Classification Analysis of Purchase Behavior: Predicting Purchases Using Age and Estimated Salary

Importing Libraries

In [1]:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score, classification_report
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix, roc_curve, precision_recall_curve, auc
```

Loading Dataset

In [2]:

```
data = pd.read_csv(r"Social_Network_Ads 2.csv")
data
```

Out[2]:

	Age	EstimatedSalary	Purchased
0	19	19000	0
1	35	20000	0
2	26	43000	0
3	27	57000	0
4	19	76000	0
...	...	...	...
395	46	41000	1
396	51	23000	1
397	50	20000	1
398	36	33000	0
399	49	36000	1

400 rows × 3 columns

Data Preprocessing

In [3]:

```
data.isnull()
```

Out[3]:

	Age	EstimatedSalary	Purchased
0	False	False	False
1	False	False	False
2	False	False	False
3	False	False	False
4	False	False	False
...	...	...	...
395	False	False	False
396	False	False	False
397	False	False	False
398	False	False	False
399	False	False	False

400 rows × 3 columns

In [4]:

```
data.describe()
```

Out[4]:

	Age	EstimatedSalary	Purchased
count	400.000000	400.000000	400.000000
mean	37.655000	69742.500000	0.357500
std	10.482877	34096.960282	0.479864
min	18.000000	15000.000000	0.000000
25%	29.750000	43000.000000	0.000000
50%	37.000000	70000.000000	0.000000
75%	46.000000	88000.000000	1.000000
max	60.000000	150000.000000	1.000000

In [5]:

```
data.shape
```

Out[5]:

```
(400, 3)
```

In [6]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 3 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Age              400 non-null    int64
 1   EstimatedSalary  400 non-null    int64
 2   Purchased        400 non-null    int64
dtypes: int64(3)
memory usage: 9.5 KB
```

Dividing into Train and Test

In [7]:

```
# Split the data into features (X) and target (y)
X = data[['Age', 'EstimatedSalary']]
y = data['Purchased']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

Feature Scaling

In [8]:

```
# Standardize the features (important for SVM)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

Logistic Regression

In [9]:

```
# Apply Logistic Regression
logreg_model = LogisticRegression()
logreg_model.fit(X_train_scaled, y_train)
logreg_preds = logreg_model.predict(X_test_scaled)
```

SVM

In [10]:

```
svm_model = SVC(kernel='linear', C=1.0)
svm_model.fit(X_train_scaled, y_train)
svm_preds = svm_model.predict(X_test_scaled)
```

Model Evaluation

In [11]:
```
# Evaluate models
logreg_accuracy = accuracy_score(y_test, logreg_preds)
svm_accuracy = accuracy_score(y_test, svm_preds)
```

In [12]:
```
print("Logistic Regression Accuracy:", logreg_accuracy)
print("SVM Accuracy:", svm_accuracy)
```

```
Logistic Regression Accuracy: 0.85
SVM Accuracy: 0.85
```

In [13]:
```
print("Logistic Regression Classification Report:")
print(classification_report(y_test, logreg_preds))

print("SVM Classification Report:")
print(classification_report(y_test, svm_preds))
```

```
Logistic Regression Classification Report:
              precision    recall  f1-score   support

           0       0.82      0.97      0.89        73
           1       0.94      0.66      0.78        47

    accuracy                           0.85       120
   macro avg       0.88      0.82      0.83       120
weighted avg       0.86      0.85      0.84       120

SVM Classification Report:
              precision    recall  f1-score   support

           0       0.81      0.99      0.89        73
           1       0.97      0.64      0.77        47

    accuracy                           0.85       120
   macro avg       0.89      0.81      0.83       120
weighted avg       0.87      0.85      0.84       120
```

