# ex10

September 6, 2024

```
[44]: import pandas as pd
      import matplotlib.pyplot as plt
      import seaborn as sns
      from imblearn.over_sampling import SMOTE
      from sklearn.model_selection import train_test_split
      from sklearn.ensemble import RandomForestClassifier
      from sklearn.metrics import classification_report, roc_auc_score, roc_curve
      from sklearn.preprocessing import StandardScaler
      from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
```

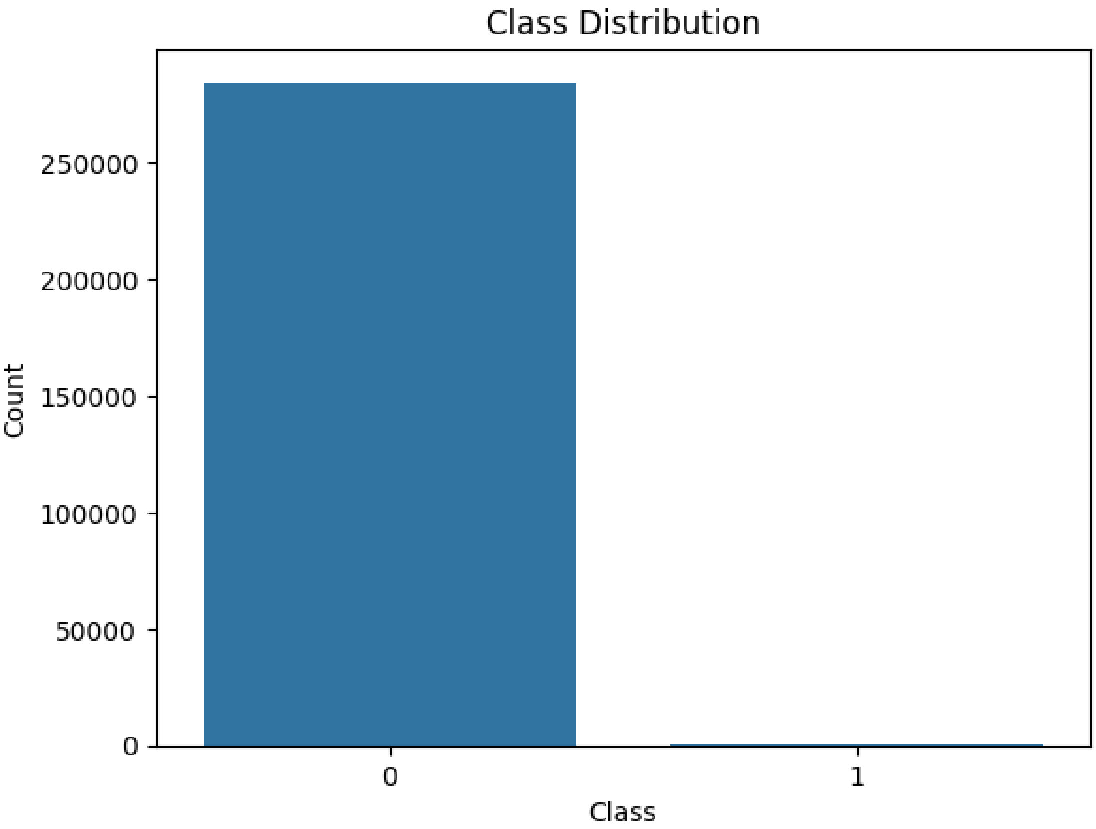
```
[45]: df = pd.read_csv('datasets\creditcard.csv')
      df.head()
```

```
[45]:    Time        V1        V2        V3        V4        V5        V6        V7  \
      0   0.0 -1.359807 -0.072781  2.536347  1.378155 -0.338321  0.462388  0.239599
      1   0.0  1.191857  0.266151  0.166480  0.448154  0.060018 -0.082361 -0.078803
      2   1.0 -1.358354 -1.340163  1.773209  0.379780 -0.503198  1.800499  0.791461
      3   1.0 -0.966272 -0.185226  1.792993 -0.863291 -0.010309  1.247203  0.237609
      4   2.0 -1.158233  0.877737  1.548718  0.403034 -0.407193  0.095921  0.592941

               V8        V9  …       V21       V22       V23       V24       V25  \
      0  0.098698  0.363787  … -0.018307  0.277838 -0.110474  0.066928  0.128539
      1  0.085102 -0.255425  … -0.225775 -0.638672  0.101288 -0.339846  0.167170
      2  0.247676 -1.514654  …  0.247998  0.771679  0.909412 -0.689281 -0.327642
      3  0.377436 -1.387024  … -0.108300  0.005274 -0.190321 -1.175575  0.647376
      4 -0.270533  0.817739  … -0.009431  0.798278 -0.137458  0.141267 -0.206010

              V26       V27       V28  Amount  Class
      0 -0.189115  0.133558 -0.021053  149.62      0
      1  0.125895 -0.008983  0.014724    2.69      0
      2 -0.139097 -0.055353 -0.059752  378.66      0
      3 -0.221929  0.062723  0.061458  123.50      0
      4  0.502292  0.219422  0.215153   69.99      0

      [5 rows x 31 columns]
```

[46]:

```
class_counts = df['Class'].value_counts()
print(class_counts)

sns.barplot(x=class_counts.index, y=class_counts.values)
plt.xlabel('Class')
plt.ylabel('Count')
plt.title('Class Distribution')
plt.show()
```

```
Class
0    284315
1       492
Name: count, dtype: int64
```



