```
Task 4 -CREDIT CARD FRAUD DETECTION
```

```
CODSOFT
```

Import Modules

```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline
```

Loading the Dataset

```python
df = pd.read_csv('creditcard.csv')
df.head()
```

	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	V21	V22	V23	V24	V25	V26	V27	V28	Amoun
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698	0.363787	...	-0.018307	0.277838	-0.110474	0.066928	0.128539	-0.189115	0.133558	-0.021053	149.6
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102	-0.255425	...	-0.225775	-0.638672	0.101288	-0.339846	0.167170	0.125895	-0.008983	0.014724	2.6
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676	-1.514654	...	0.247998	0.771679	0.909412	-0.689281	-0.327642	-0.139097	-0.055353	-0.059752	378.6
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436	-1.387024	...	-0.108300	0.005274	-0.190321	-1.175575	0.647376	-0.221929	0.062723	0.061458	123.5
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533	0.817739	...	-0.009431	0.798278	-0.137458	0.141267	-0.206010	0.502292	0.219422	0.215153	69.9

5 rows × 31 columns

```python
# statistical info
df.describe()
```

	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	V21	V22	
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	2.848070e+05	...	2.848070e+05	2.848070e+05	2.848070
mean	94813.859575	1.168375e-15	3.416908e-16	-1.379537e-15	2.074095e-15	9.604066e-16	1.487313e-15	-5.556467e-16	1.213481e-16	-2.406331e-15	...	1.654067e-16	-3.568593e-16	2.578648
std	47488.145955	1.958696e+00	1.651309e+00	1.516255e+00	1.415869e+00	1.380247e+00	1.332271e+00	1.237094e+00	1.194353e+00	1.098632e+00	...	7.345240e-01	7.257016e-01	6.244603
min	0.000000	-5.640751e+01	-7.271573e+01	-4.832559e+01	-5.683171e+00	-1.137433e+02	-2.616051e+01	-4.355724e+01	-7.321672e+01	-1.343407e+01	...	-3.483038e+01	-1.093314e+01	-4.480774
25%	54201.500000	-9.203734e-01	-5.985499e-01	-8.903648e-01	-8.486401e-01	-6.915971e-01	-7.682956e-01	-5.540759e-01	-2.086297e-01	-6.430976e-01	...	-2.283949e-01	-5.423504e-01	-1.618463
50%	84692.000000	1.810880e-02	6.548556e-02	1.798463e-01	-1.984653e-02	-5.433583e-02	-2.741871e-01	4.010308e-02	2.235804e-02	-5.142873e-02	...	-2.945017e-02	6.781943e-03	-1.119293
75%	139320.500000	1.315642e+00	8.037239e-01	1.027196e+00	7.433413e-01	6.119264e-01	3.985649e-01	5.704361e-01	3.273459e-01	5.971390e-01	...	1.863772e-01	5.285536e-01	1.476421
max	172792.000000	2.454930e+00	2.205773e+01	9.382558e+00	1.687534e+01	3.480167e+01	7.330163e+01	1.205895e+02	2.000721e+01	1.559499e+01	...	2.720284e+01	1.050309e+01	2.252841

