

IBM CLOUD CODE MODEL TESTING CODE:

```
In [1]: pwd

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

In [2]: !pip install keras==2.7.0
!pip install tensorflow==2.5.0

Requirement already satisfied: keras==2.7.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.7.0)
Collecting tensorflow==2.5.0
  Downloading tensorflow-2.5.0-cp39-cp39-manylinux2010_x86_64.whl (454.4 MB)
    454.4 MB 36 kB/s eta 0:00:01
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)
Collecting tensorflow-estimator<2.6.0,>=2.5.0rc0
  Downloading tensorflow_estimator-2.5.0-py2.py3-none-any.whl (462 kB)
    462 kB 76.0 MB/s eta 0:00:01
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: 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: protobuf>=3.9.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (3.19.1)
Collecting keras-nightly==2.5.0.dev
  Downloading keras_nightly-2.5.0.dev2021032900-py2.py3-none-any.whl (1.2 MB)
    1.2 MB 75.7 MB/s eta 0:00:01
Collecting grpcio==1.34.0
  Downloading grpcio-1.34.1-cp39-cp39-manylinux2014_x86_64.whl (4.0 MB)
    4.0 MB 71.6 MB/s eta 0:00:01
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)
Collecting h5py==3.1.0
  Downloading h5py-3.1.0-cp39-cp39-manylinux1_x86_64.whl (4.4 MB)
    4.4 MB 67.1 MB/s eta 0:00:01
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)
Collecting typing-extensions==3.7.4
  Downloading typing_extensions-3.7.4.3-py3-none-any.whl (22 kB)
Requirement already satisfied: tensorboard==2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (2.7.0)
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: 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: 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: gast==0.4.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.4.0)
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: 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: 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: gast==0.4.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.4.0)
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)
Collecting flatbuffers==1.12.0
  Downloading flatbuffers-1.12-py2.py3-none-any.whl (15 kB)
Collecting numpy==1.19.2
  Downloading numpy-1.19.5-cp39-cp39-manylinux2010_x86_64.whl (14.9 MB)
    14.9 MB 77.1 MB/s eta 0:00:01
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.5.0) (0.4.4)
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: 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: 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: 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: 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: google-auth<3,>=1.6.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard==2.5->tensorflow==2.5.0) (1.23.0)
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: 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: 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: 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: 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: 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: 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: 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: 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)
Installing collected packages: numpy, grpcio, typing-extensions, tensorflow-estimator, keras-nightly, h5py, flatbuffers, tensorflow
Attempting uninstall: numpy
  Found existing installation: numpy 1.20.3
  Uninstalling numpy-1.20.3:
    Successfully uninstalled numpy-1.20.3
Attempting uninstall: grpcio
  Found existing installation: grpcio 1.42.0
  Uninstalling grpcio-1.42.0:
    Successfully uninstalled grpcio-1.42.0
```

Successfully installed tensorflow-2.7.2
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.
tensorflow-text 2.7.3 requires tensorflow<2.8,>=2.7.0, but you have tensorflow 2.5.0 which is incompatible.
pytorch-lightning 1.6.5 requires typing-extensions>=4.0.0, but you have typing-extensions 3.7.4.3 which is incompatible.
autoai-ts-lb 1.1.9 requires tensorflow<2.8,>=2.7.0; python_version >= "3.9", but you have tensorflow 2.5.0 which is incompatible.
Successfully installed flatbuffers-1.12 grpcio-1.34.1 h5py-3.1.0 keras-nightly-2.5.0.dev2021032900 numpy-1.19.5 tensorflow-2.5.0 tensorflow-estimator-2.5.0 typing-extensions-3.7.4.3

Loading the dataset

```
In [137]: 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='bu2-Fr134koAuABacUdHSAkX2QGb141Mbp9EoUgJx4',
                              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 = 'cnmodel-donotdelete-pr-idhobzhssx2cyu'
object_key = 'conversation engine for deaf and dumb.zip'

streaming_body_6 = 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/
```

