninstall: urllib3
    Found existing installation: urllib3 1.24.3
    Uninstalling urllib3-1.24.3:
      Successfully uninstalled urllib3-1.24.3
  Attempting uninstall: requests
    Found existing installation: requests 2.23.0
    Uninstalling requests-2.23.0:
      Successfully uninstalled requests-2.23.0
Successfully installed boto3-1.26.3 botocore-1.29.3 ibm-cos-sdk-2.12.0 ibm-
cos-sdk-core-2.12.0 ibm-cos-sdk-s3transfer-2.12.0 jmespath-0.10.0 lomond-0.
3.3 requests-2.28.1 s3transfer-0.6.0 urllib3-1.26.12 watson-machine-learnin
g-client-1.0.391
```

In [ ]:

```
!pip install ibm_watson_machine_learning
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/cola
b-wheels/public/simple/
Collecting ibm_watson_machine_learning
  Downloading ibm_watson_machine_learning-1.0.257-py3-none-any.whl (1.8 MB)
     |████████████████████████████████| 1.8 MB 28.2 MB/s
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /usr/local/lib/pyth
on3.7/dist-packages (from ibm_watson_machine_learning) (1.3.5)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-pac
kages (from ibm_watson_machine_learning) (1.26.12)
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-p
ackages (from ibm_watson_machine_learning) (21.3)
Requirement already satisfied: lomond in /usr/local/lib/python3.7/dist-pack
ages (from ibm_watson_machine_learning) (0.3.3)
Requirement already satisfied: tabulate in /usr/local/lib/python3.7/dist-pa
ckages (from ibm_watson_machine_learning) (0.8.10)
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-pa
ckages (from ibm_watson_machine_learning) (2.28.1)
Collecting ibm-cos-sdk==2.7.*
  Downloading ibm-cos-sdk-2.7.0.tar.gz (51 kB)
     |████████████████████████████████| 51 kB 872 kB/s
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3
.7/dist-packages (from ibm_watson_machine_learning) (4.13.0)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-pac
kages (from ibm_watson_machine_learning) (2022.9.24)
Collecting ibm-cos-sdk-core==2.7.0
  Downloading ibm-cos-sdk-core-2.7.0.tar.gz (824 kB)
     |████████████████████████████████| 824 kB 59.5 MB/s
Collecting ibm-cos-sdk-s3transfer==2.7.0
  Downloading ibm-cos-sdk-s3transfer-2.7.0.tar.gz (133 kB)
     |████████████████████████████████| 133 kB 62.4 MB/s
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /usr/local/lib/pyt
hon3.7/dist-packages (from ibm-cos-sdk==2.7.*->ibm_watson_machine_learning)
(0.10.0)
Collecting docutils<0.16,>=0.10
  Downloading docutils-0.15.2-py3-none-any.whl (547 kB)
     |████████████████████████████████| 547 kB 68.0 MB/s
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /usr/local/li
b/python3.7/dist-packages (from ibm-cos-sdk-core==2.7.0->ibm-cos-sdk==2.7.*
->ibm_watson_machine_learning) (2.8.2)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dis
t-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (2022.
5)
```