8 rows × 31 columns

```python
# datatype info
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 Dataset

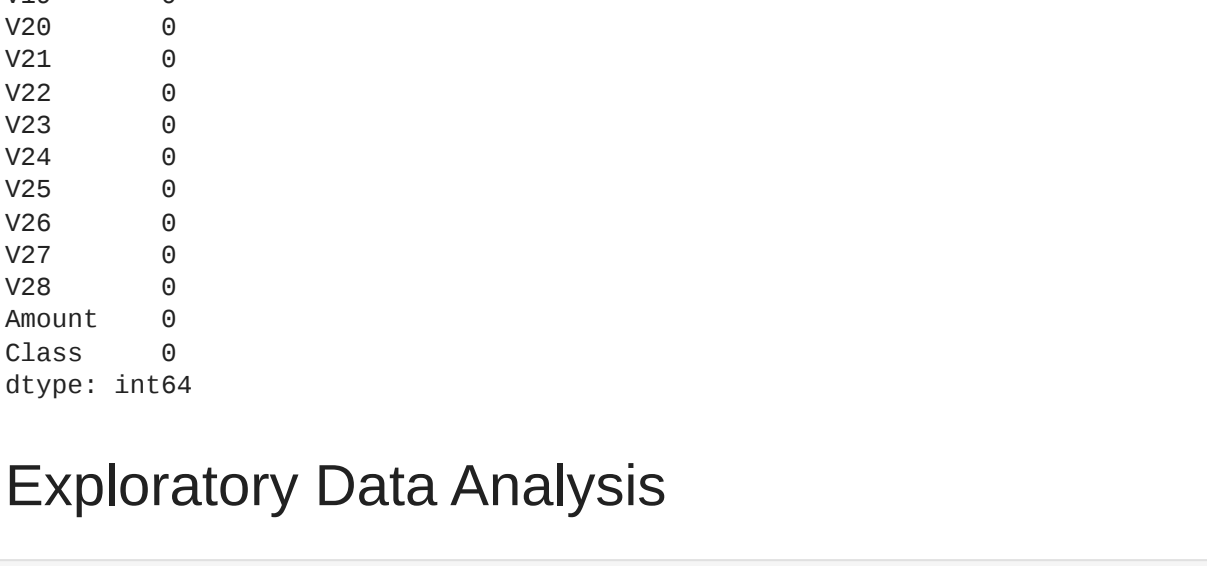
```python
# check for null values
df.isnull().sum()
```

```
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
```

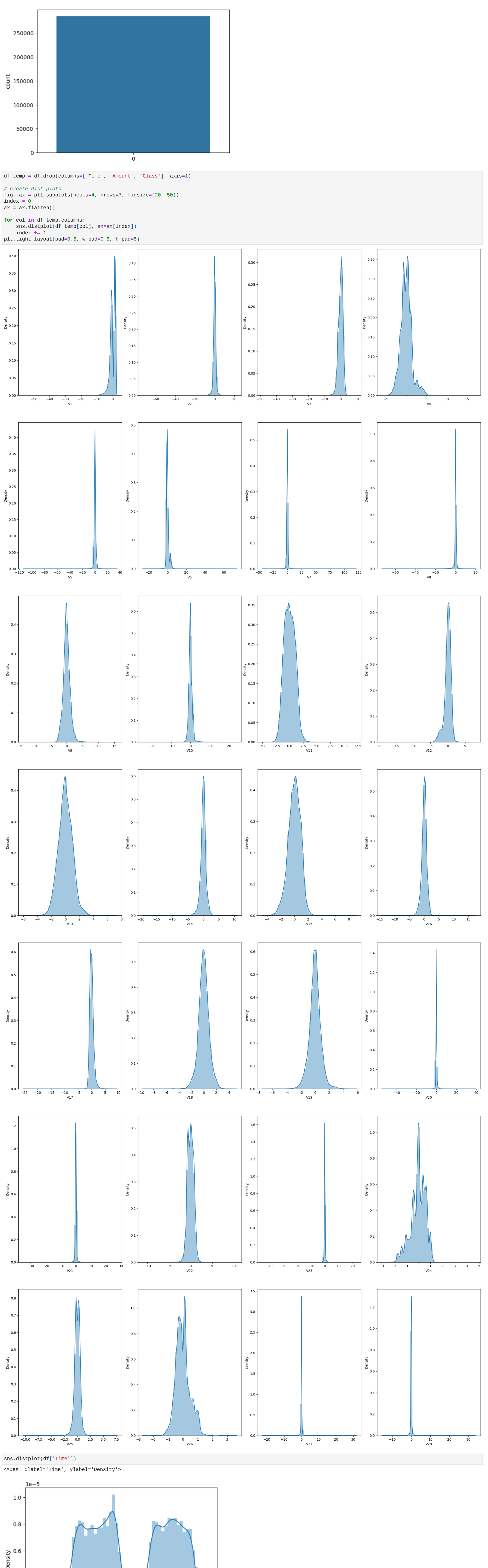
Exploratory Data Analysis