Unzip the dataset

Unzip the dataset

```
In [5]: from io import BytesIO
import zipfile
unzip=zipfile.ZipFile(BytesIO(streaming_body_6.read()), 'r')
file_paths=unzip.namelist()
for path in file_paths:
    unzip.extract(path)
```

Image Augmentation.

```
In [6]: from tensorflow.keras.preprocessing.image import ImageDataGenerator

2022-11-07 13:52:16.590488: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcudart.so.11.0'; dlerror: libcudart.so.11.0: cannot open shared object file: No such file or directory; LD_LIBRARY_PATH: /opt/ibm/dsdriver/lib:/opt/oracle/lib:/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/tensorflow

In [7]: train_datagen=ImageDataGenerator(rescale=1./255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)
test_datagen=ImageDataGenerator(rescale=1./255)

In [8]: x_train=train_datagen.flow_from_directory(r"/home/wsuser/work/Dataset/training_set", target_size=(64,64), class_mode="categorical", batch_size=32)
x_test=test_datagen.flow_from_directory(r"/home/wsuser/work/Dataset/test_set", target_size=(64,64), class_mode="categorical", batch_size=32)

Found 15750 images belonging to 9 classes.
Found 2250 images belonging to 9 classes.

In [9]: x_train.class_indices

Out[9]: {'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

CNN

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https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/81b14c3e-d2c1-4ffc-98e6-f8e770f5db68/view?projectid=cb3991be-...

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CNN

```
In [10]: from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten

In [11]: model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())

2022-11-07 13:52:20.325670: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'libcuda.so.1'; dLError: libcuda.so.1: cannot open shared object file: No such file or directory; LD_LIBRARY_PATH: /opt/ibm/dsdriver/lib:/opt/oracle/lib:/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/tensorflow

2022-11-07 13:52:20.325705: W tensorflow/stream_executor/cuda/cuda_driver.cc:326] failed call to cuInit: UNKNOWN ERROR (303)

In [12]: model.summary()

Model: "sequential"

Layer (type)                Output Shape              Param #
=====
conv2d (Conv2D)              (None, 62, 62, 32)        896
max_pooling2d (MaxPooling2D) (None, 31, 31, 32)         0
flatten (Flatten)             (None, 30752)              0
=====
Total params: 896
Trainable params: 896
Non-trainable params: 0
```

Hidden Layers

```
In [13]: model.add(Dense(units=300,kernel_initializer = "uniform",activation= "relu" ))
model.add(Dense(units=150,kernel_initializer="uniform",activation="relu"))
```

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https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/81b14c3e-d2c1-4ffc-98e6-f8e770f5db68/view?projectid=cb3991be-...

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```
In [13]: model.add(Dense(units=300,kernel_initializer = "uniform",activation= "relu" ))
model.add(Dense(units=150,kernel_initializer="uniform",activation="relu"))
```

