```
# ==============================
# Online Payment Fraud Detection
# ==============================
```

```
## Data Loading from Google Drive
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
import pandas as pd

path ='/content/drive/MyDrive/Colab Notebooks/onlinefraud.csv'
df = pd.read_csv(path, nrows=1000000)

df.head()
```

	step	type	amount	nameOrig	oldbalanceOrg	newbalanceOrig	nameDest	oldbalanceDest	newbalanceDest	isFraud	isFlaggedFraud
0	1	PAYMENT	9839.64	C1231006815	170136.0	160296.36	M1979787155	0.0	0.0	0	0
1	1	PAYMENT	1864.28	C1666544295	21249.0	19384.72	M2044282225	0.0	0.0	0	0
2	1	TRANSFER	181.00	C1305486145	181.0	0.00	C553264065	0.0	0.0	1	0
3	1	CASH_OUT	181.00	C840083671	181.0	0.00	C38997010	21182.0	0.0	1	0
4	1	PAYMENT	11668.14	C2048537720	41554.0	29885.86	M1230701703	0.0	0.0	0	0

```
## Initial Dataset Inspection
```

```
df.shape
df.info()
df.isnull().sum()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000000 entries, 0 to 999999
Data columns (total 11 columns):
 #   Column          Non-Null Count    Dtype  
---  ------          --------------    -----  
 0   step            1000000 non-null  int64  
 1   type            1000000 non-null  object 
 2   amount          1000000 non-null  float64
 3   nameOrig        1000000 non-null  object 
 4   oldbalanceOrg   1000000 non-null  float64
 5   newbalanceOrig  1000000 non-null  float64
 6   nameDest        1000000 non-null  object 
 7   oldbalanceDest  1000000 non-null  float64
 8   newbalanceDest  1000000 non-null  float64
 9   isFraud         1000000 non-null  int64  
 10  isFlaggedFraud  1000000 non-null  int64  
dtypes: float64(5), int64(3), object(3)
memory usage: 83.9+ MB
```

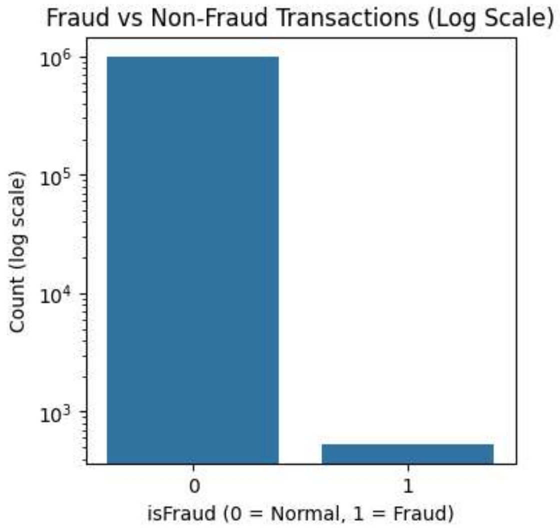
	0
step	0
type	0
amount	0
nameOrig	0
oldbalanceOrg	0
newbalanceOrig	0
nameDest	0
oldbalanceDest	0
newbalanceDest	0
isFraud	0
isFlaggedFraud	0

dtype: int64

```
## Exploratory Data Analysis (EDA)
### Fraud vs Non-Fraud Distribution
```

```
import seaborn as sns
import matplotlib.pyplot as plt

# check exact counts
print(df['isFraud'].value_counts())

# better visualization
plt.figure(figsize=(4,4))
sns.countplot(x='isFraud', data=df)
plt.yscale('log')
plt.title('Fraud vs Non-Fraud Transactions (Log Scale)')
plt.xlabel('isFraud (0 = Normal, 1 = Fraud)')
plt.ylabel('Count (log scale)')
plt.show()
```

```
isFraud
0    999465
1       535
Name: count, dtype: int64
```



Data Preprocessing
Removing Non-Predictive Identifier Columns

```
df = df.drop(['nameOrig', 'nameDest'], axis=1)
```

Encoding Transaction Type using LabelEncoder

```
from sklearn.preprocessing import LabelEncoder

le = LabelEncoder()
df['type'] = le.fit_transform(df['type'])
```

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

Splitting Features and Target Variable

```
from sklearn.model_selection import train_test_split

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

```
!pip install imbalanced-learn
```

```
Requirement already satisfied: imbalanced-learn in /usr/local/lib/python3.12/dist-packages (0.14.1)
Requirement already satisfied: numpy<3,>=1.25.2 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (2.0.2)
Requirement already satisfied: scipy<2,>=1.11.4 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (1.16.3)
Requirement already satisfied: scikit-learn<2,>=1.4.2 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (1.6.1)
Requirement already satisfied: sklearn-compat<0.2,>=0.1.5 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (0.1.5)
Requirement already satisfied: joblib<2,>=1.2.0 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (1.5.3)
Requirement already satisfied: threadpoolctl<4,>=2.0.0 in /usr/local/lib/python3.12/dist-packages (from imbalanced-learn) (3.6.0)
```

Handling Class Imbalance using SMOTE

```
from imblearn.over_sampling import SMOTE

smote = SMOTE(random_state=42)
X_train_res, y_train_res = smote.fit_resample(X_train, y_train)
```

Random Forest Model Training