```python
sns.countplot(df['Class'])
```

```
<Axes: ylabel='count'>
```

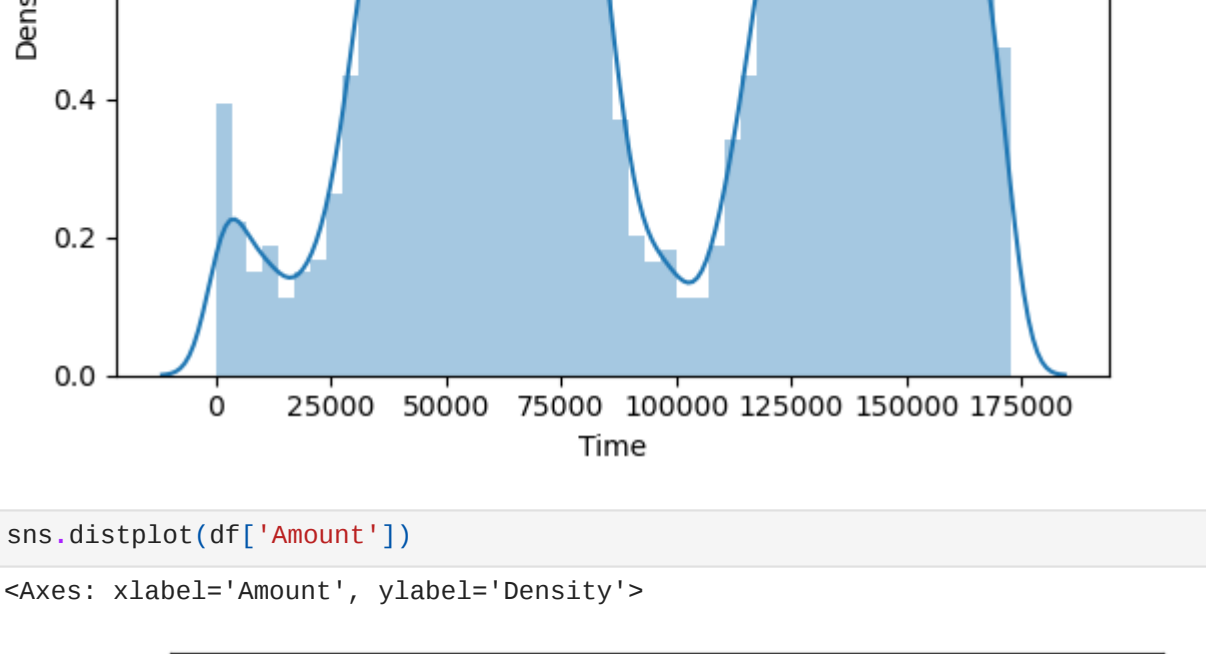


```python
df_temp = df.drop(columns=['Time', 'Amount', 'Class'], axis=1)

# create dist plots
fig, ax = plt.subplots(ncols=4, nrows=7, figsize=(20, 50))
index = 0
ax = ax.flatten()

for col in df_temp.columns:
    sns.distplot(df_temp[col], ax=ax[index])
    index += 1
plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=5)
```



