bigdata_project_in_progress

April 12, 2024

1 Project: Big Data - Comparing ec2 Instance Performances

1.1 Short S3 Tutorial

a) access s3 in your aws account

b) upload data file

c) access IAM in your aws account (put in aws search bar)

d) look for ec2 default role (just familiarize yourself with the name)

e) now go to your instances

f) click on one of your instances' ID summaries

g) click on the instant action drop down menu

h) click on security

i) select Modify IAM role

j) add the default ec2 IAM role & then press update

k) restart kernel in jupyter lab & run code below
** Ask Elisabeth or chatgpt for further clarification **

1.2 Connect Dask

[1]:

```
from dask.distributed import Client

# Create a client and connect to the scheduler
client = Client('172.31.3.68:8786')

# Restart the client
client.restart()

# Perform an operation to check if the client is active
# For example, you can print the cluster information
print(client)
```

```
<Client: 'tcp://172.31.3.68:8786' processes=0 threads=0, memory=0 B>
```

1.3 Connect s3 data

[2]:
```
import boto3

s3 = boto3.client('s3') # connect to s3
```

[4]:
```
response = s3.list_objects_v2(Bucket='digit-dataset') # connect to s3 bucket
```

[5]:
```
for obj in response['Contents']: # show bucket contents
    print(obj['Key'])
```

```
digits.csv
```

[8]:
```
s3.download_file('digit-dataset', 'digits.csv', 'digits.csv') # should download into file successfully
```

[10]:
```
import pandas as pd
import numpy as np
```

[11]:
```
df = pd.read_csv("digits.csv")
```

[14]:
```
df.head(10)
```

[14]:
```
   pixel_0_0  pixel_0_1  pixel_0_2  pixel_0_3  pixel_0_4  pixel_0_5  \
0        0.0        0.0        5.0       13.0        9.0        1.0
1        0.0        0.0        0.0       12.0       13.0        5.0
2        0.0        0.0        0.0        4.0       15.0       12.0
3        0.0        0.0        7.0       15.0       13.0        1.0
4        0.0        0.0        0.0        1.0       11.0        0.0
5        0.0        0.0       12.0       10.0        0.0        0.0
6        0.0        0.0        0.0       12.0       13.0        0.0
7        0.0        0.0        7.0        8.0       13.0       16.0
8        0.0        0.0        9.0       14.0        8.0        1.0
9        0.0        0.0       11.0       12.0        0.0        0.0

   pixel_0_6  pixel_0_7  pixel_1_0  pixel_1_1  …  pixel_6_7  pixel_7_0  \
0        0.0        0.0        0.0        0.0  …        0.0        0.0
1        0.0        0.0        0.0        0.0  …        0.0        0.0
2        0.0        0.0        0.0        0.0  …        0.0        0.0
3        0.0        0.0        0.0        8.0  …        0.0        0.0
4        0.0        0.0        0.0        0.0  …        0.0        0.0
5        0.0        0.0        0.0        0.0  …        0.0        0.0
6        0.0        0.0        0.0        0.0  …        0.0        0.0
```

```
7       15.0        1.0        0.0        0.0  …        0.0        0.0
8        0.0        0.0        0.0        0.0  …        0.0        0.0
9        0.0        0.0        0.0        2.0  …        0.0        0.0

   pixel_7_1  pixel_7_2  pixel_7_3  pixel_7_4  pixel_7_5  pixel_7_6  \
0        0.0        6.0       13.0       10.0        0.0        0.0
1        0.0        0.0       11.0       16.0       10.0        0.0
2        0.0        0.0        3.0       11.0       16.0        9.0
3        0.0        7.0       13.0       13.0        9.0        0.0
4        0.0        0.0        2.0       16.0        4.0        0.0
5        0.0        9.0       16.0       16.0       10.0        0.0
6        0.0        1.0        9.0       15.0       11.0        3.0
7        0.0       13.0        5.0        0.0        0.0        0.0
8        0.0       11.0       16.0       15.0       11.0        1.0
9        0.0        9.0       12.0       13.0        3.0        0.0

   pixel_7_7  target
0        0.0       0
1        0.0       1
2        0.0       2
3        0.0       3
4        0.0       4
5        0.0       5
6        0.0       6
7        0.0       7
8        0.0       8
9        0.0       9

[10 rows x 65 columns]
```

[34]:

```
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap

import sklearn
from sklearn.inspection import DecisionBoundaryDisplay
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier,␣
 ↪NeighborhoodComponentsAnalysis
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
import seaborn as sns
from sklearn.metrics import classification_report
```

