*SAMUEL MAINA :BCS-05-0407/2022

##CAT 2 DATA SCIENCE

Training a model To predict students likely to enroll in a specific program and identify those who may need additional support to graduate.

Beggining of the process

Importing all libralies

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, accuracy_score
import matplotlib.pyplot as plt
```

Step 1: Generate Synthetic Data

```
np.random.seed(42)
n_samples = 1000
```

Simulating the features features of the data

```
data = {
    "GPA": np.random.uniform(2.0, 4.0, n_samples),
    "Test_Scores": np.random.randint(800, 1600, n_samples),
    "Attendance_Rate": np.random.uniform(50, 100, n_samples),
    "Extracurricular_Activity": np.random.choice([0, 1], size=n_samples, p=[0.6, 0.4]),
    "First_Gen_College": np.random.choice([0, 1], size=n_samples, p=[0.7, 0.3]),
    "Socioeconomic_Status": np.random.choice([0, 1], size=n_samples, p=[0.5, 0.5]),
    "Engagement_Score": np.random.uniform(0, 1, n_samples),
    "Enrolled": np.random.choice([0, 1], size=n_samples, p=[0.7, 0.3]),  # Target 1
    "Graduated": np.random.choice([0, 1], size=n_samples, p=[0.6, 0.4])  # Target 2
}

df = pd.DataFrame(data)

df
```

	GPA	Test_Scores	Attendance_Rate	Extracurricular_Activity	First_Gen_College	Socioeconomic_Status	Engagement_Scor
0	2.749080	811	67.316088	0	1	0	0.69386
1	3.901429	1117	61.952767	0	0	1	0.30581
2	3.463988	1391	75.486212	0	0	1	0.75923
3	3.197317	1015	91.264305	1	0	1	0.61974
4	2.312037	1138	63.985177	0	0	0	0.07741
...	...	...	...	...	...	...	.
995	2.183164	913	55.548876	1	0	1	0.43094
996	3.834627	1548	81.721207	0	1	1	0.19800
997	2.273637	1377	88.539031	1	1	1	0.43802
998	3.900475	1160	50.144063	0	0	1	0.40874
999	2.892012	1140	92.947834	1	0	0	0.42891

1000 rows × 9 columns

Next steps: Generate code with df | View recommended plots | New interactive sheet

Defining the Features and Target

```
features = ["GPA", "Test_Scores", "Attendance_Rate", "Extracurricular_Activity",
            "First_Gen_College", "Socioeconomic_Status", "Engagement_Score"]


target_enrollment = "Enrolled"
target_graduation = "Graduated"
```

Spliting the Data into Training and Testing Sets

```
X_train, X_test, y_train, y_test = train_test_split(
    df[features], df[target_enrollment], test_size=0.3, random_state=42
)
```

Model Training:Random Forest Classifier

```
model = RandomForestClassifier(n_estimators=100, random_state=42)
model.fit(X_train, y_train)
```

