In [1]:
```
FindDefault (Prediction of Credit Card fraud)
```

In [ ]:
```
# Importing necessary libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, confusion_matrix,roc_auc_score, roc_curve
from imblearn.over_sampling import SMOTE
```

In [2]:
```
# Load the dataset
data = pd.read_csv('creditcard.csv')
```

In [3]:
```
# 1. Exploratory Data Analysis (EDA)
print("Dataset Overview:")
print(data.head())
```

```
Dataset Overview:
   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]
```

In [4]:
```
print("\nDataset Info:")
print(data.info())
```

```
Dataset 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
None
```

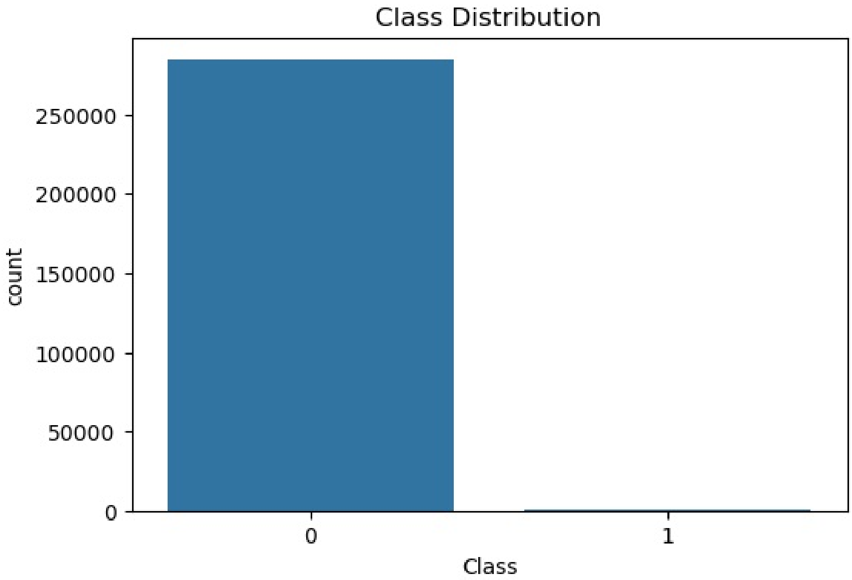
In [5]:

```
print("\nSummary Statistics:")
print(data.describe())
```

```
Summary Statistics:
                Time            V1            V2            V3            V4  \
count  284807.000000  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   
std     47488.145955  1.958696e+00  1.651309e+00  1.516255e+00  1.415869e+00   
min         0.000000 -5.640751e+01 -7.271573e+01 -4.832559e+01 -5.683171e+00   
25%     54201.500000 -9.203734e-01 -5.985499e-01 -8.903648e-01 -8.486401e-01   
50%     84692.000000  1.810880e-02  6.548556e-02  1.798463e-01 -1.984653e-02   
75%    139320.500000  1.315642e+00  8.037239e-01  1.027196e+00  7.433413e-01   
max    172792.000000  2.454930e+00  2.205773e+01  9.382558e+00  1.687534e+01   

                 V5            V6            V7            V8            V9  \
count  2.848070e+05  2.848070e+05  2.848070e+05  2.848070e+05  2.848070e+05   
mean   9.604066e-16  1.487313e-15 -5.556467e-16  1.213481e-16 -2.406331e-15   
std    1.380247e+00  1.332271e+00  1.237094e+00  1.194353e+00  1.098632e+00   
min   -1.137433e+02 -2.616051e+01 -4.355724e+01 -7.321672e+01 -1.343407e+01   
25%   -6.915971e-01 -7.682956e-01 -5.540759e-01 -2.086297e-01 -6.430976e-01   
50%   -5.433583e-02 -2.741871e-01  4.010308e-02  2.235804e-02 -5.142873e-02   
75%    6.119264e-01  3.985649e-01  5.704361e-01  3.273459e-01  5.971390e-01   
max    3.480167e+01  7.330163e+01  1.205895e+02  2.000721e+01  1.559499e+01   

       ...           V21           V22           V23           V24  \
count  ...  2.848070e+05  2.848070e+05  2.848070e+05  2.848070e+05   
mean   ...  1.654067e-16 -3.568593e-16  2.578648e-16  4.473266e-15   
std    ...  7.345240e-01  7.257016e-01  6.244603e-01  6.056471e-01   
min    ... -3.483038e+01 -1.093314e+01 -4.480774e+01 -2.836627e+00   
25%    ... -2.283949e-01 -5.423504e-01 -1.618463e-01 -3.545861e-01   
50%    ... -2.945017e-02  6.781943e-03 -1.119293e-02  4.097606e-02   
75%    ...  1.863772e-01  5.285536e-01  1.476421e-01  4.395266e-01   
max    ...  2.720284e+01  1.050309e+01  2.252841e+01  4.584549e+00   

                V25           V26           V27           V28         Amount  \
count  2.848070e+05  2.848070e+05  2.848070e+05  2.848070e+05  284807.000000   
mean   5.340915e-16  1.683437e-15 -3.660091e-16 -1.227390e-16      88.349619   
std    5.212781e-01  4.822270e-01  4.036325e-01  3.300833e-01     250.120109   
min   -1.029540e+01 -2.604551e+00 -2.256568e+01 -1.543008e+01       0.000000   
25%   -3.171451e-01 -3.269839e-01 -7.083953e-02 -5.295979e-02       5.600000   
50%    1.659350e-02 -5.213911e-02  1.342146e-03  1.124383e-02      22.000000   
75%    3.507156e-01  2.409522e-01  9.104512e-02  7.827995e-02      77.165000   
max    7.519589e+00  3.517346e+00  3.161220e+01  3.384781e+01   25691.160000   

               Class  
count  284807.000000  
mean        0.001727  
std         0.041527  
min         0.000000  
25%         0.000000  
50%         0.000000  
75%         0.000000  
max         1.000000  

[8 rows x 31 columns]
```