[47]:

```
X = df.drop(columns=['Class'])
y = df['Class']

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

```
smote = SMOTE(random_state=42)
X_train_smote, y_train_smote = smote.fit_resample(X_train, y_train)

smote_class_counts = y_train_smote.value_counts()
print(smote_class_counts)
```

```
Class
0    227451
1    227451
Name: count, dtype: int64
```

[48]:

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

[49]:

```
clf = RandomForestClassifier(random_state=42, n_estimators=20)
clf.fit(X_train, y_train)
y_pred = clf.predict(X_test)

print("Without SMOTE")
print(classification_report(y_test, y_pred))
print("ROC AUC Score:", roc_auc_score(y_test, clf.predict_proba(X_test)[:, 1]))
```

```
Without SMOTE
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     56864
           1       0.97      0.74      0.84        98

    accuracy                           1.00     56962
   macro avg       0.99      0.87      0.92     56962
weighted avg       1.00      1.00      1.00     56962

ROC AUC Score: 0.9331926408013965
```

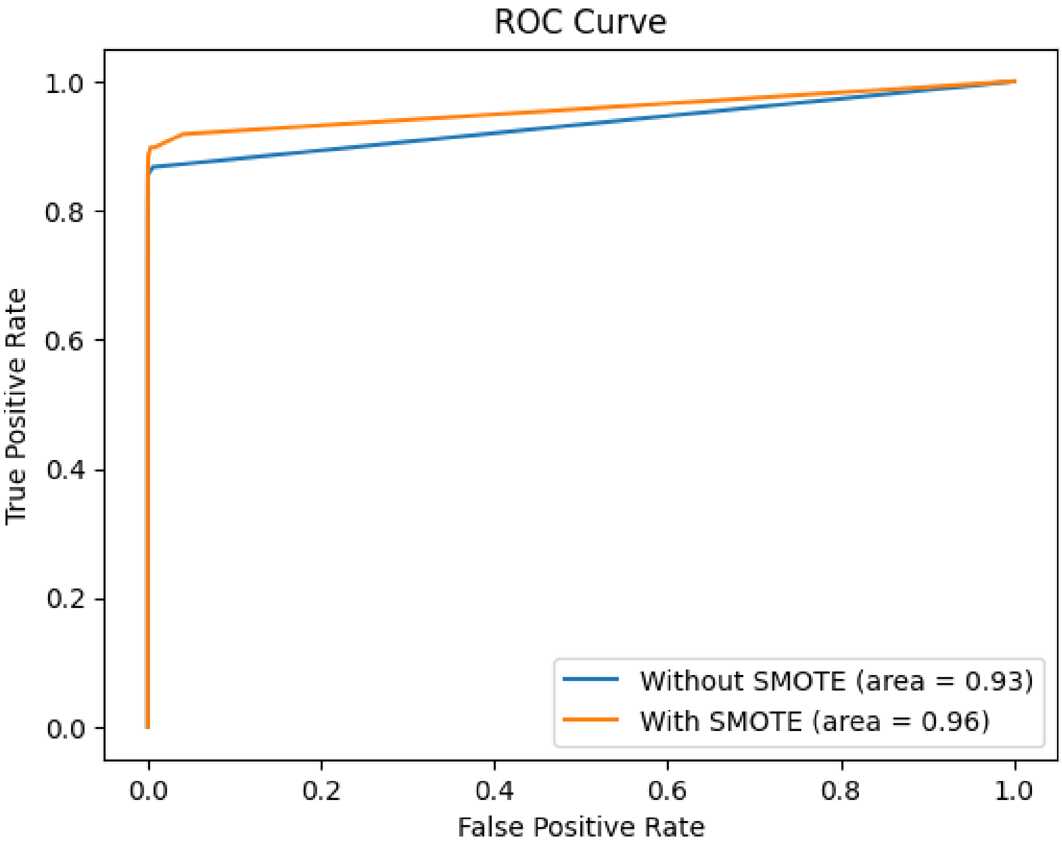
[50]:

```
clf_smote = RandomForestClassifier(random_state=42, n_estimators=20)
clf_smote.fit(X_train_smote, y_train_smote)
y_pred_smote = clf_smote.predict(X_test)

print("With SMOTE")
print(classification_report(y_test, y_pred_smote))
print("ROC AUC Score:", roc_auc_score(y_test, clf_smote.predict_proba(X_test)[:
  ↪, 1]))
```

```
With SMOTE
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     56864
           1       0.86      0.84      0.85        98

    accuracy                           1.00     56962
   macro avg       0.93      0.92      0.92     56962
weighted avg       1.00      1.00      1.00     56962

ROC AUC Score: 0.9569530559128546
```

[51]:

```
fpr, tpr, _ = roc_curve(y_test, clf.predict_proba(X_test)[:, 1])
fpr_smote, tpr_smote, _ = roc_curve(y_test, clf_smote.predict_proba(X_test)[:,␣
 ↪1])

plt.figure()
plt.plot(fpr, tpr, label='Without SMOTE (area = %0.2f)' % roc_auc_score(y_test,␣
 ↪clf.predict_proba(X_test)[:, 1]))
plt.plot(fpr_smote, tpr_smote, label='With SMOTE (area = %0.2f)' %␣
 ↪roc_auc_score(y_test, clf_smote.predict_proba(X_test)[:, 1]))
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC Curve')
plt.legend(loc='best')
plt.show()
```


ROC Curve
True Positive Rate
False Positive Rate
Without SMOTE (area = 0.93)
With SMOTE (area = 0.96)