```
RandomForestClassifier(random_state=42)
```

Evaluating The Model

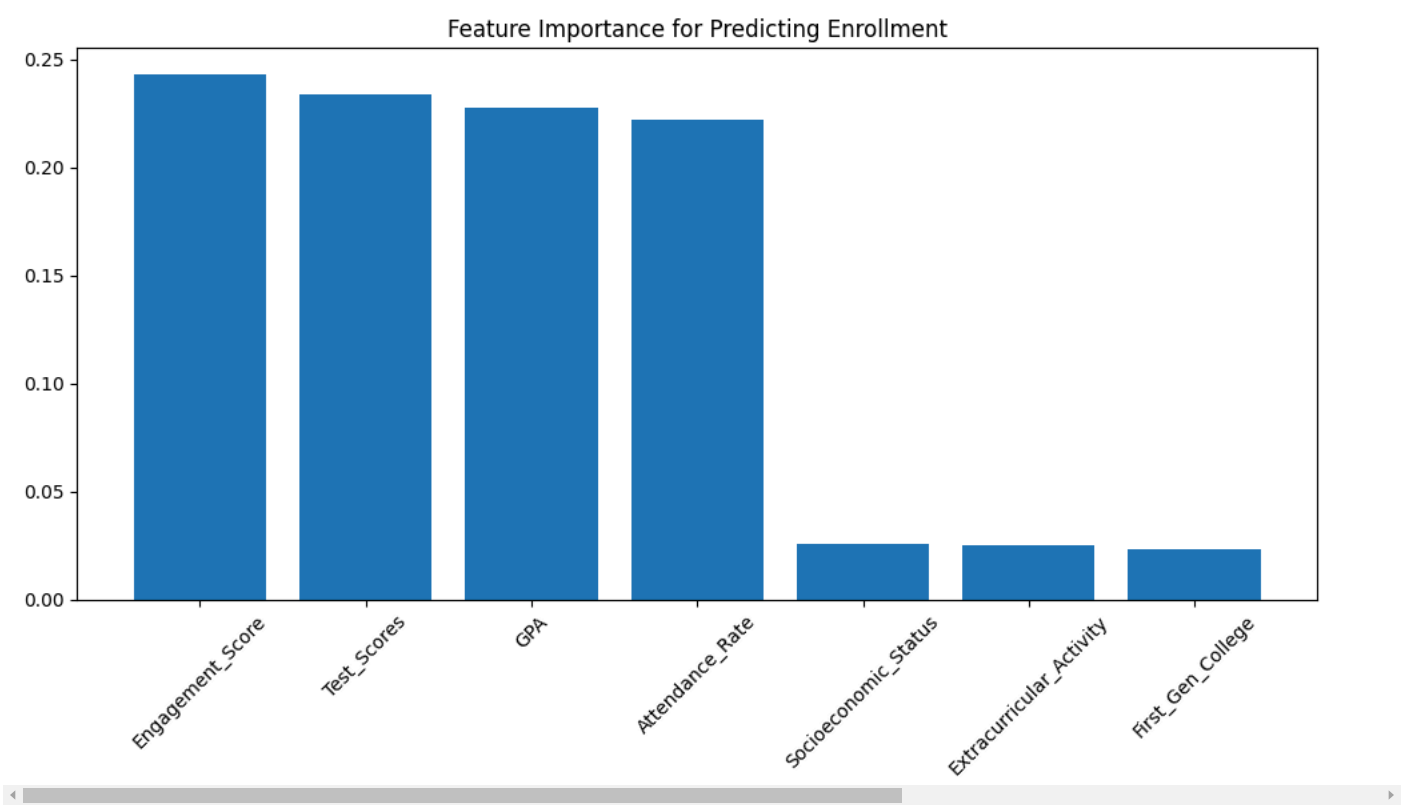
```
y_pred = model.predict(X_test)
print("Classification Report (Enrollment):\n", classification_report(y_test, y_pred))
print("Accuracy Score (Enrollment):", accuracy_score(y_test, y_pred))
```

```
Classification Report (Enrollment):
                precision    recall  f1-score   support

             0       0.68      0.87      0.76       208
             1       0.22      0.09      0.12        92

      accuracy                           0.63       300
     macro avg       0.45      0.48      0.44       300
  weighted avg       0.54      0.63      0.57       300
```

```
Accuracy Score (Enrollment): 0.6266666666666667
```

Featuring Important Visualization

```
importances = model.feature_importances_
sorted_indices = np.argsort(importances)[::-1]
plt.figure(figsize=(10, 6))
plt.title("Feature Importance for Predicting Enrollment")
plt.bar(range(len(importances)), importances[sorted_indices], align="center")
plt.xticks(range(len(importances)), [features[i] for i in sorted_indices], rotation=45)
plt.tight_layout()
plt.show()
```



Predicting Graduation

```
X_train_grad, X_test_grad, y_train_grad, y_test_grad = train_test_split(
    df[features], df[target_graduation], test_size=0.3, random_state=42
)
model_grad = RandomForestClassifier(n_estimators=100, random_state=42)
model_grad.fit(X_train_grad, y_train_grad)
y_pred_grad = model_grad.predict(X_test_grad)

print("\nClassification Report (Graduation):\n", classification_report(y_test_grad, y_pred_grad))
print("Accuracy Score (Graduation):", accuracy_score(y_test_grad, y_pred_grad))
```

```
Classification Report (Graduation):
              precision    recall  f1-score   support

           0       0.57      0.62      0.59       186
           1       0.28      0.25      0.26       114

    accuracy                           0.48       300
   macro avg       0.43      0.43      0.43       300
weighted avg       0.46      0.48      0.47       300

Accuracy Score (Graduation): 0.4766666666666667
```

Graduation Prediction Visualization

```
importances_grad = model_grad.feature_importances_
sorted_indices_grad = np.argsort(importances_grad)[::-1]
plt.figure(figsize=(10, 6))
plt.title("Feature Importance for Predicting Graduation")
plt.bar(range(len(importances_grad)), importances_grad[sorted_indices_grad], align="center")
plt.xticks(range(len(importances_grad)), [features[i] for i in sorted_indices_grad], rotation=45)
plt.tight_layout()
plt.show()
```