Output Layers

```
In [14]: model.add(Dense(units=9,activation="softmax"))
```

Compiling the model

```
In [15]: model.compile(optimizer="adam",loss="categorical_crossentropy",metrics=["accuracy"])

In [16]: model.fit_generator(x_train,steps_per_epoch=493,epochs=20,validation_data=x_test,validation_steps=71)

/opt/conda/envs/Python-3.9/lib/python3.9/site-packages/tensorflow/python/keras/engine/training.py:1940: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
warnings.warn("`Model.fit_generator` is deprecated and ")

Epoch 1/20
493/493 [=====] - 69s 140ms/step - loss: 0.1718 - accuracy: 0.9422 - val_loss: 0.2556 - val_accuracy: 0.9676
Epoch 2/20
493/493 [=====] - 68s 137ms/step - loss: 0.0245 - accuracy: 0.9919 - val_loss: 0.4197 - val_accuracy: 0.9716
Epoch 3/20
493/493 [=====] - 67s 136ms/step - loss: 0.0196 - accuracy: 0.9931 - val_loss: 0.3413 - val_accuracy: 0.9751
Epoch 4/20
493/493 [=====] - 68s 139ms/step - loss: 0.0140 - accuracy: 0.9957 - val_loss: 0.3298 - val_accuracy: 0.9760
Epoch 5/20
493/493 [=====] - 68s 137ms/step - loss: 0.0133 - accuracy: 0.9957 - val_loss: 0.3155 - val_accuracy: 0.9769
Epoch 6/20
493/493 [=====] - 67s 135ms/step - loss: 0.0104 - accuracy: 0.9971 - val_loss: 0.1956 - val_accuracy: 0.9809
Epoch 7/20
493/493 [=====] - 68s 137ms/step - loss: 0.0117 - accuracy: 0.9966 - val_loss: 0.3471 - val_accuracy: 0.9729
Epoch 8/20
493/493 [=====] - 66s 133ms/step - loss: 0.0090 - accuracy: 0.9966 - val_loss: 0.3655 - val_accuracy: 0.9760
Epoch 9/20
```

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```
493/493 [=====] - 66s 133ms/step - loss: 0.0085 - accuracy: 0.9978 - val_loss: 0.6417 - val_accuracy: 0.9764
Epoch 17/20
493/493 [=====] - 67s 135ms/step - loss: 0.0065 - accuracy: 0.9981 - val_loss: 0.5323 - val_accuracy: 0.9787
Epoch 18/20
493/493 [=====] - 66s 135ms/step - loss: 0.0025 - accuracy: 0.9994 - val_loss: 0.4519 - val_accuracy: 0.9773
Epoch 19/20
493/493 [=====] - 67s 136ms/step - loss: 0.0044 - accuracy: 0.9990 - val_loss: 0.3816 - val_accuracy: 0.9804
Epoch 20/20
493/493 [=====] - 66s 135ms/step - loss: 0.0037 - accuracy: 0.9989 - val_loss: 0.5016 - val_accuracy: 0.9800
```

Out[16]: <tensorflow.python.keras.callbacks.History at 0x7f0abc5bcd90>

In [82]: model.save("cnn_handclassification.h5")

In [100]: cd '/home/wsuser/work'

/home/wsuser/work

In [101]: !tar -zvcf image-classification-model_new.tgz cnn_handclassification.h5

cnn_handclassification.h5

In [117]: ls -l

```
cnn_handclassification.h5
Dataset/
HandClassification.tar.gz
image-classification-model_new.tgz
```

In [118]: !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: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.26.7)
Requirement already satisfied: tqdm in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (4.62.3)
Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.3.4)
Requirement already satisfied: ibm-cos-sdk in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.11.0)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.26.0)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2022.9.24)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (0.8.9)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (0.3.3)
Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.18.31)
```

Projects / CNN-Model / CNNHandClassification

```
Requirement already satisfied: s3transfer<0.6.0,>=0.5.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.5.0)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->boto3->watson-machine-learning-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=1.21.21->boto3->watson-machine-learning-client) (1.15.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (3.3)
Requirement already satisfied: charset-normalizer==2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (2.0.4)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (2021.3)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (1.19.5)
```

In [119]: import tensorflow as tf
tf.__version__

Out[119]: '2.5.0'

In [120]: !pip install keras==2.2.4

```
Requirement already satisfied: keras==2.2.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.2.4)
Requirement already satisfied: scipy>=0.14 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.7.3)
Requirement already satisfied: six>=1.9.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.15.0)
Requirement already satisfied: keras-preprocessing>=1.0.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.1.2)
Requirement already satisfied: numpy>=1.9.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.19.5)
Requirement already satisfied: pyyaml in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (5.4.1)
Requirement already satisfied: h5py in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (3.1.0)
Requirement already satisfied: keras-applications>=1.0.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.0.8)
```

