A Novel Method for Handwritten Digit Recognition

Team ID: PNT2022TMID35495

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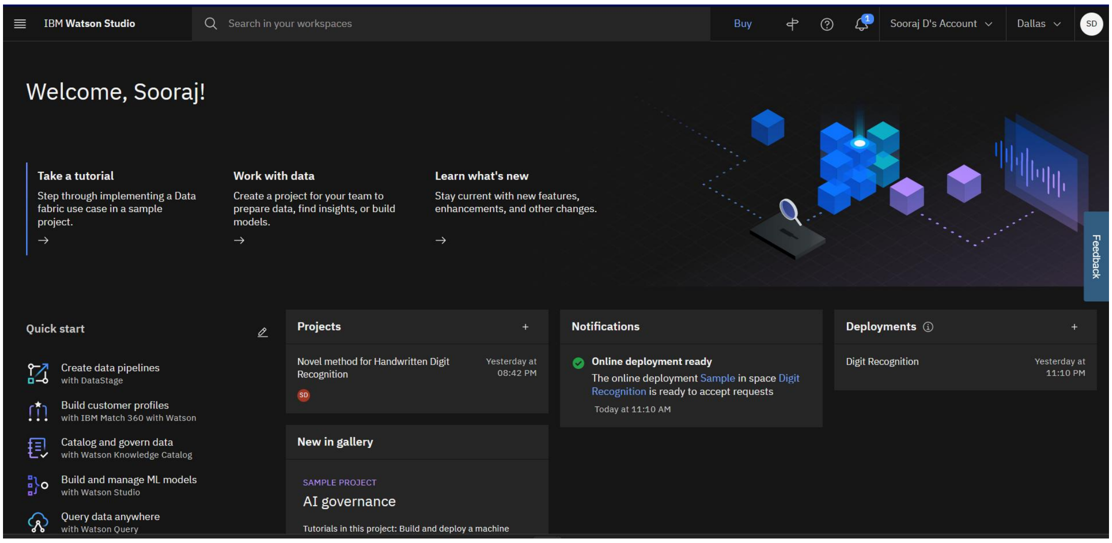
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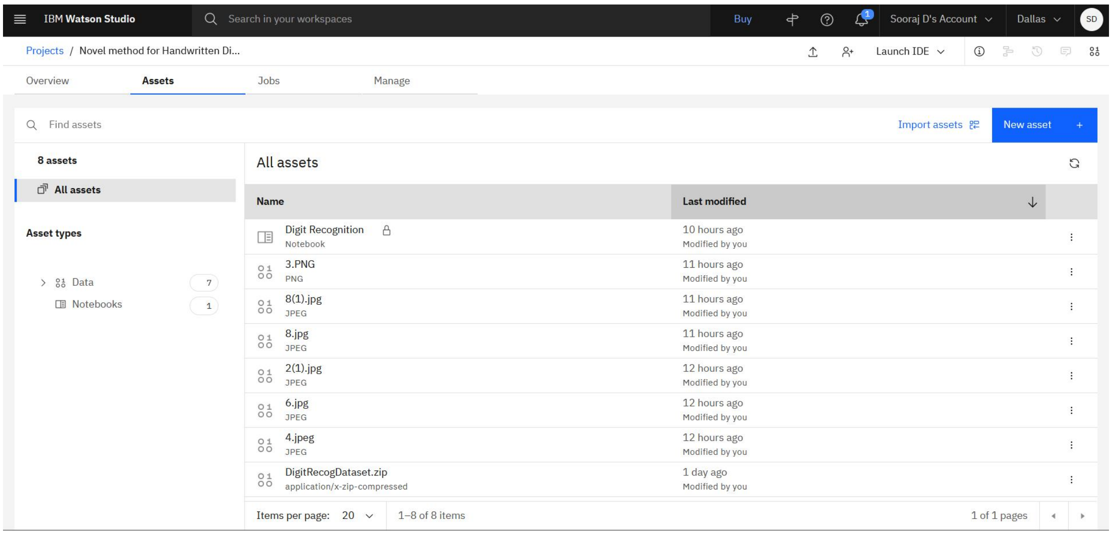
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Digit Recognition Notebook	10 hours ago Modified by you
3.PNG PNG	11 hours ago Modified by you
8(1).jpg JPEG	11 hours ago Modified by you
8.jpg JPEG	11 hours ago Modified by you
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DigitRecogDataset.zip application/x-zip-compressed	1 day ago Modified by you