Visualiseing Models Preformance

Confusion Matrix

In [14]:
```
# Confusion Matrix
def plot_confusion_matrix(y_true, y_pred, title):
    cm = confusion_matrix(y_true, y_pred)
    plt.figure(figsize=(6, 6))
    sns.heatmap(cm, annot=True, fmt="d", cmap="Blues")
    plt.title(title)
    plt.xlabel("Predicted")
    plt.ylabel("Actual")
    plt.show()
```

In [15]:

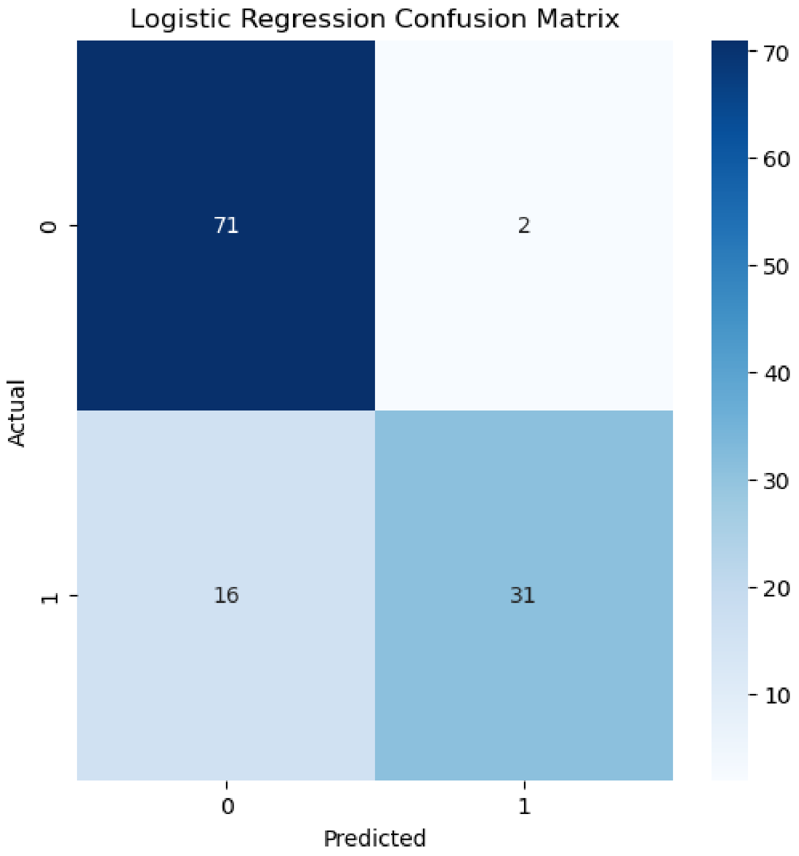
```
# ROC Curve
def plot_roc_curve(y_true, y_scores):
    fpr, tpr, _ = roc_curve(y_true, y_scores)
    roc_auc = auc(fpr, tpr)
    plt.figure(figsize=(8, 6))
    plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % roc_auc)
    plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
    plt.xlim([0.0, 1.0])
    plt.ylim([0.0, 1.05])
    plt.xlabel('False Positive Rate')
    plt.ylabel('True Positive Rate')
    plt.title('Receiver Operating Characteristic')
    plt.legend(loc="lower right")
    plt.show()
```