In [121]: import numpy as np
from ibm_watson_machine_learning import APIClient
wml_credentials={
 "url": "https://us-south.ml.cloud.ibm.com",
 "apikey": "UuqqXk7YbDspFR3hj707P5_8W2_26twv_92FMLoZY9MG"
}
client=APIClient(wml_credentials)

```
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https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/81b14c3e-d2c1-4ffc-98e6-f8e770f5db68/view?projectId=cb3991be-...
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In [120]: !pip install keras==2.2.4

Requirement already satisfied: keras==2.2.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.2.4)
Requirement already satisfied: scipy>=0.14 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.7.3)
Requirement already satisfied: six>=1.9.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.15.0)
Requirement already satisfied: keras-preprocessing>=1.0.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.1.2)
Requirement already satisfied: numpy>=1.9.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.19.5)
Requirement already satisfied: pyyaml in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (5.4.1)
Requirement already satisfied: h5py in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (3.1.0)
Requirement already satisfied: keras-applications>=1.0.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from keras==2.2.4) (1.0.8)

In [121]: import numpy as np
from ibm_watson_machine_learning import APIClient
wml_credentials={
    "url":"https://us-south.ml.cloud.ibm.com",
    "apikey":"UwqqKx7YbDspFR3hj707P5_8W2_26twv_92FMLoZY9MG"
}
client=APIClient(wml_credentials)

In [122]: def guid_from_space_name(client,space_name):
space=client.spaces.get_details()
#print(space)
return(next(item for item in space['resources'] if item['entity']['name']==space_name)['metadata']['id'])

In [123]: space_uid=guid_from_space_name(client,'cnnhandclassification')
print("Space UID="+ space_uid)

Space UID=8415b8b8-5e5f-4ccf-873e-c12fad833520

In [124]: client.set_default_space(space_uid)

Out[124]: 'SUCCESS'
```

```
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Out[124]: 'SUCCESS'

In [125]: client.software_specifications.list()

-----
NAME ASSET_ID TYPE
default_py3.6 0062b8c9-8b7d-44a0-a9b9-46c416adcbd9 base
kernel-spark3.2-scala2.12 028d69ce-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 0c0b0f1e-5376-4fad-92dd-da3b69aa9bda base
shiny-r3.6 06e679df-875e-4f24-8ae9-62dc2148306 base
tensorflow_2.4-py3.7-horovod 1092590a-307d-563d-9b62-4ab7d64b3f22 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-b6a5-3fbd1665666 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-abd6-15e9c2402fb5 base
tensorflow_1.15-py3.6 2b73a275-7cbf-420b-a912-aae7f436e0bc base
kernel-spark3.3-py3.9 2b7961e2-e3b1-5a8c-a911-482c8368839a 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-ae44-60233c80306a base
pytorch-onnx_1.3-py3.6-edt 46e0ad0c-7010-4a78-ed4c-fb43c6f6f17 base
```

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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
sps-modeler_18.2	687eddc9-028a-4117-b9dd-e57b36f1efa5	base

Note: Only first 50 records were displayed. To display more use 'limit' parameter.

```
In [126...] software_spec_uid=client.software_specifications.get_uid_by_name("tensorflow_rt22.1-py3.9")

In [127...] software_spec_uid

Out[127]: 'acd9c798-6974-5d2f-a657-ce06e986df4d'

In [128...] model_details=client.repository.store_model(model='image-classification-model_new.tgz',meta_props={
client.repository.ModelMetaNames.NAME:"CNN Model Building",
client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_spec_uid
})
model_id=client.repository.get_model_id(model_details)

In [129...] model_id

Out[129]: '9c18b439-a2e1-4314-865e-877e46e3dd45'

client.repository.download(model_id,'HandClassification.tar.gb')

In [131...] from keras.models import load_model
from keras.preprocessing import image

In [132...] pwd

Out[132]: '/home/wsuser/work'

In [133...] cd '/home/wsuser/work'

/home/wsuser/work
```