Import Modules

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier
from xgboost import XGBClassifier
from imblearn.over_sampling import SMOTE  # Assuming you have imblearn installed
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, f1_score
import seaborn as sns
import matplotlib.pyplot as plt
```

Loading Dataset

```
df=pd.read_csv('creditcard.csv')
df.head()
df_clean = df.dropna()  # Ensure no NaN values are present
X = df_clean.drop(columns=['Class'])
y = df_clean['Class']
```

```
df.describe()
```

	Time	V1	V2	V3	V4	V5	V6	V7	
count	284807.000000	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.8480
mean	94813.859575	1.168375e-15	3.416908e-16	-1.379537e-15	2.074095e-15	9.604066e-16	1.487313e-15	-5.556467e-16	1.2134
std	47488.145955	1.958696e+00	1.651309e+00	1.516255e+00	1.415869e+00	1.380247e+00	1.332271e+00	1.237094e+00	1.1943
min	0.000000	-5.640751e+01	-7.271573e+01	-4.832559e+01	-5.683171e+00	-1.137433e+02	-2.616051e+01	-4.355724e+01	-7.3216
25%	54201.500000	-9.203734e-01	-5.985499e-01	-8.903648e-01	-8.486401e-01	-6.915971e-01	-7.682956e-01	-5.540759e-01	-2.0862
50%	84692.000000	1.810880e-02	6.548556e-02	1.798463e-01	-1.984653e-02	-5.433583e-02	-2.741871e-01	4.010308e-02	2.2358
75%	139320.500000	1.315642e+00	8.037239e-01	1.027196e+00	7.433413e-01	6.119264e-01	3.985649e-01	5.704361e-01	3.2734
max	172792.000000	2.454930e+00	2.205773e+01	9.382558e+00	1.687534e+01	3.480167e+01	7.330163e+01	1.205895e+02	2.0007

8 rows × 31 columns

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 284807 entries, 0 to 284806
Data columns (total 31 columns):
 #   Column  Non-Null Count   Dtype  
---  ------  --------------   -----  
 0   Time    284807 non-null  float64
 1   V1      284807 non-null  float64
 2   V2      284807 non-null  float64
 3   V3      284807 non-null  float64
 4   V4      284807 non-null  float64
 5   V5      284807 non-null  float64
 6   V6      284807 non-null  float64
 7   V7      284807 non-null  float64
 8   V8      284807 non-null  float64
 9   V9      284807 non-null  float64
 10  V10     284807 non-null  float64
 11  V11     284807 non-null  float64
 12  V12     284807 non-null  float64
 13  V13     284807 non-null  float64
 14  V14     284807 non-null  float64
 15  V15     284807 non-null  float64
 16  V16     284807 non-null  float64
 17  V17     284807 non-null  float64
 18  V18     284807 non-null  float64
 19  V19     284807 non-null  float64
 20  V20     284807 non-null  float64
 21  V21     284807 non-null  float64
 22  V22     284807 non-null  float64
 23  V23     284807 non-null  float64
 24  V24     284807 non-null  float64
 25  V25     284807 non-null  float64
 26  V26     284807 non-null  float64
 27  V27     284807 non-null  float64
 28  V28     284807 non-null  float64
 29  Amount  284807 non-null  float64
 30  Class   284807 non-null  int64  
dtypes: float64(30), int64(1)
memory usage: 67.4 MB
```

Preprocessing the Data

```
df.isnull().sum()
```

```
        0
Time    0
V1      0
V2      0
V3      0
V4      0
V5      0
V6      0
V7      0
V8      0
V9      0
V10     0
V11     0
V12     0
V13     0
V14     0
V15     0
V16     0
V17     0
V18     0
V19     0
V20     0
V21     0
```

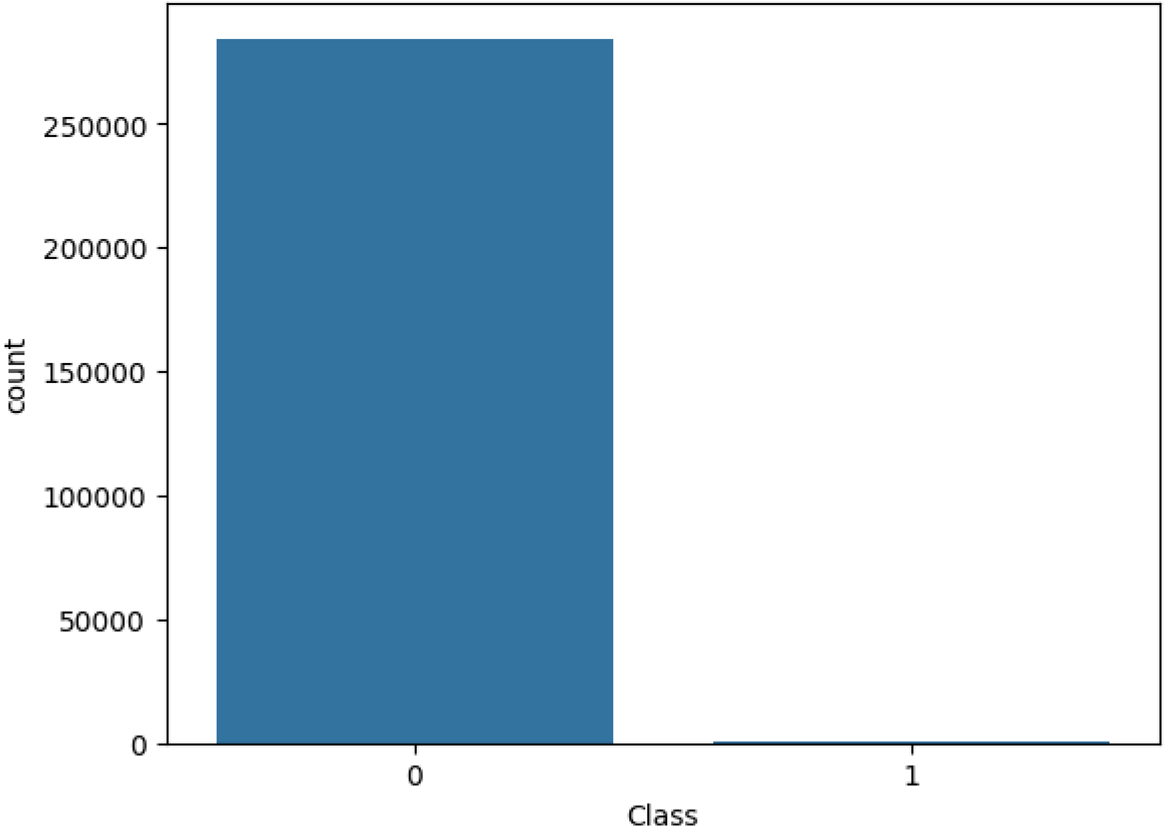
```
   V22   0
   V23   0
   V24   0
   V25   0
   V26   0
   V27   0
   V28   0
Amount   0
 Class   0

dtype: int64
```

