

## 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	2.848070e+05
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

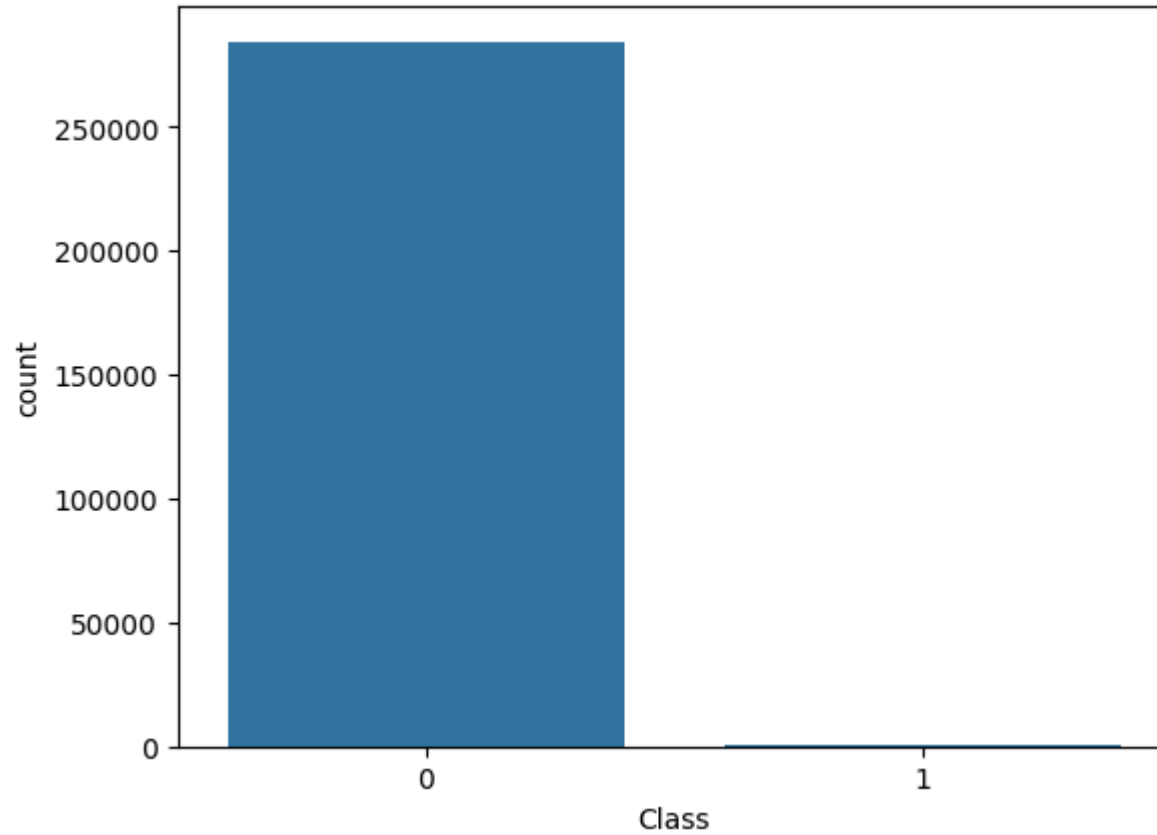
<b>V22</b>	0
<b>V23</b>	0
<b>V24</b>	0
<b>V25</b>	0
<b>V26</b>	0
<b>V27</b>	0
<b>V28</b>	0
<b>Amount</b>	0
<b>Class</b>	0

**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          1.00          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