In [6]:

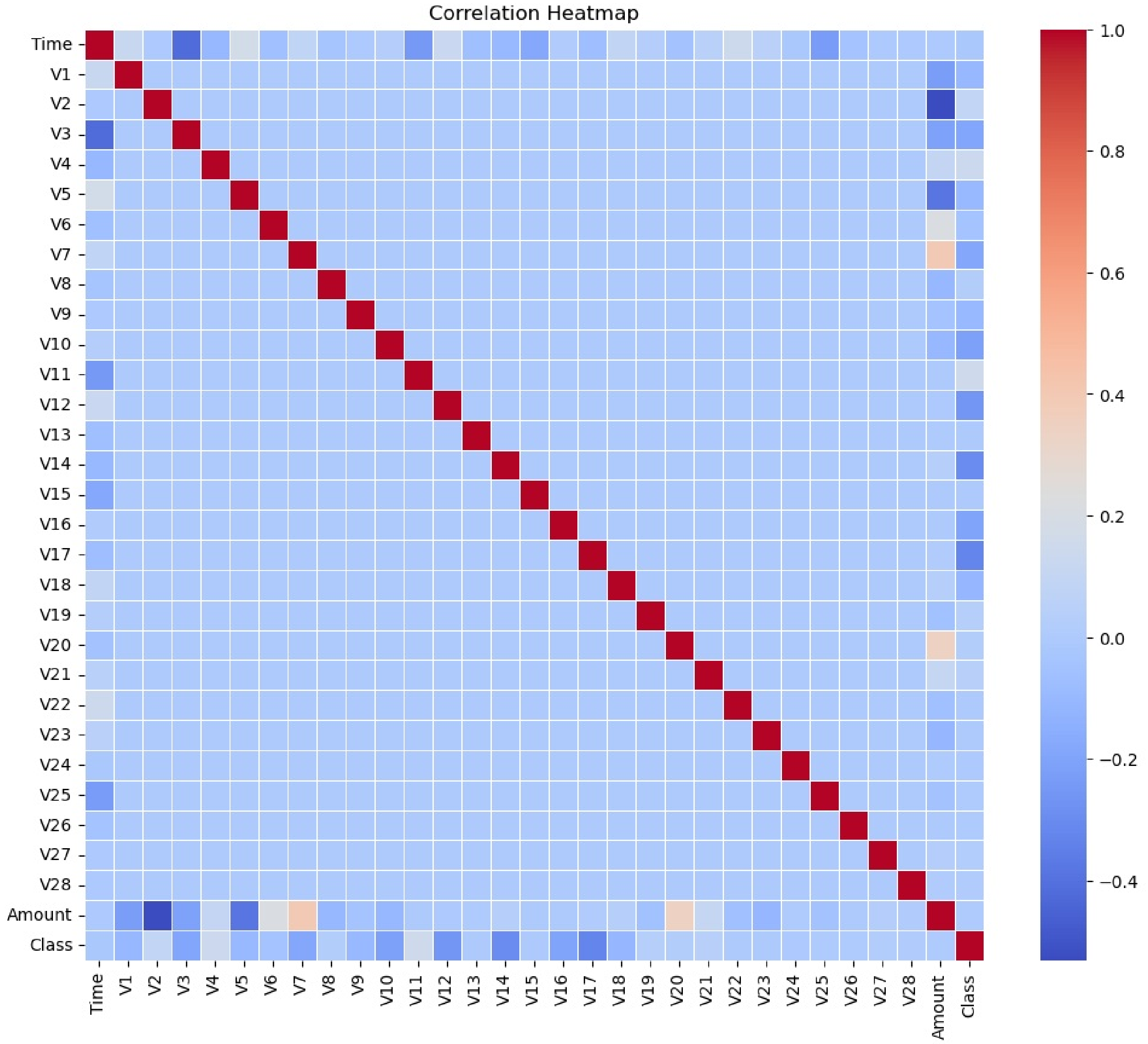
```python
# plt.figure(figsize=(6, 4))
# sns.countplot(data['Class'])
# plt.title('Class Distribution')
# plt.show()
plt.figure(figsize=(6, 4))
sns.countplot(x='Class', data=data)
plt.title('Class Distribution')
plt.show()
```