[28]:

```
X_train, X_test, y_train, y_test = train_test_split(df, df.target, test_size=0.
 ↪2, random_state=42)
```

[29]:

```
knn = KNeighborsClassifier(n_neighbors=5)
```

[30]:
```
knn.fit(X_train, y_train)
```

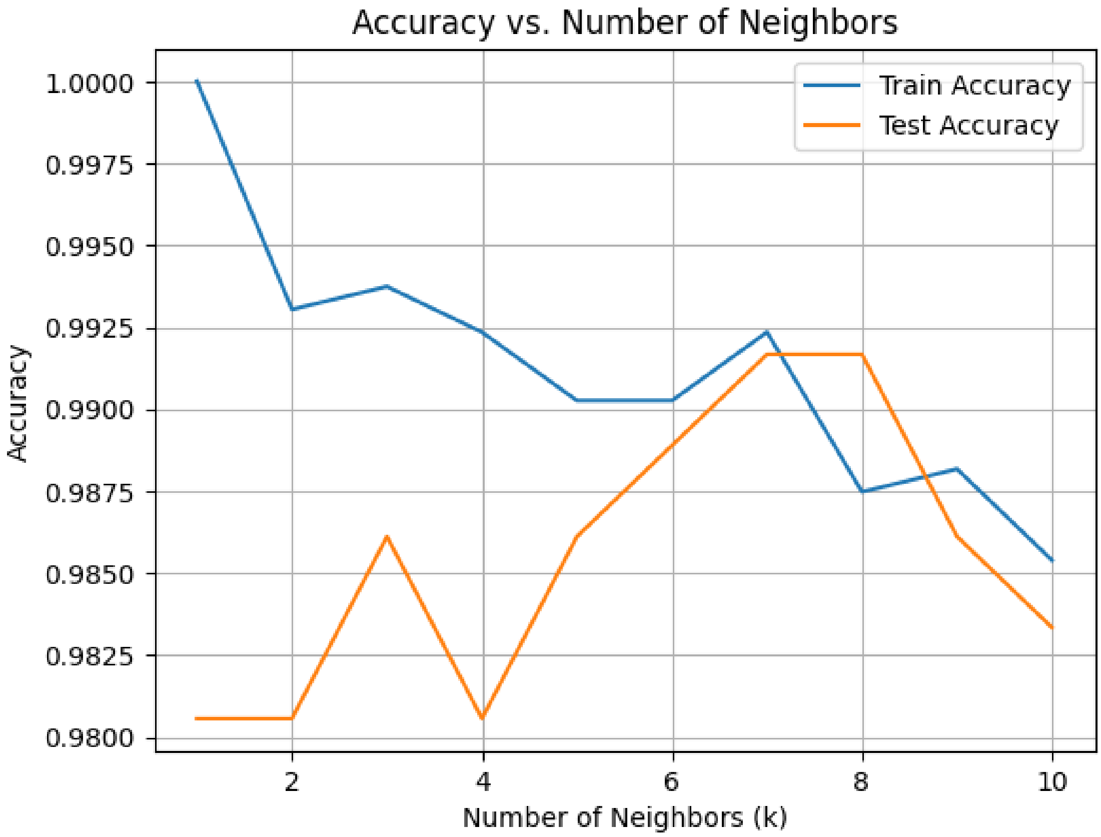
[30]:
```
KNeighborsClassifier()
```

[31]:
```
y_pred = knn.predict(X_test)
```

[35]:
```
classification_report(y_test, y_pred)
```

[35]:
```
'              precision    recall  f1-score   support\n\n           0
1.00      1.00      1.00        33\n           1       1.00      1.00      1.00
28\n           2       1.00      1.00      1.00        33\n           3
1.00      1.00      1.00        34\n           4       0.98      1.00      0.99
46\n           5       0.98      0.96      0.97        47\n           6
0.97      1.00      0.99        35\n           7       1.00      0.97      0.99
34\n           8       1.00      1.00      1.00        30\n           9
0.95      0.95      0.95        40\n\n    accuracy
0.99       360\n   macro avg       0.99      0.99      0.99       360\nweighted
avg       0.99      0.99      0.99       360\n'
```