```
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.7/di
st-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (1.21
.6)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-pa
ckages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-core==2.7.0->ibm-cos-
sdk==2.7.*->ibm_watson_machine_learning) (1.15.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.7/dis
t-packages (from requests->ibm_watson_machine_learning) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in /usr/local/lib/p
ython3.7/dist-packages (from requests->ibm_watson_machine_learning) (2.1.1)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/p
ython3.7/dist-packages (from importlib-metadata->ibm_watson_machine_learnin
g) (4.1.1)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-p
ackages (from importlib-metadata->ibm_watson_machine_learning) (3.10.0)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/p
ython3.7/dist-packages (from packaging->ibm_watson_machine_learning) (3.0.9
)
Building wheels for collected packages: ibm-cos-sdk, ibm-cos-sdk-core, ibm-
cos-sdk-s3transfer
  Building wheel for ibm-cos-sdk (setup.py) ... done
  Created wheel for ibm-cos-sdk: filename=ibm_cos_sdk-2.7.0-py2.py3-none-an
y.whl size=72564 sha256=56105e697a72d306509b002fc17ae8c34b1d4bd76fdf0964d4d
3ed080c2df207
  Stored in directory: /root/.cache/pip/wheels/47/22/bf/e1154ff0f5de93cc477
acd0ca69abfbb8b799c5b28a66b44c2
  Building wheel for ibm-cos-sdk-core (setup.py) ... done
  Created wheel for ibm-cos-sdk-core: filename=ibm_cos_sdk_core-2.7.0-py2.p
y3-none-any.whl size=501013 sha256=f4332bbbf19a09538eebe223970e2a21b20ae427
ee257a286cd257d7b0299276
  Stored in directory: /root/.cache/pip/wheels/6c/a2/e4/c16d02f809a3ea998e1
7cfd02c13369281f3d232aaf5902c19
  Building wheel for ibm-cos-sdk-s3transfer (setup.py) ... done
  Created wheel for ibm-cos-sdk-s3transfer: filename=ibm_cos_sdk_s3transfer
-2.7.0-py2.py3-none-any.whl size=88619 sha256=d7e2db8061a6f30837c2774916647
97080c80dd80aa354eed8d50a8eac8d482b
  Stored in directory: /root/.cache/pip/wheels/5f/b7/14/fbe02bc1ef1af890650
c7e51743d1c83890852e598d164b9da
Successfully built ibm-cos-sdk ibm-cos-sdk-core ibm-cos-sdk-s3transfer
Installing collected packages: docutils, ibm-cos-sdk-core, ibm-cos-sdk-s3tr
ansfer, ibm-cos-sdk, ibm-watson-machine-learning
  Attempting uninstall: docutils
    Found existing installation: docutils 0.17.1
    Uninstalling docutils-0.17.1:
      Successfully uninstalled docutils-0.17.1
  Attempting uninstall: ibm-cos-sdk-core
    Found existing installation: ibm-cos-sdk-core 2.12.0
    Uninstalling ibm-cos-sdk-core-2.12.0:
      Successfully uninstalled ibm-cos-sdk-core-2.12.0
  Attempting uninstall: ibm-cos-sdk-s3transfer
    Found existing installation: ibm-cos-sdk-s3transfer 2.12.0
    Uninstalling ibm-cos-sdk-s3transfer-2.12.0:
      Successfully uninstalled ibm-cos-sdk-s3transfer-2.12.0
  Attempting uninstall: ibm-cos-sdk
    Found existing installation: ibm-cos-sdk 2.12.0
    Uninstalling ibm-cos-sdk-2.12.0:
      Successfully uninstalled ibm-cos-sdk-2.12.0
```

```
Successfully installed docutils-0.15.2 ibm-cos-sdk-2.7.0 ibm-cos-sdk-core-2
.7.0 ibm-cos-sdk-s3transfer-2.7.0 ibm-watson-machine-learning-1.0.257
```

In [ ]:

```
from ibm_watson_machine_learning import APIClient

wml_credentials = {
    "url":"https://us-south.ml.cloud.ibm.com",
    "apikey":"40Pslm7hdEW6cH-Xm9Wpcw2Wju_D7hiLhUmPZxBdYpKc"
}

client = APIClient(wml_credentials)
client
```

```
Python 3.7 and 3.8 frameworks are deprecated and will be removed in a future release. Use Python 3.9 framework instead.
```

Out[ ]:

In [ ]:

```
client.spaces.get_details()
```

```
{'resources': [{'entity': {'compute': [{'crn': 'crn:v1:bluemix:public:pm-20
:us-south:a/62d30bff2fea47468ededaf8e1999732:f217ce19-96e7-4016-a71c-99665b
52bb81::',
      'guid': 'f217ce19-96e7-4016-a71c-99665b52bb81',
      'name': 'Watson Machine Learning-3e',
      'type': 'machine_learning'}],
    'description': '',
    'name': 'IT Innovators',
    'scope': {'bss_account_id': '62d30bff2fea47468ededaf8e1999732'},
    'stage': {'production': False},
    'status': {'state': 'active'},
    'storage': {'properties': {'bucket_name': '8c5de283-e321-4129-99fc-f4c6
d940d806',
      'bucket_region': 'us-south',
      'credentials': {'admin': {'access_key_id': '017f832fe7f04cf7ad7efeef9
b91ce1e',
        'api_key': 'YgpxcJBvPBELdu_QcfxVhPc6OnB4AWhTZEz9ROKPe2IJ',
        'secret_access_key': 'ecdc78aca723ca1a3e1d03b038985603b9d26d010dde2
b1a',
        'service_id': 'ServiceId-77115f0a-6ae3-44b3-8c87-281e78592737'},
       'editor': {'access_key_id': '343a648836a745e1b5dad12ec558bd6b',
        'api_key': '221KjnLfy0TaJrl4qm8gIAzPFmDpL6FVLJmdyaX0p_AS',
        'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:glo
bal:a/62d30bff2fea47468ededaf8e1999732:ea280dc7-c8c6-4f92-8afe-e4c1060219d5
::',
        'secret_access_key': 'd3a2fe4d67da7bc498b0017f675a34ef7d062758e4563
e34',
        'service_id': 'ServiceId-ef9076dd-14b3-4e0e-83ab-88cdaf33b3f7'},
       'viewer': {'access_key_id': 'de737a6c00a746c380bce5cdf96654d9',
        'api_key': '08WdhGXpH0YxGijS6smbEHEwFIIhISMQ2coBH5wnwgfy',
```

```
        'resource_key_crn': 'crn:v1:bluemix:public:cloud-object-storage:glo
bal:a/62d30bff2fea47468ededaf8e1999732:ea280dc7-c8c6-4f92-8afe-e4c1060219d5
::',
        'secret_access_key': '44980d485cd300dcda0ae1b238012a25a99a96e4fbca2
a86',
        'service_id': 'ServiceId-27575730-22b7-4cfa-aba4-e7c7ad0fed26'}},
      'endpoint_url': 'https://s3.us-south.cloud-object-storage.appdomain.c
loud',
      'guid': 'ea280dc7-c8c6-4f92-8afe-e4c1060219d5',
      'resource_crn': 'crn:v1:bluemix:public:cloud-object-storage:global:a/
62d30bff2fea47468ededaf8e1999732:ea280dc7-c8c6-4f92-8afe-e4c1060219d5::'},
     'type': 'bmcos_object_storage'}},
   'metadata': {'created_at': '2022-11-04T04:34:14.219Z',
    'creator_id': 'IBMid-6610044IGT',
    'id': 'dffc5933-5201-43fa-948d-465e0b994546',
    'updated_at': '2022-11-04T04:34:45.889Z',
    'url': '/v2/spaces/dffc5933-5201-43fa-948d-465e0b994546'}}]}
```

In [ ]:
```
client.spaces.list()
```

