```
import torch
import torch.nn as nn
import torch.optim as optim
import torch.nn.functional as F
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler, LabelEncoder
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
from torch.utils.data import TensorDataset, DataLoader
```

```
df = pd.read_csv("/content/customers.csv")
print("Dataset Shape:", df.shape)
print(df.head())
```

```
Dataset Shape: (10695, 11)
       ID  Gender Ever_Married  Age Graduated     Profession  Work_Experience  \
0  462809    Male           No   22        No     Healthcare              1.0
1  462643  Female          Yes   38       Yes       Engineer              NaN
2  466315  Female          Yes   67       Yes       Engineer              1.0
3  461735    Male          Yes   67       Yes         Lawyer              0.0
4  462669  Female          Yes   40       Yes  Entertainment              NaN

  Spending_Score  Family_Size  Var_1 Segmentation
0            Low          4.0  Cat_4            D
1        Average          3.0  Cat_4            A
2            Low          1.0  Cat_6            B
3           High          2.0  Cat_6            B
4           High          6.0  Cat_6            A
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10695 entries, 0 to 10694
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   ID               10695 non-null  int64
 1   Gender           10695 non-null  object
 2   Ever_Married     10505 non-null  object
 3   Age              10695 non-null  int64
 4   Graduated        10593 non-null  object
 5   Profession       10533 non-null  object
 6   Work_Experience  9597 non-null   float64
 7   Spending_Score   10695 non-null  object
 8   Family_Size      10247 non-null  float64
 9   Var_1            10587 non-null  object
 10  Segmentation     10695 non-null  object
dtypes: float64(2), int64(2), object(7)
memory usage: 919.2+ KB
```

```
df.describe()
```

	ID	Age	Work_Experience	Family_Size
count	10695.000000	10695.000000	9597.000000	10247.000000
mean	463468.088640	43.511828	2.619777	2.844052
std	2600.966411	16.774158	3.390790	1.536427
min	458982.000000	18.000000	0.000000	1.000000
25%	461220.500000	30.000000	0.000000	2.000000
50%	463451.000000	41.000000	1.000000	3.000000
75%	465733.500000	53.000000	4.000000	4.000000
max	467974.000000	89.000000	14.000000	9.000000

```
df = df.drop(columns=["ID"])
```

```
df.fillna({"Work_Experience": 0, "Family_Size": df["Family_Size"].median()}, inplace=True)
```

```
categorical_columns = ["Gender", "Ever_Married", "Graduated", "Profession", "Spending_Score", "Var_1"]
for col in categorical_columns:
    df[col] = LabelEncoder().fit_transform(df[col])
```

```
label_encoder = LabelEncoder()
df["Segmentation"] = label_encoder.fit_transform(df["Segmentation"])
```

```
X = df.drop(columns=["Segmentation"])
y = df["Segmentation"].values

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
X_train = torch.tensor(X_train, dtype=torch.float32)
X_test = torch.tensor(X_test, dtype=torch.float32)
y_train = torch.tensor(y_train, dtype=torch.long)
y_test = torch.tensor(y_test, dtype=torch.long)

train_dataset = TensorDataset(X_train, y_train)
test_dataset = TensorDataset(X_test, y_test)
train_loader = DataLoader(train_dataset, batch_size=16, shuffle=True)
test_loader = DataLoader(test_dataset, batch_size=16)
```

```
class PeopleClassifier(nn.Module):