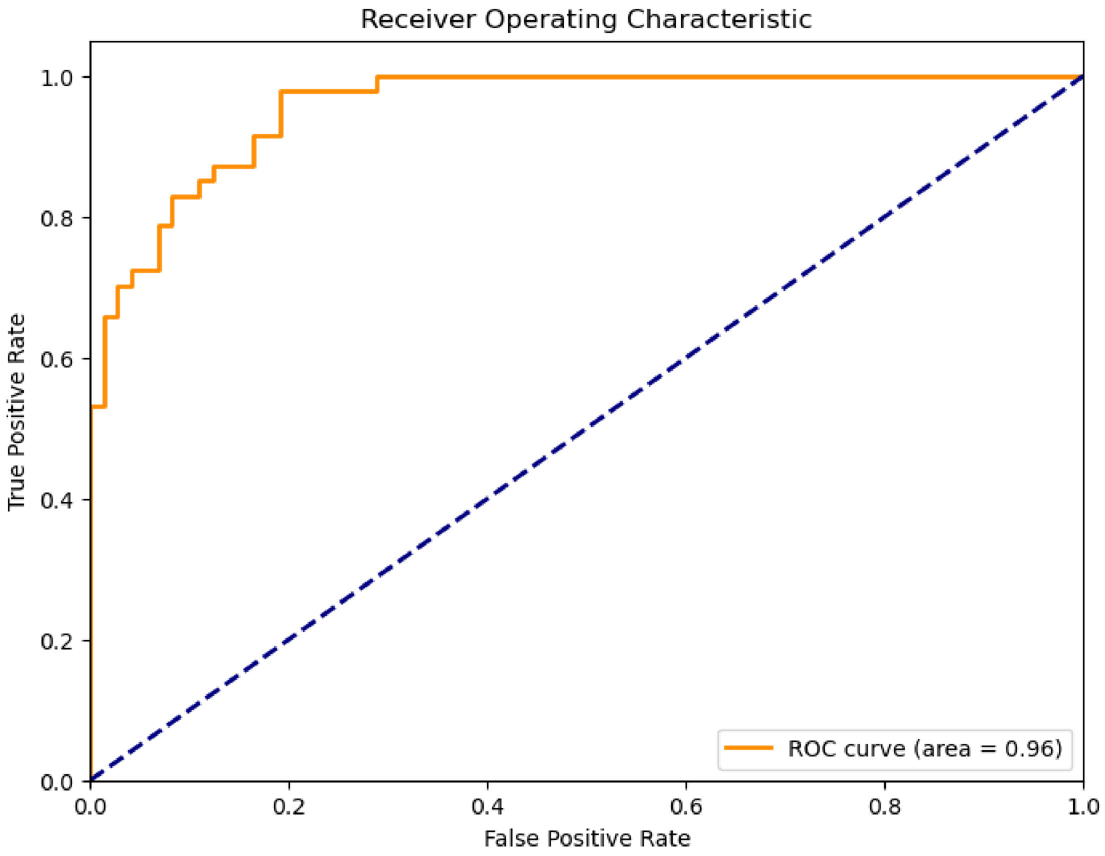
In [16]:

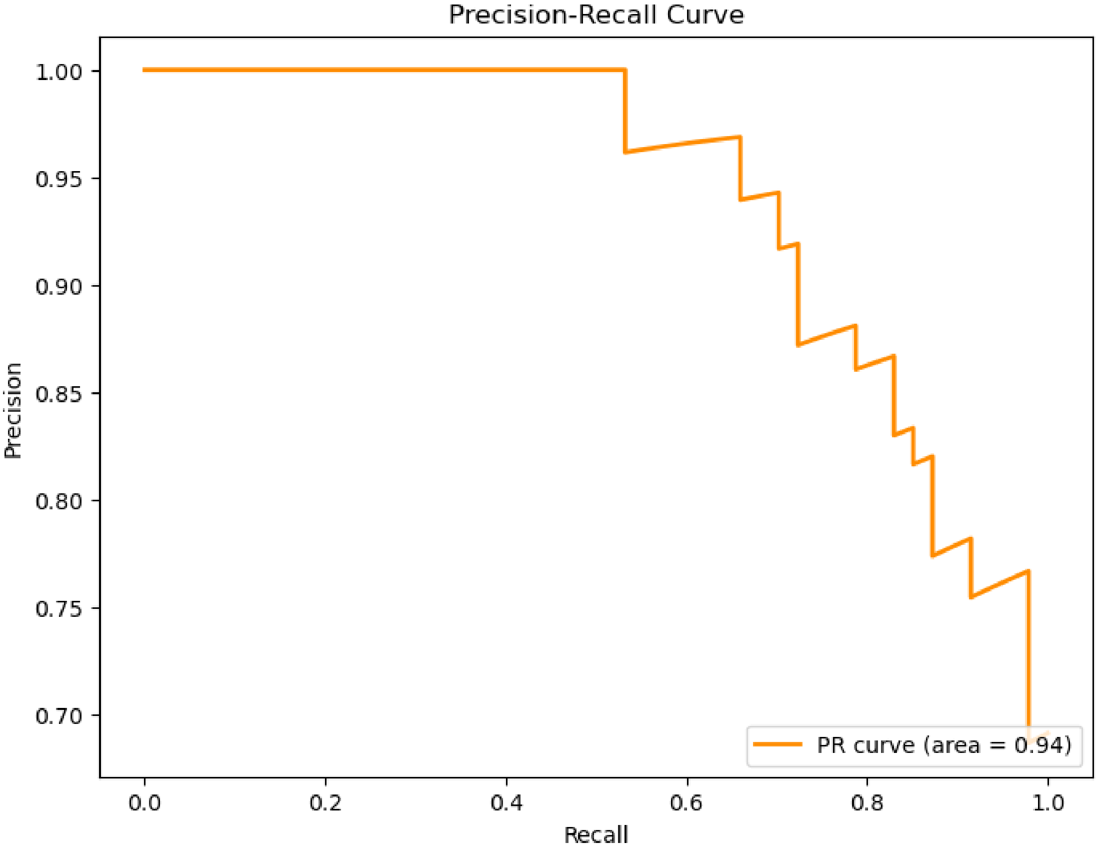
```
# Precision-Recall Curve
def plot_precision_recall_curve(y_true, y_scores):
    precision, recall, _ = precision_recall_curve(y_true, y_scores)
    pr_auc = auc(recall, precision)
    plt.figure(figsize=(8, 6))
    plt.plot(recall, precision, color='darkorange', lw=2, label='PR curve (area = %0.2f)' % pr_auc
    plt.xlabel('Recall')
    plt.ylabel('Precision')
    plt.title('Precision-Recall Curve')
    plt.legend(loc="lower right")
    plt.show()
```

In [17]:

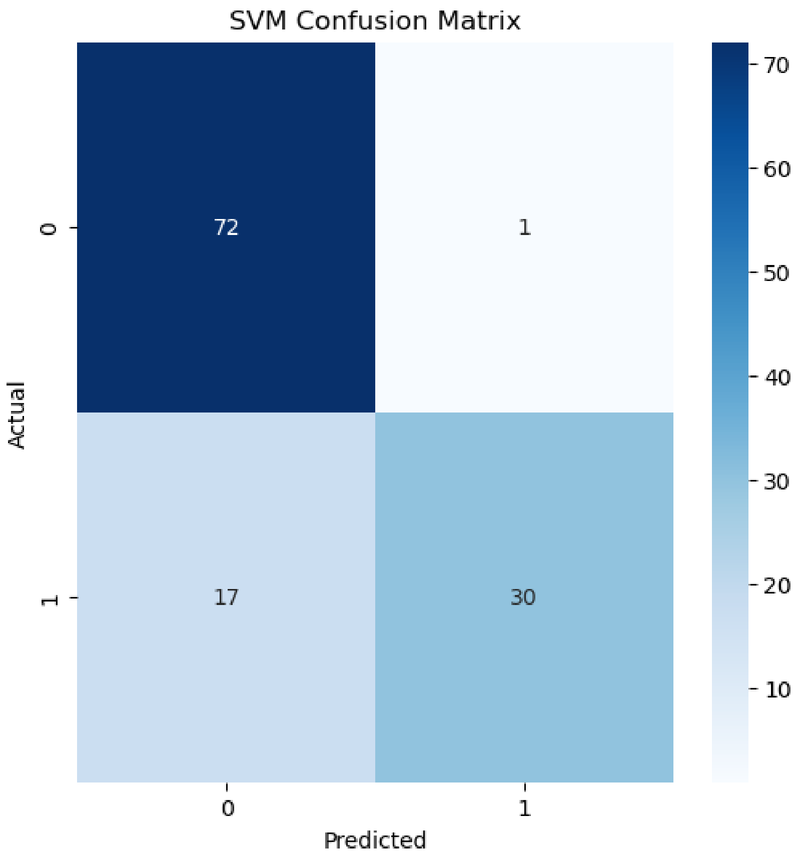
```python
# Visualize Logistic Regression performance
plot_confusion_matrix(y_test, logreg_preds, title='Logistic Regression Confusion Matrix')
plot_roc_curve(y_test, logreg_model.predict_proba(X_test_scaled)[:, 1])
plot_precision_recall_curve(y_test, logreg_model.predict_proba(X_test_scaled)[:, 1])
```