In [7]:
```
# Check for missing values
print("\nMissing Values:")
print(data.isnull().sum())
```

```
Missing Values:
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
```

In [8]:
```
# Correlation heatmap
plt.figure(figsize=(12, 10))
sns.heatmap(data.corr(), cmap='coolwarm', linewidths=0.5)
plt.title('Correlation Heatmap')
plt.show()
```



In [9]:
```
# 2. Data Cleaning (if needed)
# Check for outliers (optional, based on EDA)
# For simplicity, assuming no missing values or significant outliers in this example.

# 3. Dealing with Imbalanced Data
X = data.drop('Class', axis=1)
y = data['Class']
```

In [10]:
```
# Splitting the data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42, stratify=y)
```

In [11]:
```
# Balancing the dataset using SMOTE
smote = SMOTE(random_state=42)

X_train_resampled, y_train_resampled = smote.fit_resample(X_train, y_train)
print("\nClass Distribution After Resampling:")
print(y_train_resampled.value_counts())
```

```
Class Distribution After Resampling:
Class
0    227451
1    227451
Name: count, dtype: int64
```

In [12]:
```
# 4. Feature Engineering
# Standardizing numerical features
scaler = StandardScaler()
X_train_resampled = scaler.fit_transform(X_train_resampled)
X_test = scaler.transform(X_test)
```

In [13]:
```
# 5. Model Selection
# Using Random Forest Classifier as an example
# model = RandomForestClassifier(random_state=42)
# If You have multiple CPU use below line and comment above line
```

```python
model = RandomForestClassifier(n_jobs=-1, random_state=42)
```

In [14]:
```python
# 6. Model Training
model.fit(X_train_resampled, y_train_resampled)
```