    def __init__(self, input_size):
        super(PeopleClassifier, self).__init__()
        self.fc1 = nn.Linear(input_size, 32)
        self.fc2 = nn.Linear(32, 20)
        self.fc3 = nn.Linear(20, 16)
        self.fc4 = nn.Linear(16, 4)

    def forward(self, x):
        x=F.relu(self.fc1(x))
        x=F.relu(self.fc2(x))
        x=F.relu(self.fc3(x))
        x=self.fc4(x)
        return x
```

```
def train_model(model,train_loader,criterion,optimizer,epochs=100):
  for epoch in range(epochs):
    model.train()
    for X_batch,y_batch in train_loader:
      optimizer.zero_grad()
      outputs=model(X_batch)
      loss=criterion(outputs,y_batch)
      loss.backward()
      optimizer.step()

  if(epoch+1)%10==0:
    print(f'Epoch [{epoch+1}/{epochs}],Loss:{loss.item():.4f}')
```

```
model =PeopleClassifier(input_size=X_train.shape[1])
criterion =nn.CrossEntropyLoss()
optimizer =optim.Adam(model.parameters(),lr=0.001)

train_model(model,train_loader,criterion,optimizer,epochs=100)
```

```
Epoch [100/100],Loss:0.7839
```

```
model.eval()
predictions, actuals = [], []
with torch.no_grad():
    for X_batch, y_batch in test_loader:
        outputs = model(X_batch)
        _, predicted = torch.max(outputs, 1)
        predictions.extend(predicted.numpy())
        actuals.extend(y_batch.numpy())
```

```
accuracy = accuracy_score(actuals, predictions)
conf_matrix = confusion_matrix(actuals, predictions)
class_report = classification_report(actuals, predictions, target_names=[str(i) for i in label_encoder.classes_])
print("Name: A.LAHARI")
print("Register No: 212223230111")
print(f'Test Accuracy: {accuracy:.2f}%')
print("Confusion Matrix:\n", conf_matrix)
print("Classification Report:\n", class_report)
```

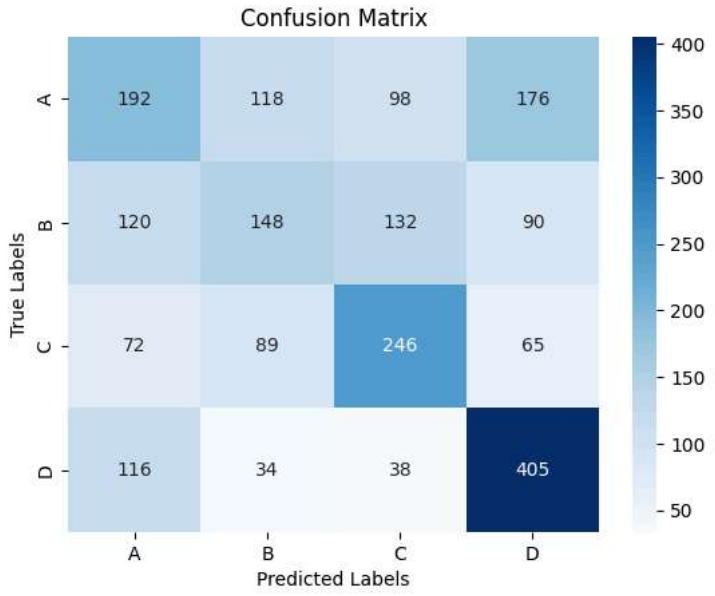
```
Name: A.LAHARI
Register No: 212223230111
Test Accuracy: 0.46%
Confusion Matrix:
 [[192 118  98 176]
```

```
 [120 148 132  90]
 [ 72  89 246  65]
 [116  34  38 405]]
Classification Report:
              precision    recall  f1-score   support

           A       0.38      0.33      0.35       584
           B       0.38      0.30      0.34       490
           C       0.48      0.52      0.50       472
           D       0.55      0.68      0.61       593

    accuracy                           0.46      2139
   macro avg       0.45      0.46      0.45      2139
weighted avg       0.45      0.46      0.45      2139
```

```
import seaborn as sns
import matplotlib.pyplot as plt
sns.heatmap(conf_matrix, annot=True, cmap='Blues', xticklabels=label_encoder.classes_, yticklabels=label_encoder.classes_,fmt=
plt.xlabel("Predicted Labels")
plt.ylabel("True Labels")
plt.title("Confusion Matrix")
plt.show()
```




```
sample_input = X_test[9].clone().unsqueeze(0).detach().type(torch.float32)
with torch.no_grad():
    output = model(sample_input)
    predicted_class_index = torch.argmax(output[0]).item()
    predicted_class_label = label_encoder.inverse_transform([predicted_class_index])[0]
print("Name: A.LAHARI")
print("Register No: 212223230111")
print(f'Predicted class for sample input: {predicted_class_label}')
print(f'Actual class for sample input: {label_encoder.inverse_transform([y_test[9].item()])[0]}')
```

```
Name: A.LAHARI
Register No: 212223230111
Predicted class for sample input: D
Actual class for sample input: A
```