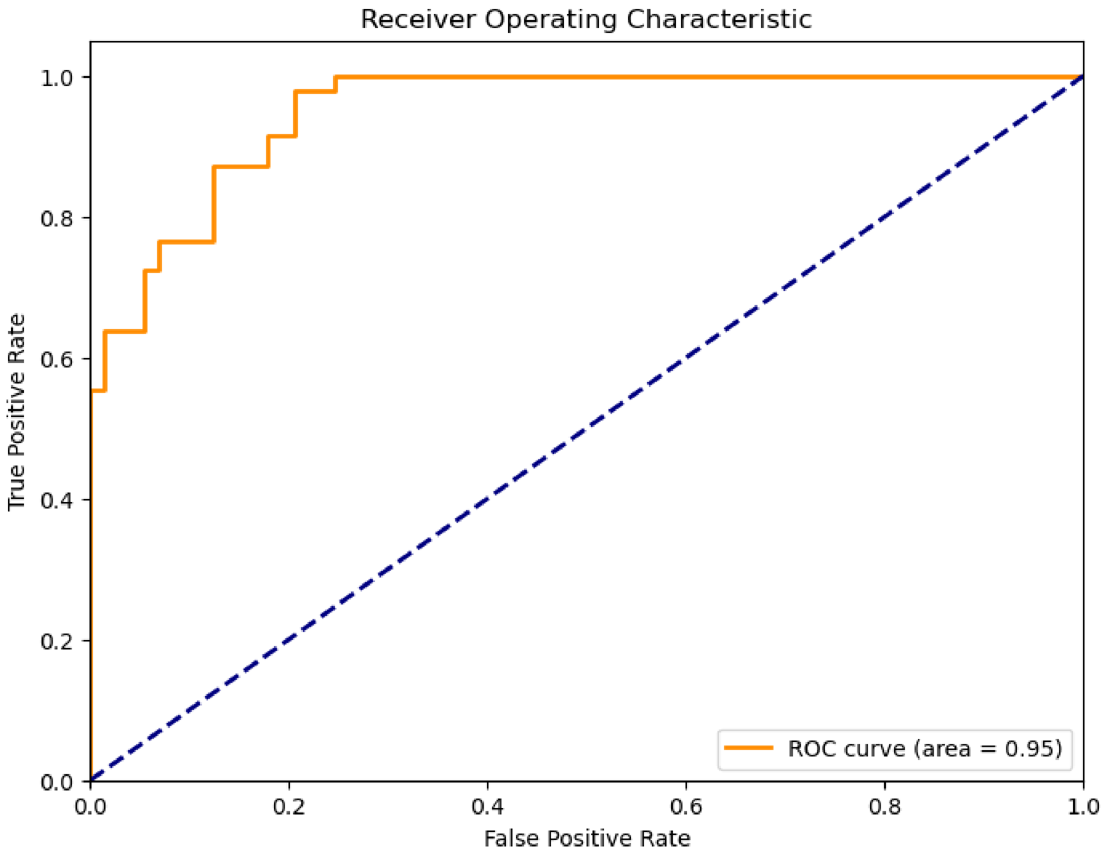



Precision-Recall Curve
Precision
Recall
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.0
0.2
0.4
0.6
0.8
1.0
PR curve (area = 0.94)