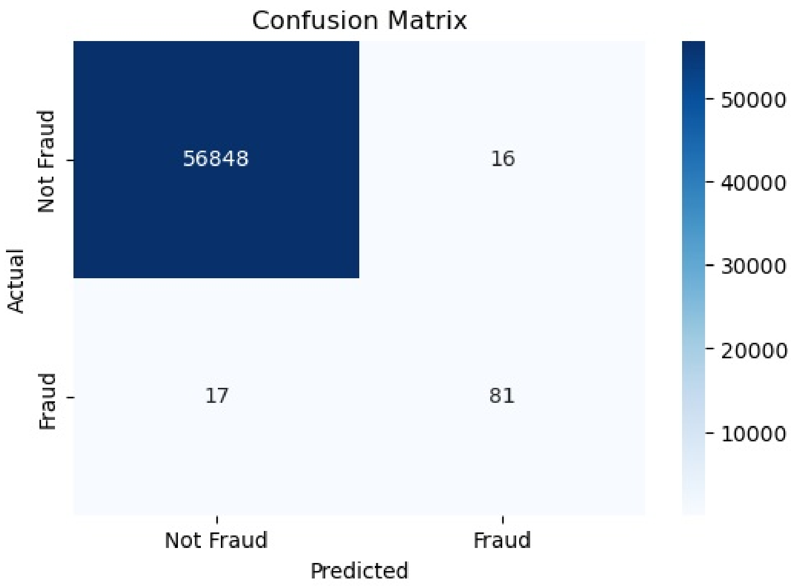
Out[14]:
```
RandomForestClassifier
RandomForestClassifier(n_jobs=-1, random_state=42)
```

In [15]:
```python
# 7. Model Validation
y_pred = model.predict(X_test)
```

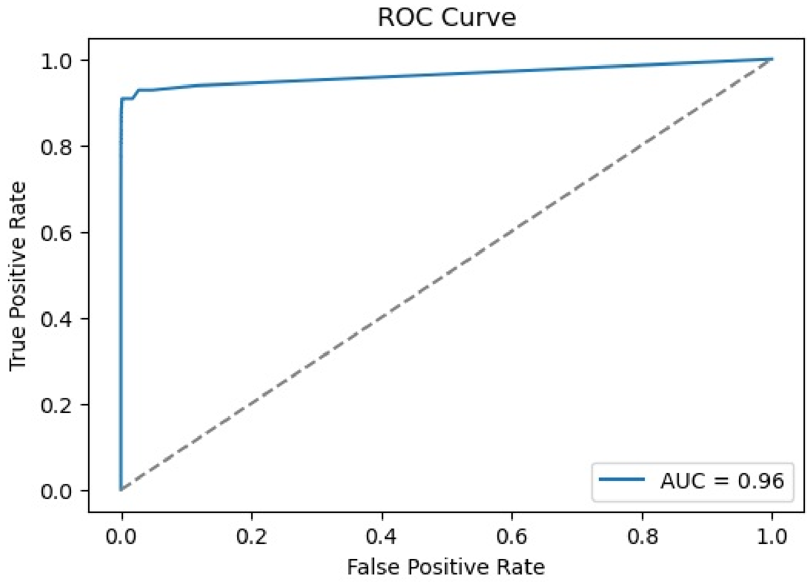
In [16]:
```python
# Classification Report
print("\nClassification Report:")
print(classification_report(y_test, y_pred))
```

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

           0       1.00      1.00      1.00     56864
           1       0.84      0.83      0.83        98

    accuracy                           1.00     56962
   macro avg       0.92      0.91      0.92     56962
weighted avg       1.00      1.00      1.00     56962
```

In [17]:
```python
# Confusion Matrix
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(6, 4))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=['Not Fraud', 'Fraud'], yticklabels=['Not Fraud'
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```



In [18]:
```python
# ROC Curve
y_pred_prob = model.predict_proba(X_test)[:, 1]
fpr, tpr, thresholds = roc_curve(y_test, y_pred_prob)
roc_auc = roc_auc_score(y_test, y_pred_prob)
plt.figure(figsize=(6, 4))
plt.plot(fpr, tpr, label=f'AUC = {roc_auc:.2f}')
plt.plot([0, 1], [0, 1], linestyle='--', color='gray')
plt.title('ROC Curve')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.legend()
plt.show()
```



In [19]:
```
# 8. Model Deployment
# Save the model using joblib (for example)
import joblib
joblib.dump(model, 'credit_card_fraud_model.pkl')
print("Model saved as 'credit_card_fraud_model.pkl'")
```

```
Model saved as 'credit_card_fraud_model.pkl'
```

In [ ]:

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