[52]:
```
k_val = range(1,11)

# Initialize lists to store accuracy scores
train_accuracy = []
test_accuracy = []

# Iterate over each value of k
for k in k_val:

    knn = KNeighborsClassifier(n_neighbors=k)

    knn.fit(X_train, y_train)

    train_accuracy.append(knn.score(X_train, y_train))

    test_accuracy.append(knn.score(X_test, y_test))

# Plot the accuracy scores
plt.plot(k_val, train_accuracy, label='Train Accuracy')
plt.plot(k_val, test_accuracy, label='Test Accuracy')
plt.xlabel('Number of Neighbors (k)')
plt.ylabel('Accuracy')
plt.title('Accuracy vs. Number of Neighbors')
plt.legend()
plt.grid(True)
plt.show()
```



[53]:
```
for k_val, train_acc, test_acc in zip(k_val, train_accuracy, test_accuracy):
    print(f'k={k_val}: Train Accuracy={train_acc:.2f}, Test Accuracy={test_acc:.
 ↪2f}')
```

```
k=1: Train Accuracy=1.00, Test Accuracy=0.98
k=2: Train Accuracy=0.99, Test Accuracy=0.98
k=3: Train Accuracy=0.99, Test Accuracy=0.99
k=4: Train Accuracy=0.99, Test Accuracy=0.98
k=5: Train Accuracy=0.99, Test Accuracy=0.99
k=6: Train Accuracy=0.99, Test Accuracy=0.99
k=7: Train Accuracy=0.99, Test Accuracy=0.99
k=8: Train Accuracy=0.99, Test Accuracy=0.99
k=9: Train Accuracy=0.99, Test Accuracy=0.99
k=10: Train Accuracy=0.99, Test Accuracy=0.98
```

[55]:
```
from sklearn.model_selection import train_test_split
from sklearn.neural_network import MLPClassifier
```

[56]:
```
mlp = MLPClassifier(hidden_layer_sizes=(2,), activation='logistic',␣
 ↪max_iter=1000)
```

[57]:

```
# Train the XOR classifier
mlp.fit(X_train, y_train)
```

```
/home/ubuntu/.local/lib/python3.10/site-
packages/sklearn/neural_network/_multilayer_perceptron.py:691:
ConvergenceWarning: Stochastic Optimizer: Maximum iterations (1000) reached and
the optimization hasn't converged yet.
  warnings.warn(
```

[57]:

```
MLPClassifier(activation='logistic', hidden_layer_sizes=(2,), max_iter=1000)
```

[58]:

```
# Predict the labels for the test data
y_pred = mlp.predict(X_test)
```

[59]:

```
# Evaluate the classifier's performance
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.33      0.03      0.06        33
           1       0.46      0.93      0.61        28
           2       0.43      0.88      0.57        33
           3       0.77      0.29      0.43        34
           4       0.86      0.26      0.40        46
           5       0.00      0.00      0.00        47
           6       0.34      0.91      0.50        35
           7       0.57      0.24      0.33        34
           8       0.14      0.07      0.09        30
           9       0.45      0.93      0.60        40

    accuracy                           0.44       360
   macro avg       0.43      0.45      0.36       360
weighted avg       0.44      0.44      0.35       360


/home/ubuntu/.local/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/home/ubuntu/.local/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/home/ubuntu/.local/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1509: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
```

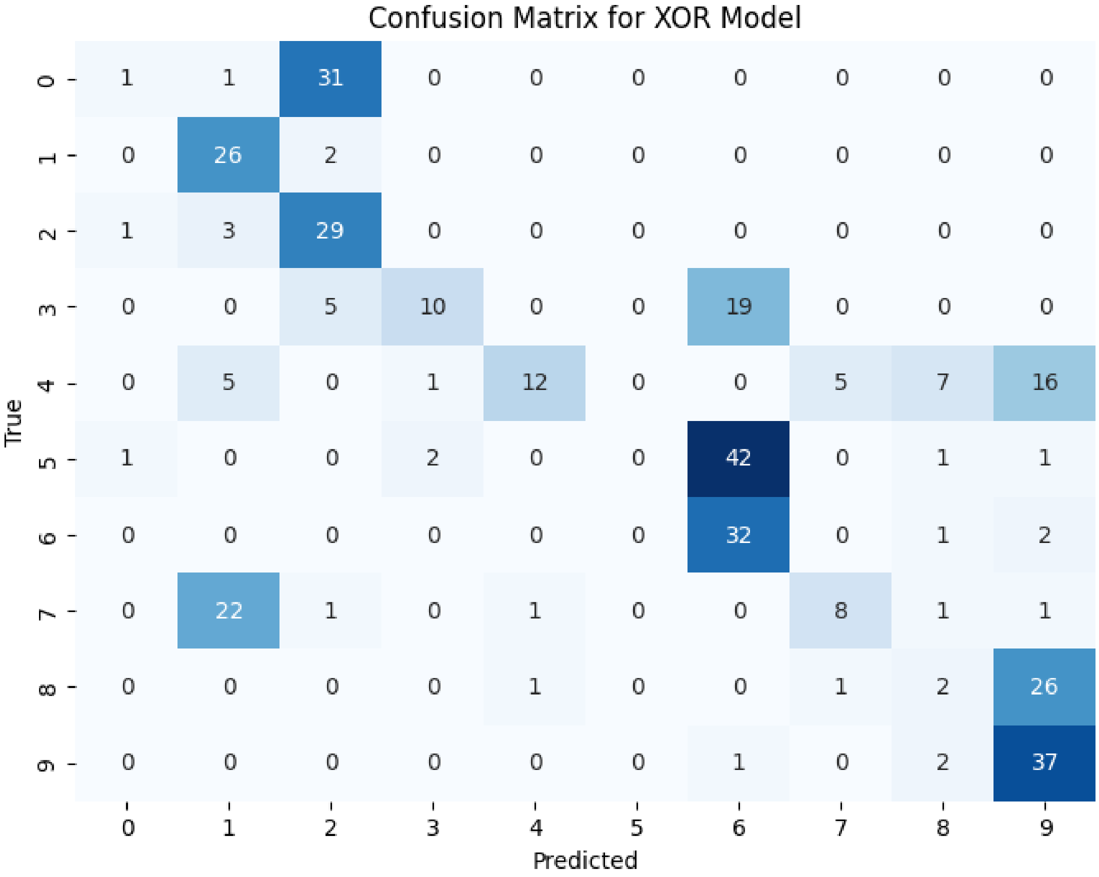
```
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

[60]:

```python
from sklearn.metrics import confusion_matrix
```

[61]:

```python
# Calculate confusion matrix for XOR model
conf_matrix_xor = confusion_matrix(y_test, y_pred)

# Plot confusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix_xor, annot=True, cmap='Blues', fmt='g', cbar=False)
plt.xlabel('Predicted')
plt.ylabel('True')
plt.title('Confusion Matrix for XOR Model')
plt.show()
```



	0	1	2	3	4	5	6	7	8	9
0	1	1	31	0	0	0	0	0	0	0
1	0	26	2	0	0	0	0	0	0	0
2	1	3	29	0	0	0	0	0	0	0
3	0	0	5	10	0	0	19	0	0	0
4	0	5	0	1	12	0	0	5	7	16
5	1	0	0	2	0	0	42	0	1	1
6	0	0	0	0	0	0	32	0	1	2
7	0	22	1	0	1	0	0	8	1	1
8	0	0	0	0	1	0	0	1	2	26
9	0	0	0	0	0	0	1	0	2	37

[63]:

```python
import tensorflow as tf
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
```

```
2024-04-12 08:34:23.971769: I tensorflow/core/platform/cpu_feature_guard.cc:210]
```

```
This TensorFlow binary is optimized to use available CPU instructions in
performance-critical operations.
To enable the following instructions: AVX2 AVX512F FMA, in other operations,
rebuild TensorFlow with the appropriate compiler flags.
2024-04-12 08:34:25.927707: W
tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not
find TensorRT
```

[65]:

```
# Reshape the digit images for CNN input
X_train_cnn = X_train.values.reshape(-1, 8, 8, 1)
X_test_cnn = X_test.values.reshape(-1, 8, 8, 1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[65], line 2
      1 # Reshape the digit images for CNN input
----> 2 X_train_cnn = X_train.values.reshape(-1, 8, 8, 1)
      3 X_test_cnn = X_test.values.reshape(-1, 8, 8, 1)

ValueError: cannot reshape array of size 93405 into shape (8,8,1)
```

[ ]:

```
# Define the CNN model
model = Sequential([
    Conv2D(32, kernel_size=(3, 3), activation='relu', input_shape=(8, 8, 1)),
    MaxPooling2D(pool_size=(2, 2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dense(10, activation='softmax')
])
```

[ ]:

```
# Compile the model
model.compile(optimizer='adam', loss='sparse_categorical_crossentropy',␣
 ↪metrics=['accuracy'])
```

[ ]:

```
# Train the model
model.fit(X_train_cnn, y_train, epochs=10, batch_size=32,␣
 ↪validation_data=(X_test_cnn, y_test))
```

[ ]:

```
# Evaluate the model on test data
test_loss, test_acc = model.evaluate(X_test_cnn, y_test)
print(f'Test accuracy: {test_acc}')
```