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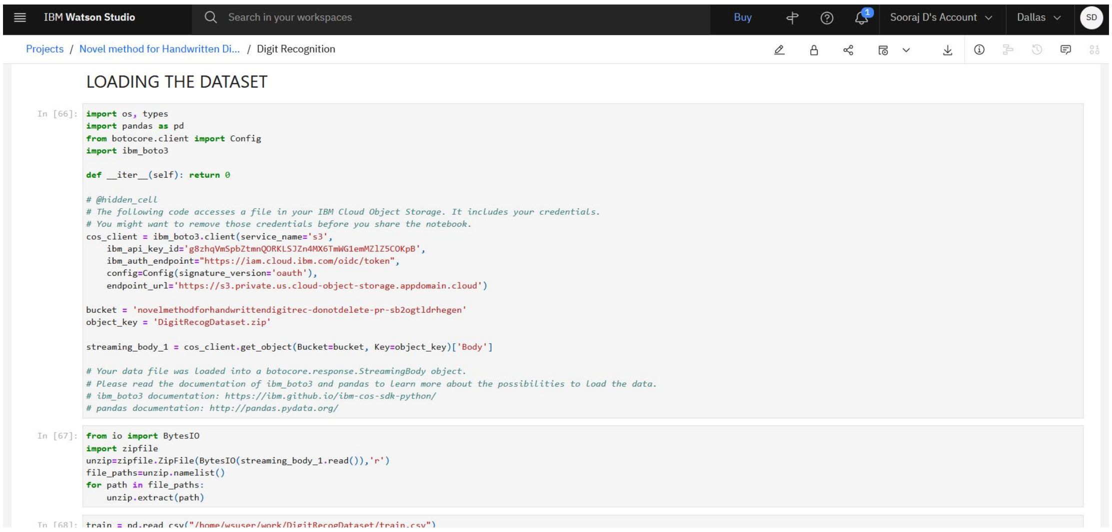
IBM Notebook: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LOADING THE DATASET

In [66]:

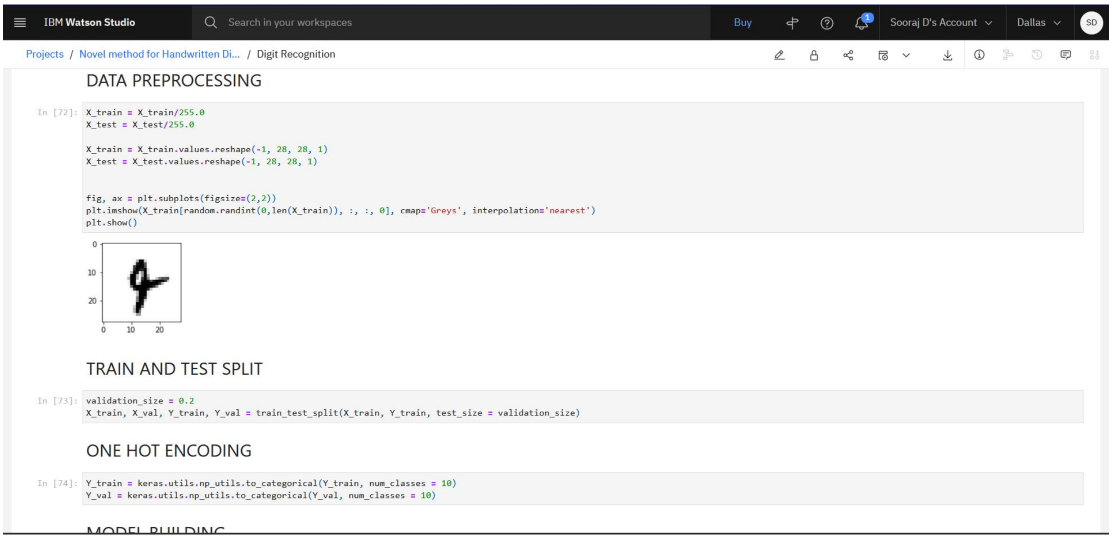
```
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3

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='g8zhqVmSpbZtmnQORKLSJZn4MX6TmWG1emMZlZ5COKpB',
    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 = 'novelmethodforhandwrittendigitrec-donotdelete-pr-sb2ogtldrhegen'
object_key = 'DigitRecogDataset.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 [67]:

```
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 [68]:

```
train = pd.read_csv("/home/wsuser/work/DigitRecogDataset/train.csv")
```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0
10
20
0
10
20

DATA PREPROCESSING

In [72]:

```
X_train = X_train/255.0
X_test = X_test/255.0

X_train = X_train.values.reshape(-1, 28, 28, 1)
X_test = X_test.values.reshape(-1, 28, 28, 1)


fig, ax = plt.subplots(figsize=(2,2))
plt.imshow(X_train[random.randint(0,len(X_train)), :, :, 0], cmap='Greys', interpolation='nearest')
plt.show()
```

TRAIN AND TEST SPLIT

In [73]:

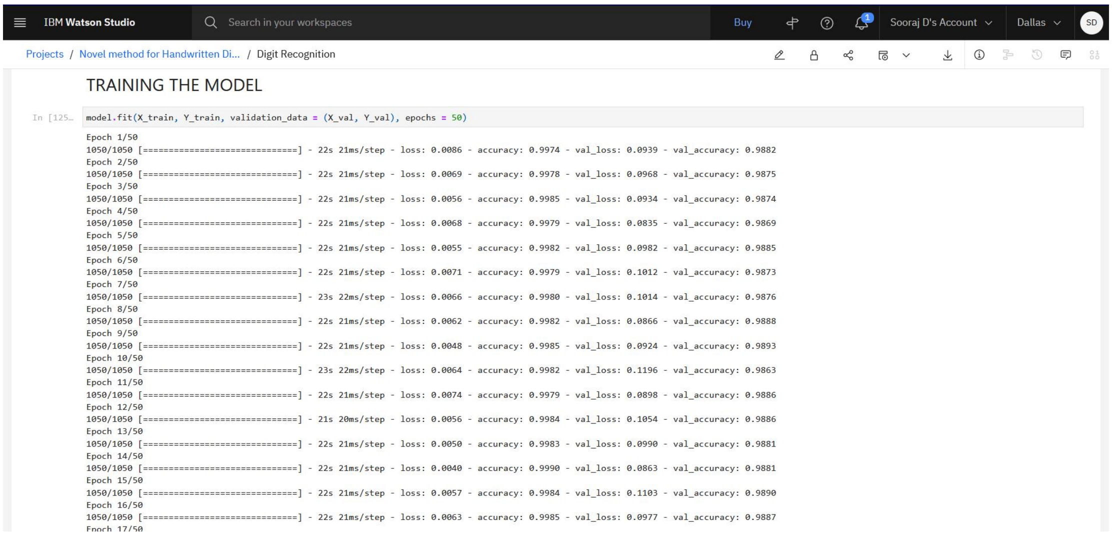
```
validation_size = 0.2
X_train, X_val, Y_train, Y_val = train_test_split(X_train, Y_train, test_size = validation_size)
```

ONE HOT ENCODING

In [74]:

```
Y_train = keras.utils.np_utils.to_categorical(Y_train, num_classes = 10)
Y_val = keras.utils.np_utils.to_categorical(Y_val, num_classes = 10)
```

MODEL BUILDING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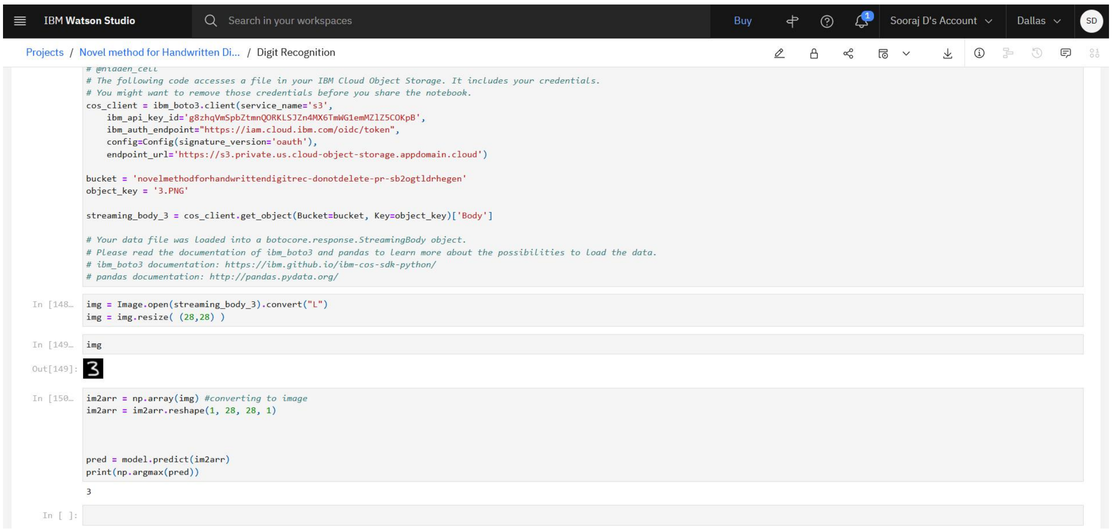
TRAINING THE MODEL