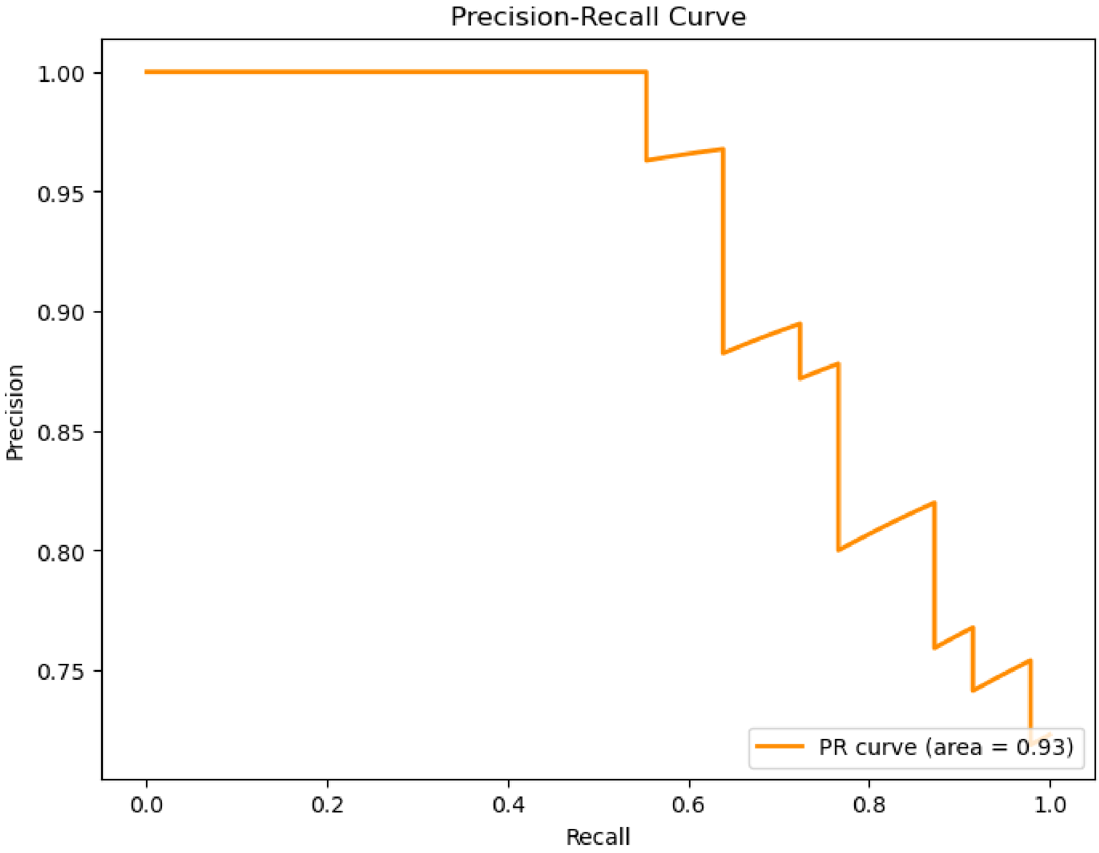
```
In [18]: # Visualize SVM performance
         plot_confusion_matrix(y_test, svm_preds, title='SVM Confusion Matrix')
         plot_roc_curve(y_test, svm_model.decision_function(X_test_scaled))
         plot_precision_recall_curve(y_test, svm_model.decision_function(X_test_scaled))
```



SVM Confusion Matrix



Receiver Operating Characteristic


Precision-Recall Curve
1.00
0.95
0.90
0.85
0.80
0.75
Precision
0.0
0.2
0.4
0.6
0.8
1.0
Recall
PR curve (area = 0.93)

```
In [ ]:
```