```
from sklearn.ensemble import RandomForestClassifier

model = RandomForestClassifier(
    n_estimators=100,
    random_state=42,
    n_jobs=-1
)

model.fit(X_train_res, y_train_res)
```

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

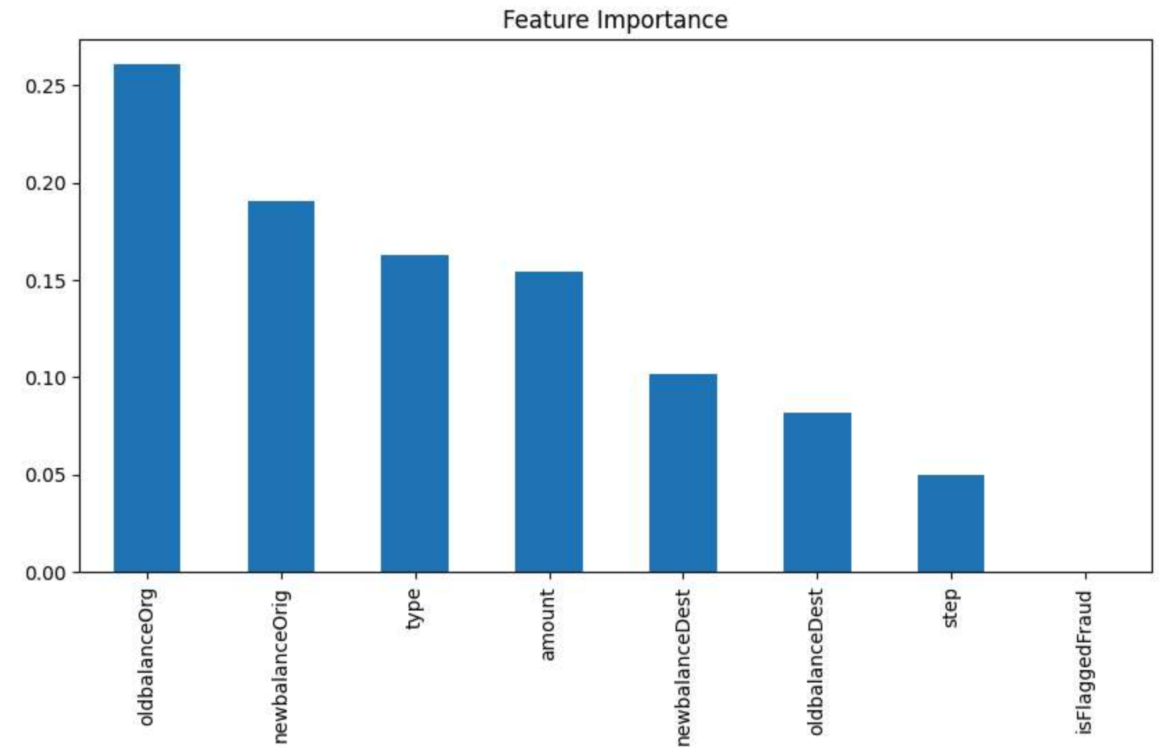
```
y_pred = model.predict(X_test)
```

Model Evaluation Metrics
Confusion Matrix and Classification Report
Model Prediction

```
from sklearn.metrics import confusion_matrix, classification_report

print(confusion_matrix(y_test, y_pred))
print(classification_report(y_test, y_pred))
```

```
[[199786    107]
 [    24     83]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00    199893
           1       0.44      0.78      0.56       107

    accuracy                           1.00    200000
   macro avg       0.72      0.89      0.78    200000
weighted avg       1.00      1.00      1.00    200000
```

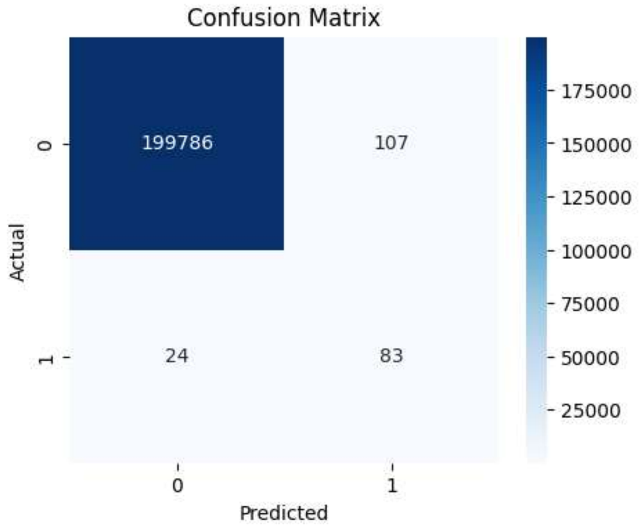
```
import pandas as pd

importance = pd.Series(model.feature_importances_, index=X.columns)
importance.sort_values(ascending=False).plot(kind='bar', figsize=(10,5))
plt.title('Feature Importance')
plt.show()
```



```
from sklearn.metrics import confusion_matrix, classification_report

y_pred = model.predict(X_test)

print(confusion_matrix(y_test, y_pred))
print(classification_report(y_test, y_pred))
```

```
[[199786    107]
 [    24     83]]
              precision    recall  f1-score   support

           0       1.00      1.00      1.00    199893
           1       0.44      0.78      0.56       107

    accuracy                           1.00    200000
   macro avg       0.72      0.89      0.78    200000
weighted avg       1.00      1.00      1.00    200000
```

```
import seaborn as sns
import matplotlib.pyplot as plt

cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(5,4))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```


Confusion Matrix
Actual
Predicted