In [125…

```
model.fit(X_train, Y_train, validation_data = (X_val, Y_val), epochs = 50)
```

```
Epoch 1/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0086 - accuracy: 0.9974 - val_loss: 0.0939 - val_accuracy: 0.9882
Epoch 2/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0069 - accuracy: 0.9978 - val_loss: 0.0968 - val_accuracy: 0.9875
Epoch 3/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0056 - accuracy: 0.9985 - val_loss: 0.0934 - val_accuracy: 0.9874
Epoch 4/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0068 - accuracy: 0.9979 - val_loss: 0.0835 - val_accuracy: 0.9869
Epoch 5/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0055 - accuracy: 0.9982 - val_loss: 0.0982 - val_accuracy: 0.9885
Epoch 6/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0071 - accuracy: 0.9979 - val_loss: 0.1012 - val_accuracy: 0.9873
Epoch 7/50
1050/1050 [==============================] - 23s 22ms/step - loss: 0.0066 - accuracy: 0.9980 - val_loss: 0.1014 - val_accuracy: 0.9876
Epoch 8/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0062 - accuracy: 0.9982 - val_loss: 0.0866 - val_accuracy: 0.9888
Epoch 9/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0048 - accuracy: 0.9985 - val_loss: 0.0924 - val_accuracy: 0.9893
Epoch 10/50
1050/1050 [==============================] - 23s 22ms/step - loss: 0.0064 - accuracy: 0.9982 - val_loss: 0.1196 - val_accuracy: 0.9863
Epoch 11/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0074 - accuracy: 0.9979 - val_loss: 0.0898 - val_accuracy: 0.9886
Epoch 12/50
1050/1050 [==============================] - 21s 20ms/step - loss: 0.0056 - accuracy: 0.9984 - val_loss: 0.1054 - val_accuracy: 0.9886
Epoch 13/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0050 - accuracy: 0.9983 - val_loss: 0.0990 - val_accuracy: 0.9881
Epoch 14/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0040 - accuracy: 0.9990 - val_loss: 0.0863 - val_accuracy: 0.9881
Epoch 15/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0057 - accuracy: 0.9984 - val_loss: 0.1103 - val_accuracy: 0.9890
Epoch 16/50
1050/1050 [==============================] - 22s 21ms/step - loss: 0.0063 - accuracy: 0.9985 - val_loss: 0.0977 - val_accuracy: 0.9887
Epoch 17/50
```

Test Case: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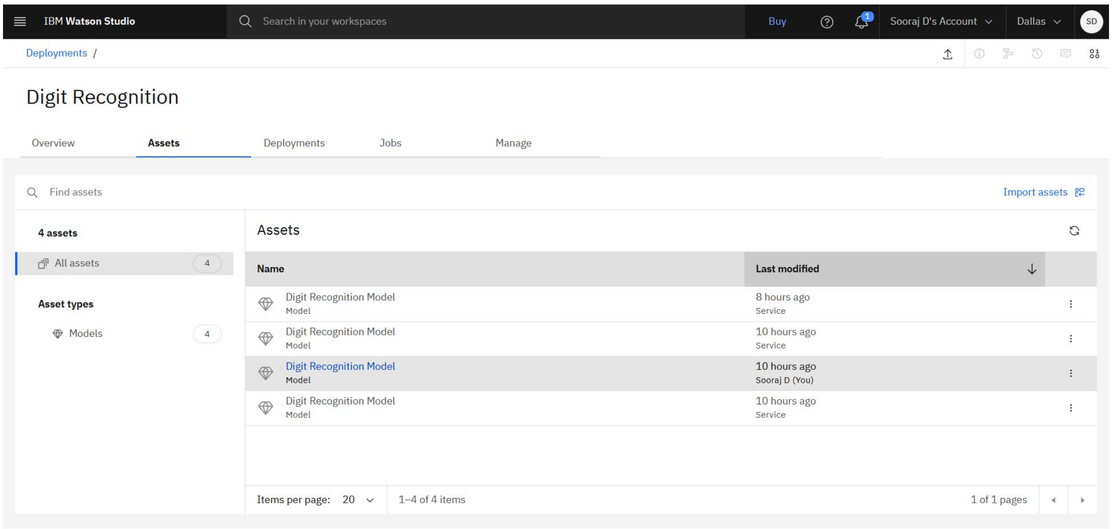
```
# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='g8zhqVmSpbZtmnQORKLSJZn4MX6TmWG1emMZ1Z5COKpB',
    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 = 'novelmethodforhandwrittendigitrec-donotdelete-pr-sb2ogtldrhegen'
object_key = '3.PNG'

streaming_body_3 = 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 [148…  img = Image.open(streaming_body_3).convert("L")
          img = img.resize( (28,28) )

In [149…  img

Out[149]: 3

In [150…  im2arr = np.array(img) #converting to image
          im2arr = im2arr.reshape(1, 28, 28, 1)



          pred = model.predict(im2arr)
          print(np.argmax(pred))

          3

In [ ]:
```

IBM Deployment space: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Digit Recognition

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