```
Data loaded successfully.
   Transaction_ID Customer_ID            Timestamp   Amount Merchant_ID  \
0         T00001      C2824  2023-05-23 19:34:06  8919.14        M106
1         T00002      C1409  2024-02-09 08:48:16  4579.28        M924
2         T00003      C5506  2023-02-22 22:54:05   802.62        M596
3         T00004      C5012  2024-09-02 16:54:57  8979.56        M738
4         T00005      C4657  2024-01-28 08:29:55  2884.44        M804

  Merchant_Category Transaction_Type  Card_Present_Flag Location_City  \
0       Electronics           Online                  1       Mumbai
1            Travel           Online                  1        Delhi
2         Utilities           Online                  1    Bangalore
3         Groceries              POS                  1        Delhi
4         Utilities           Online                  0      Chennai

  Location_Country Device_ID      Channel Is_3DS_Authenticated  \
0               UK    D10795          Web                   No
1               UK    D51661   Mobile App                  Yes
2              USA    D12380          ATM                  Yes
3              USA    D95746          Web                   No
4        Singapore    D89932   Mobile App                  Yes

  Previous_Fraud_Flag  Is_Fraud
0                  No         0
1                  No         1
2                  No         0
3                 Yes         0
4                 Yes         0
```

{} Variables   >_ Terminal

	Amount	Merchant_ID	Merchant_Category	Transaction_Type	Card_Present_Flag	Location_City	Location_Country	Channel	Is_3DS_Authenticated	Previous_Fraud_Flag	Is_Fraud
0	8919.14	M106	Electronics	Online	1	Mumbai	UK	Web	No	No	0
1	4579.28	M924	Travel	Online	1	Delhi	UK	Mobile App	Yes	No	1
2	802.62	M596	Utilities	Online	1	Bangalore	USA	ATM	Yes	No	0
3	8979.56	M738	Groceries	POS	1	Delhi	USA	Web	No	Yes	0
4	2884.44	M804	Utilities	Online	0	Chennai	Singapore	Mobile App	Yes	Yes	0
...	...	...	...	...	...	...	...	...	...	...	...
3995	6757.13	M872	Travel	ATM Withdrawal	1	Delhi	USA	Mobile App	No	No	0
3996	8522.70	M263	Dining	Online	0	Chennai	UK	ATM	No	Yes	0
3997	3009.62	M272	Entertainment	ATM Withdrawal	1	Hyderabad	India	Mobile App	No	No	0
3998	3109.60	M430	Groceries	POS	0	Chennai	India	Web	Yes	No	0
3999	9891.60	M116	Entertainment	POS	1	Hyderabad	UK	Mobile App	No	Yes	0

