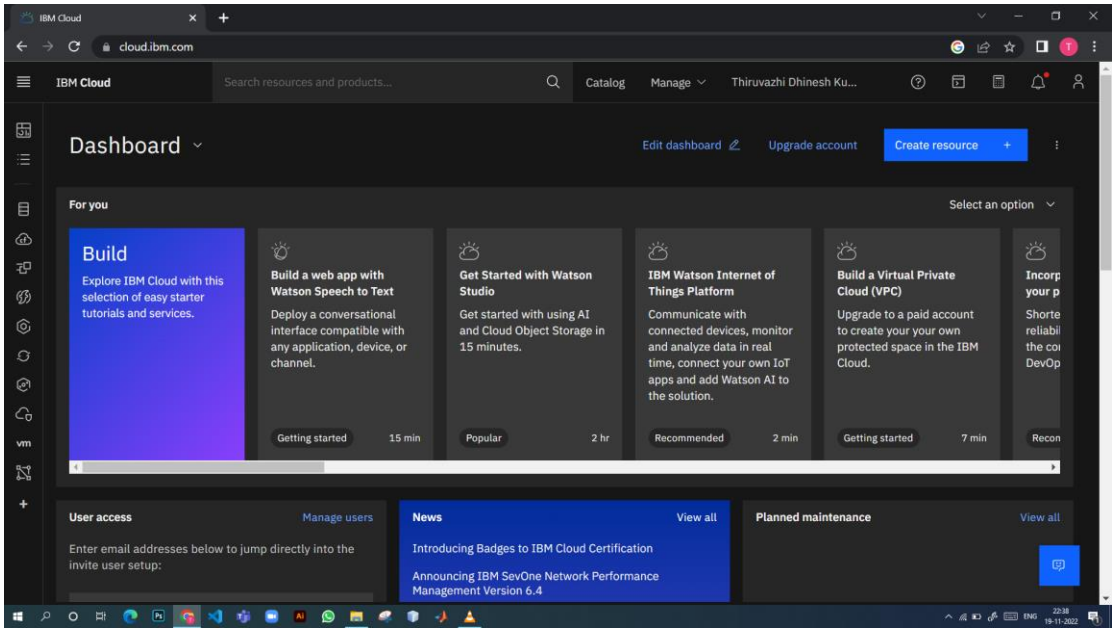
A Novel Method for Handwritten Digit Recognition

Team ID: PNT2022TMID35510

IBM Cloud Homepage:



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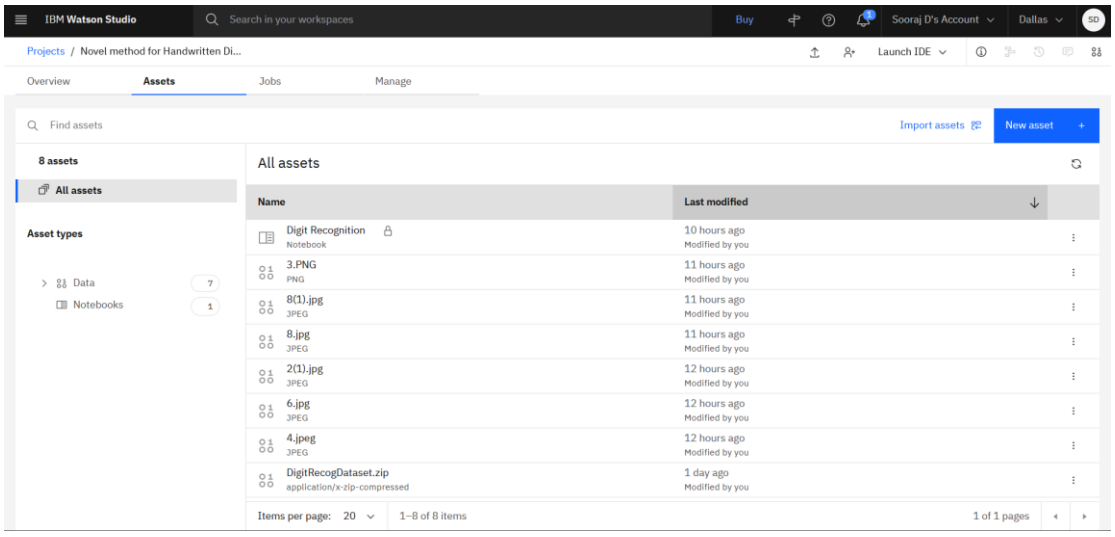

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LOADING THE DATASET

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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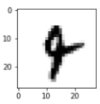
DATA PREPROCESSING

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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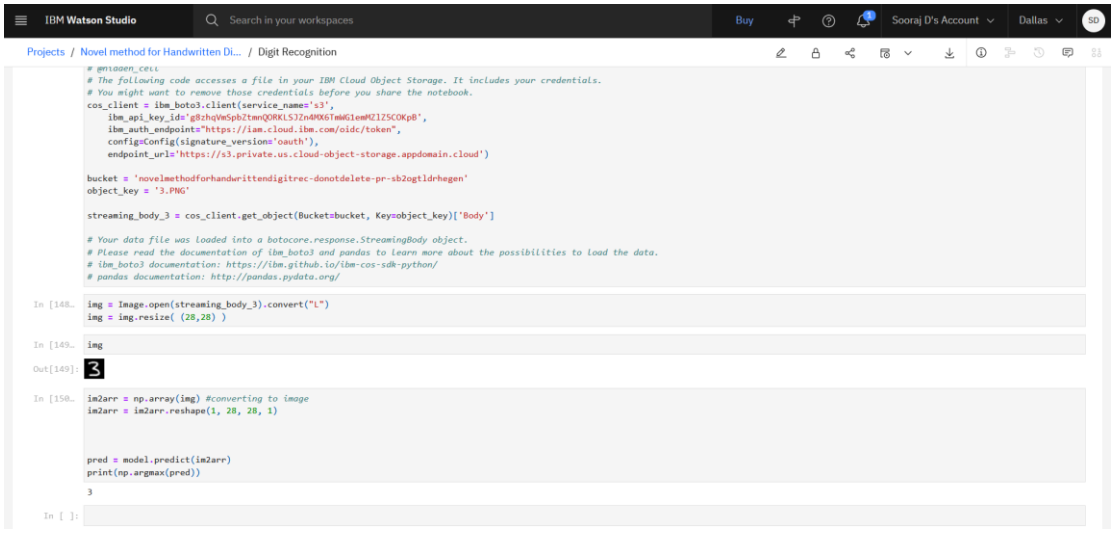
TRAINING THE MODEL

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:



IBM Deployment space: