In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [3]:

```
!pip install tensorflow
```

```
Collecting tensorflow
  Using cached tensorflow-2.11.0-cp39-cp39-win_amd64.whl (1.9 kB)
Collecting tensorflow-intel==2.11.0
  Using cached tensorflow_intel-2.11.0-cp39-cp39-win_amd64.whl (266.3 M
B)
Collecting google-pasta>=0.1.1
  Downloading google_pasta-0.2.0-py3-none-any.whl (57 kB)
     ---------------------------------------- 57.5/57.5 kB 761.8 kB/s eta
0:00:00
Collecting protobuf<3.20,>=3.9.2
  Using cached protobuf-3.19.6-cp39-cp39-win_amd64.whl (895 kB)
Requirement already satisfied: h5py>=2.9.0 in c:\users\srini\anaconda3
\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (3.7.0)
Collecting libclang>=13.0.0
  Downloading libclang-15.0.6.1-py2.py3-none-win_amd64.whl (23.2 MB)
     ---------------------------------------- 23.2/23.2 MB 959.8 kB/s eta
0:00:00
Requirement already satisfied: wrapt>=1.11.0 in c:\users\srini\anaconda
3\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (1.14.
1)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\srini\anacond
a3\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (1.4.
0)
Requirement already satisfied: setuptools in c:\users\srini\anaconda3\l
ib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (63.4.1)
Requirement already satisfied: numpy>=1.20 in c:\users\srini\anaconda3
\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (1.21.5)
Collecting astunparse>=1.6.0
  Using cached astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Collecting keras<2.12,>=2.11.0
  Using cached keras-2.11.0-py2.py3-none-any.whl (1.7 MB)
Collecting flatbuffers>=2.0
  Downloading flatbuffers-23.3.3-py2.py3-none-any.whl (26 kB)
Collecting tensorflow-io-gcs-filesystem>=0.23.1
  Using cached tensorflow_io_gcs_filesystem-0.31.0-cp39-cp39-win_amd64.
whl (1.5 MB)
Collecting tensorflow-estimator<2.12,>=2.11.0
  Using cached tensorflow_estimator-2.11.0-py2.py3-none-any.whl (439 k
B)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\srini\an
aconda3\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow)
(1.51.3)
Collecting opt-einsum>=2.3.2
  Downloading opt_einsum-3.3.0-py3-none-any.whl (65 kB)
     ---------------------------------------- 65.5/65.5 kB 1.2 MB/s eta
0:00:00
Collecting tensorboard<2.12,>=2.11
  Using cached tensorboard-2.11.2-py3-none-any.whl (6.0 MB)
Collecting termcolor>=1.1.0
  Using cached termcolor-2.2.0-py3-none-any.whl (6.6 kB)
Requirement already satisfied: packaging in c:\users\srini\anaconda3\li
b\site-packages (from tensorflow-intel==2.11.0->tensorflow) (21.3)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\sri
ni\anaconda3\lib\site-packages (from tensorflow-intel==2.11.0->tensorfl
ow) (4.3.0)
Collecting gast<=0.4.0,>=0.2.1
  Downloading gast-0.4.0-py3-none-any.whl (9.8 kB)
Requirement already satisfied: six>=1.12.0 in c:\users\srini\anaconda3
\lib\site-packages (from tensorflow-intel==2.11.0->tensorflow) (1.16.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\srini\ana
conda3\lib\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.1
```

```
1.0->tensorflow) (0.37.1)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\srini\anacon
da3\lib\site-packages (from tensorboard<2.12,>=2.11->tensorflow-intel==
2.11.0->tensorflow) (2.0.3)
Collecting tensorboard-data-server<0.7.0,>=0.6.0
  Downloading tensorboard_data_server-0.6.1-py3-none-any.whl (2.4 kB)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in c:\user
s\srini\anaconda3\lib\site-packages (from tensorboard<2.12,>=2.11->tens
orflow-intel==2.11.0->tensorflow) (1.8.1)
Requirement already satisfied: markdown>=2.6.8 in c:\users\srini\anacon
da3\lib\site-packages (from tensorboard<2.12,>=2.11->tensorflow-intel==
2.11.0->tensorflow) (3.3.4)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\srini\an
aconda3\lib\site-packages (from tensorboard<2.12,>=2.11->tensorflow-int
el==2.11.0->tensorflow) (2.28.1)
Requirement already satisfied: google-auth<3,>=1.6.3 in c:\users\srini
\anaconda3\lib\site-packages (from tensorboard<2.12,>=2.11->tensorflow-
intel==2.11.0->tensorflow) (2.16.1)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in c:\u
sers\srini\anaconda3\lib\site-packages (from tensorboard<2.12,>=2.11->t
ensorflow-intel==2.11.0->tensorflow) (0.4.6)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in c:\users\sri
ni\anaconda3\lib\site-packages (from packaging->tensorflow-intel==2.11.
0->tensorflow) (3.0.9)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\srini\anaconda
3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.12,>=2.1
1->tensorflow-intel==2.11.0->tensorflow) (4.9)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\srini
\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<
2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow) (5.3.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\srini
\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<
2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow) (0.2.8)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\sri
ni\anaconda3\lib\site-packages (from google-auth-oauthlib<0.5,>=0.4.1->
tensorboard<2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow) (1.3.1)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\sri
ni\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<
2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in c:\users\srini\anaconda3
\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.12,>=2.11->
tensorflow-intel==2.11.0->tensorflow) (3.3)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\srini\ana
conda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.12,>=
2.11->tensorflow-intel==2.11.0->tensorflow) (2022.12.7)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\srini
\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.1
2,>=2.11->tensorflow-intel==2.11.0->tensorflow) (1.26.11)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\srini\a
naconda3\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>
=1.6.3->tensorboard<2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow)
(0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\srini\anacon
da3\lib\site-packages (from requests-oauthlib>=0.7.0->google-auth-oauth
lib<0.5,>=0.4.1->tensorboard<2.12,>=2.11->tensorflow-intel==2.11.0->ten
sorflow) (3.2.2)
Installing collected packages: libclang, flatbuffers, termcolor, tensor
flow-io-gcs-filesystem, tensorflow-estimator, tensorboard-data-server,
protobuf, opt-einsum, keras, google-pasta, gast, astunparse, tensorboar
d, tensorflow-intel, tensorflow
  Attempting uninstall: tensorboard-data-server
```

```
    Found existing installation: tensorboard-data-server 0.7.0
    Uninstalling tensorboard-data-server-0.7.0:
      Successfully uninstalled tensorboard-data-server-0.7.0
  Attempting uninstall: protobuf
    Found existing installation: protobuf 4.22.0
    Uninstalling protobuf-4.22.0:
      Successfully uninstalled protobuf-4.22.0
  Attempting uninstall: tensorboard
    Found existing installation: tensorboard 2.12.0
    Uninstalling tensorboard-2.12.0:
      Successfully uninstalled tensorboard-2.12.0
Successfully installed astunparse-1.6.3 flatbuffers-23.3.3 gast-0.4.0 g
oogle-pasta-0.2.0 keras-2.11.0 libclang-15.0.6.1 opt-einsum-3.3.0 proto
buf-3.19.6 tensorboard-2.11.2 tensorboard-data-server-0.6.1 tensorflow-
2.11.0 tensorflow-estimator-2.11.0 tensorflow-intel-2.11.0 tensorflow-i
o-gcs-filesystem-0.31.0 termcolor-2.2.0
```

In [2]:

```
from keras.datasets import mnist
from keras.models import Sequential
from keras.layers import Dense, Dropout
from keras.utils import to_categorical

# Load the MNIST dataset
(x_train, y_train), (x_test, y_test) = mnist.load_data()

# Preprocess the data
x_train = x_train.reshape(60000, 784) / 255.0
x_test = x_test.reshape(10000, 784) / 255.0
y_train = to_categorical(y_train)
y_test = to_categorical(y_test)

# Define the model architecture
sri = Sequential()
sri.add(Dense(512, activation='relu', input_shape=(784,)))
sri.add(Dropout(0.2))
sri.add(Dense(10, activation='softmax'))

# Compile the model
sri.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

# Train the model
sri.fit(x_train, y_train, epochs=100, batch_size=128, validation_data=(x_test, y_test
```

```
Epoch 95/100
469/469 [==============================] - 4s 8ms/step - loss: 0.0036
- accuracy: 0.9990 - val_loss: 0.1400 - val_accuracy: 0.9821
Epoch 96/100
469/469 [==============================] - 4s 9ms/step - loss: 0.0035
- accuracy: 0.9988 - val_loss: 0.1270 - val_accuracy: 0.9837
Epoch 97/100
469/469 [==============================] - 4s 8ms/step - loss: 0.0030
- accuracy: 0.9991 - val_loss: 0.1379 - val_accuracy: 0.9825
Epoch 98/100
469/469 [==============================] - 4s 8ms/step - loss: 0.0048
- accuracy: 0.9984 - val_loss: 0.1245 - val_accuracy: 0.9840
Epoch 99/100
469/469 [==============================] - 4s 8ms/step - loss: 0.0029
- accuracy: 0.9992 - val_loss: 0.1275 - val_accuracy: 0.9849
Epoch 100/100
469/469 [==============================] - 3s 7ms/step - loss: 0.0023
- accuracy: 0.9993 - val_loss: 0.1284 - val_accuracy: 0.9845
```

Out[2]:

In [4]:

```
ypred=sri.predict(x_test)
```

```
313/313 [==============================] - 4s 2ms/step
```

In [5]:

```
ypred
```

Out[5]:

```
array([[1.07149646e-25, 6.03344233e-37, 6.37341689e-28, ...,
        1.00000000e+00, 1.08042297e-26, 2.28591155e-19],
       [7.10166610e-33, 2.83720081e-19, 1.00000000e+00, ...,
        0.00000000e+00, 1.89834506e-32, 0.00000000e+00],
       [1.04931887e-23, 1.00000000e+00, 1.08792361e-14, ...,
        1.50881000e-12, 5.85373763e-11, 1.65818360e-21],
       ...,
       [0.00000000e+00, 1.03143775e-35, 0.00000000e+00, ...,
        2.93429553e-19, 5.60589645e-24, 3.38218643e-20],
       [4.85103987e-30, 8.16433357e-34, 2.50570887e-37, ...,
        2.90163110e-23, 2.32491679e-13, 6.00827007e-37],
       [3.22375358e-32, 0.00000000e+00, 1.70543636e-30, ...,
        0.00000000e+00, 8.53054193e-32, 0.00000000e+00]], dtype=float3
2)
```

In [9]:

```
import pandas as pd
import numpy as np
```

In [11]:

```
ypred=pd.get_dummies(["ypred"])
```

In [12]:

```
ypred
```

Out[12]:

	ypred
0	1

In [13]:

```
from sklearn.metrics import classification_report
```

In [20]:

```
def pro(one):
    one.fit(x_train,y_train)
    ypred=one.predict(x_test)

    train=one.score(x_train,y_train)
    test=one.score(x_test,y_test)
    print(f"Training Accuracy: {train}\n Test Accuracy: {test}\n\n")
    print(classification_report(y_test,ypred))
    return one
```

In [21]:

```
from sklearn.tree import DecisionTreeClassifier
```

In [22]:

```
dt=pro(DecisionTreeClassifier())
```

```
Training Accuracy: 1.0
 Test Accuracy: 0.876


              precision    recall  f1-score   support

           0       0.92      0.94      0.93       980
           1       0.96      0.96      0.96      1135
           2       0.88      0.86      0.87      1032
           3       0.83      0.85      0.84      1010
           4       0.86      0.87      0.87       982
           5       0.82      0.84      0.83       892
           6       0.89      0.89      0.89       958
           7       0.92      0.89      0.91      1028
           8       0.83      0.80      0.81       974
           9       0.84      0.85      0.85      1009

   micro avg       0.88      0.88      0.88     10000
   macro avg       0.87      0.87      0.87     10000
weighted avg       0.88      0.88      0.88     10000
 samples avg       0.88      0.88      0.88     10000
```

In [ ]:

```

```