Exploratory Data Analysis

```
sns.countplot(x='Class',data=df)
```

```
<Axes: xlabel='Class', ylabel='count'>
```



Input Split

```
X = df.drop(columns=['Class'], axis=1)
y = df['Class']
```

Standard Scaling

```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
x_scaler = sc.fit_transform(X)
x_scaler[-1]
```

```
array([ 1.64205773, -0.27233093, -0.11489898,  0.46386564, -0.35757   ,
       -0.00908946, -0.48760183,  1.27476937, -0.3471764 ,  0.44253246,
       -0.84072963, -1.01934641, -0.0315383 , -0.18898634, -0.08795849,
        0.04515766, -0.34535763, -0.77752147,  0.1997554 , -0.31462479,
        0.49673933,  0.35541083,  0.8861488 ,  0.6033653 ,  0.01452561,
       -0.90863123, -1.69685342, -0.00598394,  0.04134999,  0.51435531])
```

Model Training

```
print("NaN Count in x_scaler:", np.isnan(x_scaler).sum())
print("NaN Count in y:", y.isnull().sum())
```

```
NaN Count in x_scaler: 0
NaN Count in y: 0
```

```
# Drop NaN values before scaling
df_clean = df.dropna()

# Separate features and target only from the cleaned DataFrame
X = df_clean.drop(columns=['Class'], axis=1)
y = df_clean['Class']

# Perform standard scaling
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
x_scaler = sc.fit_transform(X)

# Split the data
x_train, x_test, y_train, y_test = train_test_split(x_scaler, y, test_size=0.25, random_state=42, stratify=y)
```

```
from sklearn.linear_model import LogisticRegression
model = LogisticRegression()
# training
model.fit(x_train, y_train)
# testing
y_pred = model.predict(x_test)
print(classification_report(y_test, y_pred))
print("F1 Score:",f1_score(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     71079
           1       0.84      0.62      0.71       123

    accuracy                           1.00     71202
   macro avg       0.92      0.81      0.85     71202
weighted avg       1.00      1.00      1.00     71202

F1 Score: 0.7102803738317757
```

```
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier()
# training
model.fit(x_train, y_train)
# testing
y_pred = model.predict(x_test)
print(classification_report(y_test, y_pred))
print("F1 Score:",f1_score(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     71079
           1       0.96      0.77      0.86       123

    accuracy                           1.00     71202
   macro avg       0.98      0.89      0.93     71202
weighted avg       1.00      1.00      1.00     71202
```

```
F1 Score: 0.8558558558558559
```

```
from xgboost import XGBClassifier
model = XGBClassifier(n_jobs=-1)
# training
model.fit(x_train, y_train)
# testing
y_pred = model.predict(x_test)
print(classification_report(y_test, y_pred))
print("F1 Score:",f1_score(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     71079
           1       0.95      0.79      0.86       123

    accuracy                           1.00     71202
   macro avg       0.98      0.89      0.93     71202
weighted avg       1.00      1.00      1.00     71202

F1 Score: 0.8622222222222222
```

Class Imbalance

```
smote = SMOTE(random_state=42)
x_train_smote, y_train_smote = smote.fit_resample(x_train, y_train)
```

```
from sklearn.linear_model import LogisticRegression
log_model = LogisticRegression()
log_model.fit(x_train_smote, y_train_smote)  # Training with SMOTE data
y_pred_log = log_model.predict(x_test)
print("Logistic Regression")
print(classification_report(y_test, y_pred_log))
print("F1 Score:", f1_score(y_test, y_pred_log))
```

```
Logistic Regression
              precision    recall  f1-score   support

           0       1.00      0.98      0.99     71079
           1       0.06      0.89      0.11       123

    accuracy                           0.98     71202
   macro avg       0.53      0.93      0.55     71202
weighted avg       1.00      0.98      0.99     71202

F1 Score: 0.11082867310625318
```

```
rf_model = RandomForestClassifier(n_jobs=-1)
rf_model.fit(x_train_smote, y_train_smote)  # Training with SMOTE data
y_pred_rf = rf_model.predict(x_test)
print("Random Forest Classifier")
print(classification_report(y_test, y_pred_rf))
print("F1 Score:", f1_score(y_test, y_pred_rf))
```

```
Random Forest Classifier
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     71079
           1       0.88      0.80      0.84       123

    accuracy                           1.00     71202
   macro avg       0.94      0.90      0.92     71202
weighted avg       1.00      1.00      1.00     71202

F1 Score: 0.8376068376068376
```