```
Note: 'limit' is not provided. Only first 50 records will be displayed if t
he number of records exceed 50
------------------------------------  -------------  ------------------------
--
ID                                    NAME           CREATED
dffc5933-5201-43fa-948d-465e0b994546  IT Innovators  2022-11-04T04:34:14.21
9Z
------------------------------------  -------------  ------------------------
--
```

In [ ]:
```
space_uid = "dffc5933-5201-43fa-948d-465e0b994546"
space_uid
```

Out[ ]:
```
'dffc5933-5201-43fa-948d-465e0b994546'
```

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

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

In [ ]:
```
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
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
spark-mllib_2.3                2e51f700-bca0-4b0d-88dc-5c6791338875  base
pytorch-onnx_1.1-py3.6-edt     32983cea-3f32-4400-8965-dde874a8d67e  base
spark-mllib_3.0-py37           36507ebe-8770-55ba-ab2a-eafe787600e9  base
spark-mllib_2.4                390d21f8-e58b-4fac-9c55-d7ceda621326  base
xgboost_0.82-py3.6             39e31acd-5f30-41dc-ae44-60233c80306e  base
pytorch-onnx_1.2-py3.6-edt     40589d0e-7019-4e28-8daa-fb03b6f4fe12  base
default_r36py38                41c247d3-45f8-5a71-b065-8580229facf0  base
autoai-ts_rt22.1-py3.9         4269d26e-07ba-5d40-8f66-2d495b0c71f7  base
autoai-obm_3.0                 42b92e18-d9ab-567f-988a-4240ba1ed5f7  base
pmml-3.0_4.3                   493bcb95-16f1-5bc5-bee8-81b8af80e9c7  base
spark-mllib_2.4-r_3.6          49403dff-92e9-4c87-a3d7-a42d0021c095  base
xgboost_0.90-py3.6             4ff8d6c2-1343-4c18-85e1-689c965304d3  base
pytorch-onnx_1.1-py3.6         50f95b2a-bc16-43bb-bc94-b0bed208c60b  base
autoai-ts_3.9-py3.8            52c57136-80fa-572e-8728-a5e7cbb42cde  base
spark-mllib_2.4-scala_2.11     55a70f99-7320-4be5-9fb9-9edb5a443af5  base
spark-mllib_3.0                5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9  base
autoai-obm_2.0                 5c2e37fa-80b8-5e77-840f-d912469614ee  base
spss-modeler_18.1              5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b  base
cuda-py3.8                     5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e  base
autoai-kb_3.1-py3.7            632d4b22-10aa-5180-88f0-f52dfb6444d7  base
pytorch-onnx_1.7-py3.8         634d3cdc-b562-5bf9-a2d4-ea90a478456b  base
spark-mllib_2.3-r_3.6          6586b9e3-ccd6-4f92-900f-0f8cb2bd6f0c  base
tensorflow_2.4-py3.7           65e171d7-72d1-55d9-8ebb-f813d620c9bb  base
spss-modeler_18.2              687eddc9-028a-4117-b9dd-e57b36f1efa5  base
-----------------------------  ------------------------------------  ----
Note: Only first 50 records were displayed. To display more use 'limit' par
ameter.
```

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

Out[ ]:
```
'acd9c798-6974-5d2f-a657-ce06e986df4d'
```

In [ ]:
```
model_details = client.repository.store_model(model = 'nutrition-analysis.tgz', meta_props={
    client.repository.ModelMetaNames.NAME:"Nutritional Analyzer",
    client.repository.ModelMetaNames.TYPE:'tensorflow_2.7',
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid
})
```

In [ ]:
```
model_details
```


```
{'entity': {'hybrid_pipeline_software_specs': [],
  'software_spec': {'id': 'acd9c798-6974-5d2f-a657-ce06e986df4d',
   'name': 'tensorflow_rt22.1-py3.9'},
  'type': 'tensorflow_2.7'},
 'metadata': {'created_at': '2022-11-05T16:17:59.748Z',
  'id': '57592160-88cb-4b93-b607-92e7a988625f',
  'modified_at': '2022-11-05T16:18:03.936Z',
  'name': 'Nutritional Analyzer',
  'owner': 'IBMid-6610044IGT',
  'resource_key': '95b151b5-1488-49f6-ac66-f70e8748f5e6',
  'space_id': 'dffc5933-5201-43fa-948d-465e0b994546'},
 'system': {'warnings': []}}
```


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

Out[ ]:
```
'57592160-88cb-4b93-b607-92e7a988625f'
```

In [ ]:
```
client.repository.download(model_id, 'Nutritional_Analyzer_IBM_model.tar.gb')
```

```
Successfully saved model content to file: 'Nutritional_Analyzer_IBM_model.tar.gb'
```

Out[ ]:
```
'/content/Nutritional_Analyzer_IBM_model.tar.gb'
```