4000 rows × 11 columns

```
Index(['Transaction_ID', 'Customer_ID', 'Timestamp', 'Amount', 'Merchant_ID',
       'Merchant_Category', 'Transaction_Type', 'Card_Present_Flag',
       'Location_City', 'Location_Country', 'Device_ID', 'Channel',
       'Is_3DS_Authenticated', 'Previous_Fraud_Flag', 'Is_Fraud'],
      dtype='object')
```

```
Before scaling: 0    1.357795
1   -0.141265
2   -1.445787
3    1.378665
4   -0.726691
Name: Amount, dtype: float64
After scaling: 0    1.357795
1   -0.141265
2   -1.445787
3    1.378665
4   -0.726691
Name: Amount, dtype: float64
```

```
(4000, 15)
   Transaction_ID Customer_ID            Timestamp    Amount Merchant_ID  \
0          T00001       C2824  2023-05-23 19:34:06  1.357795        M106
1          T00002       C1409  2024-02-09 08:48:16 -0.141265        M924
2          T00003       C5506  2023-02-22 22:54:05 -1.445787        M596
3          T00004       C5012  2024-09-02 16:54:57  1.378665        M738
4          T00005       C4657  2024-01-28 08:29:55 -0.726691        M804

  Merchant_Category Transaction_Type  Card_Present_Flag Location_City  \
0       Electronics           Online                  1        Mumbai
1            Travel           Online                  1         Delhi
2         Utilities           Online                  1     Bangalore
3         Groceries              POS                  1         Delhi
4         Utilities           Online                  0       Chennai

  Location_Country Device_ID      Channel Is_3DS_Authenticated  \
0               UK    D10795          Web                   No
1               UK    D51661   Mobile App                  Yes
2              USA    D12380          ATM                  Yes
3              USA    D95746          Web                   No
4        Singapore    D89932   Mobile App                  Yes

  Previous_Fraud_Flag  Is_Fraud
0                  No         0
1                  No         1
2                  No         0
3                 Yes         0
4                 Yes         0
```
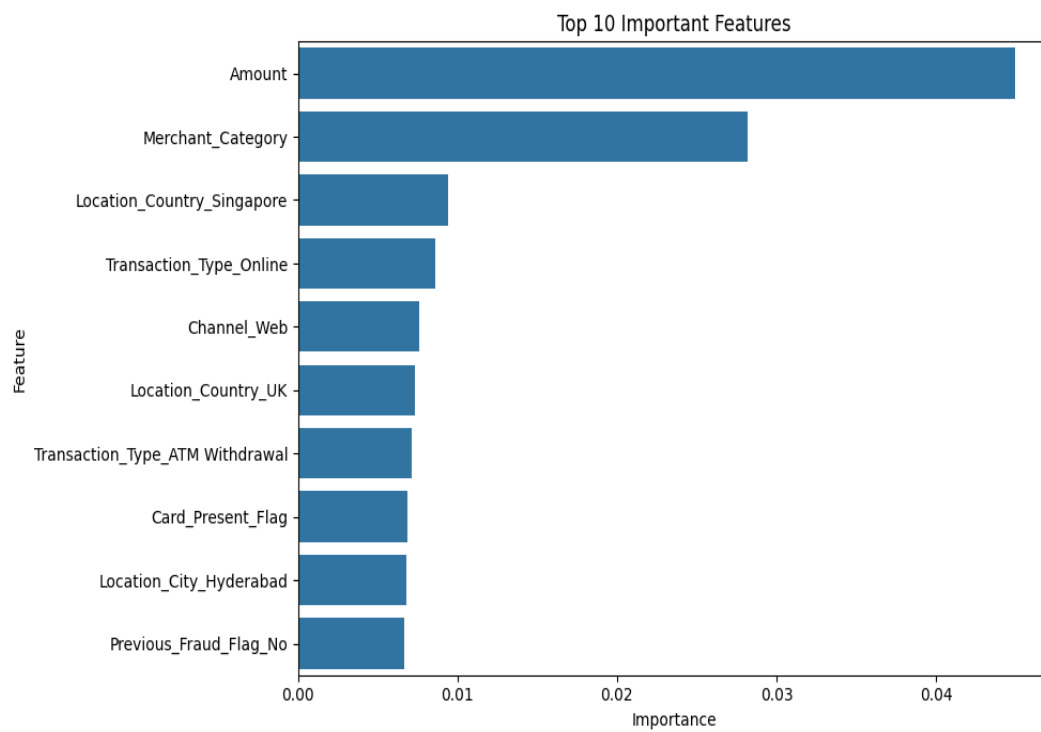
```
X_train shape: (3200, 14)
X_test shape: (800, 14)
y_train distribution:
 Is_Fraud
0    0.948125
1    0.051875
Name: proportion, dtype: float64
y_test distribution:
 Is_Fraud
0    0.94875
1    0.05125
Name: proportion, dtype: float64
```

```
Amount                    float64
Merchant_Category           int64
Card_Present_Flag           int64
Transaction_ID_T00002        bool
Transaction_ID_T00012        bool
                           ...
Channel_Web                  bool
Is_3DS_Authenticated_No      bool
Is_3DS_Authenticated_Yes     bool
Previous_Fraud_Flag_No       bool
Previous_Fraud_Flag_Yes      bool
Length: 1617, dtype: object
```
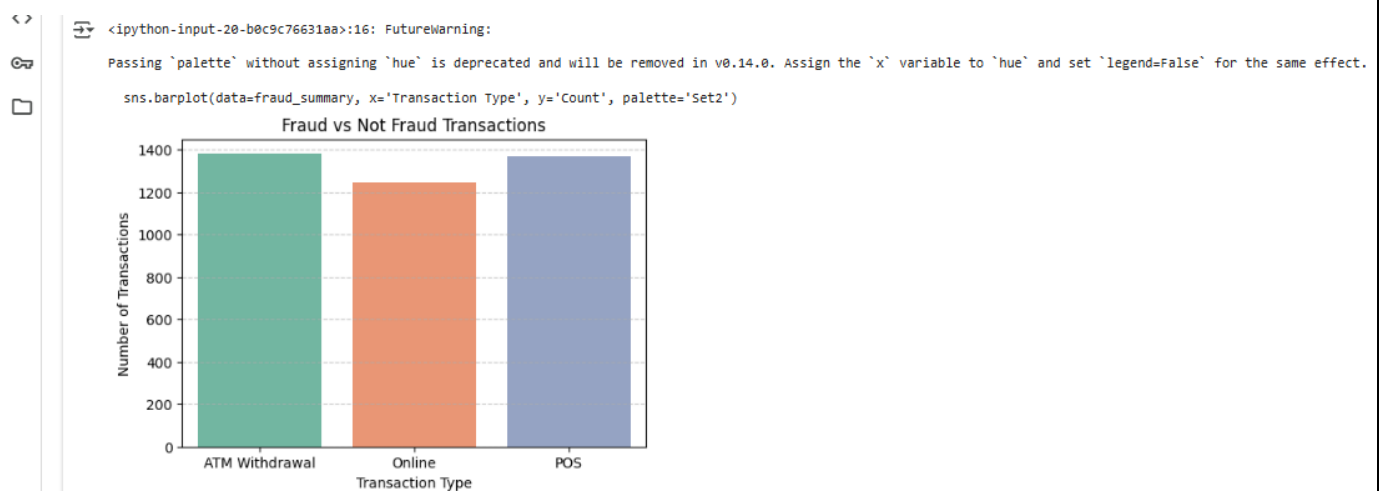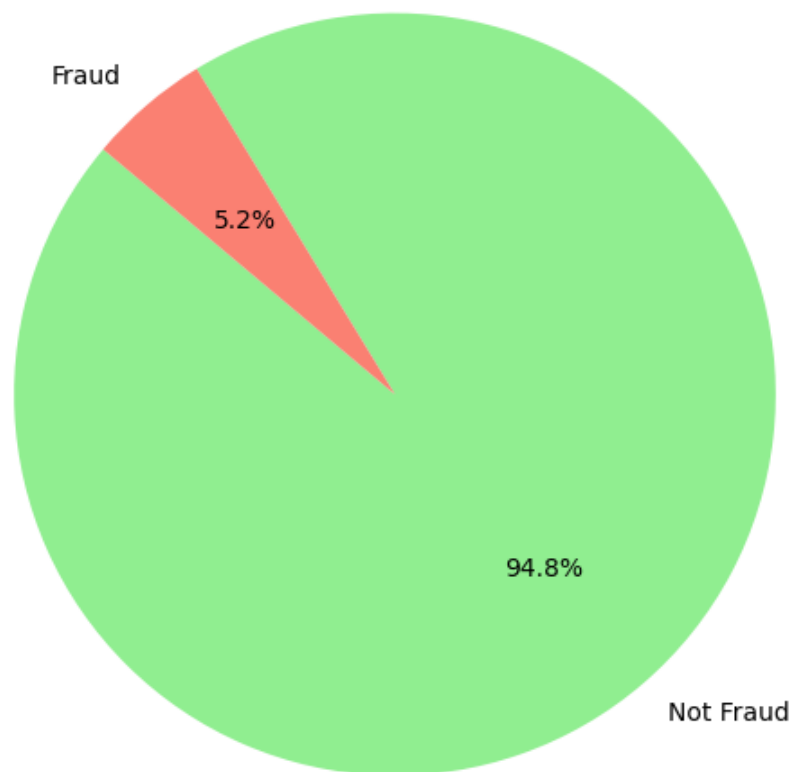
```
Amount                    float64
Merchant_Category           int64
Card_Present_Flag           int64
Transaction_ID_T00002        bool
Transaction_ID_T00012        bool
                           ...
Channel_Web                  bool
Is_3DS_Authenticated_No      bool
Is_3DS_Authenticated_Yes     bool
Previous_Fraud_Flag_No       bool
Previous_Fraud_Flag_Yes      bool
Length: 1617, dtype: object
```

Top 10 Important Features

Fraud vs Not Fraud Transactions (Pie Chart)

Fraud

5.2%

94.8%

Not Fraud

```
<ipython-input-20-b0c9c76631aa>:16: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(data=fraud_summary, x='Transaction Type', y='Count', palette='Set2')
```

Fraud vs Not Fraud Transactions

	Transaction_ID	Amount	Is_3DS_Authenticated	Previous_Fraud_Flag	Card_Present_Flag	Fraud_Alert
0	T00001	8919.14	No	No	1	ALERT: High Amount, 3DS Not Authenticated
3	T00004	8979.56	No	Yes	1	ALERT: High Amount, 3DS Not Authenticated, Pre...
4	T00005	2884.44	Yes	Yes	0	ALERT: Card Not Present, Previous Fraud History
5	T00006	9566.31	Yes	Yes	0	ALERT: High Amount, Card Not Present, Previous...
7	T00008	2760.15	No	Yes	1	ALERT: 3DS Not Authenticated, Previous Fraud H...
...	...	...	...	...	...	...
3995	T03996	6757.13	No	No	1	ALERT: High Amount, 3DS Not Authenticated
3996	T03997	8522.70	No	Yes	0	ALERT: High Amount, Card Not Present, 3DS Not ...
3997	T03998	3009.62	No	No	1	ALERT: 3DS Not Authenticated
3998	T03999	3109.60	Yes	No	0	ALERT: Card Not Present
3999	T04000	9891.60	No	Yes	1	ALERT: High Amount, 3DS Not Authenticated, Pre...

3776 rows × 6 columns

Error sending email: (534, b'5.7.9 Application-specific password required. For more information, go to\n5.7.9 https://support.google.com/mail/?p=InvalidSecondFactor 98e67ed59e1d1-30ad483ffeasm3368992a91.2