```python
sns.distplot(df['Time'])
```

```
<Axes: xlabel='Time', ylabel='Density'>
```



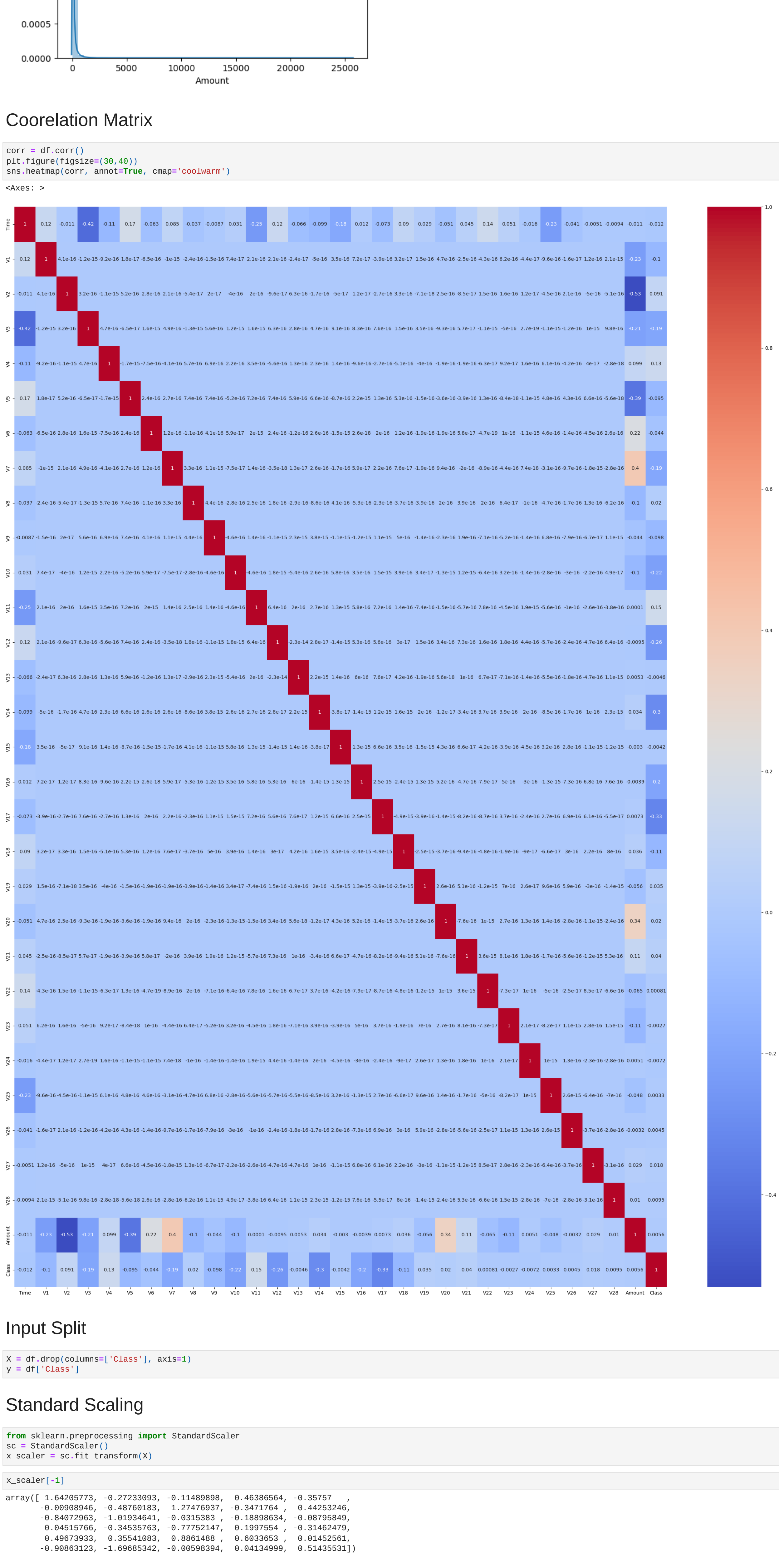
```python
sns.distplot(df['Amount'])
```

```
<Axes: xlabel='Amount', ylabel='Density'>
```

Coorelation Matrix

```python
corr = df.corr()
plt.figure(figsize=(30,40))
sns.heatmap(corr, annot=True, cmap='coolwarm')
```

```
<Axes: >
```



Input Split

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

Standard Scaling

```python
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
x_scaler = sc.fit_transform(X)
```

```python
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

```python
# train test split
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, f1_score
x_train, x_test, y_train, y_test = train_test_split(x_scaler, y, test_size=0.25, random_state=42, stratify=y)
```

```python
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       0.85      0.63      0.72       123

    accuracy                           1.00     71202
   macro avg       0.92      0.81      0.86     71202
weighted avg       1.00      1.00      1.00     71202

F1 Score: 0.719626168224299
```

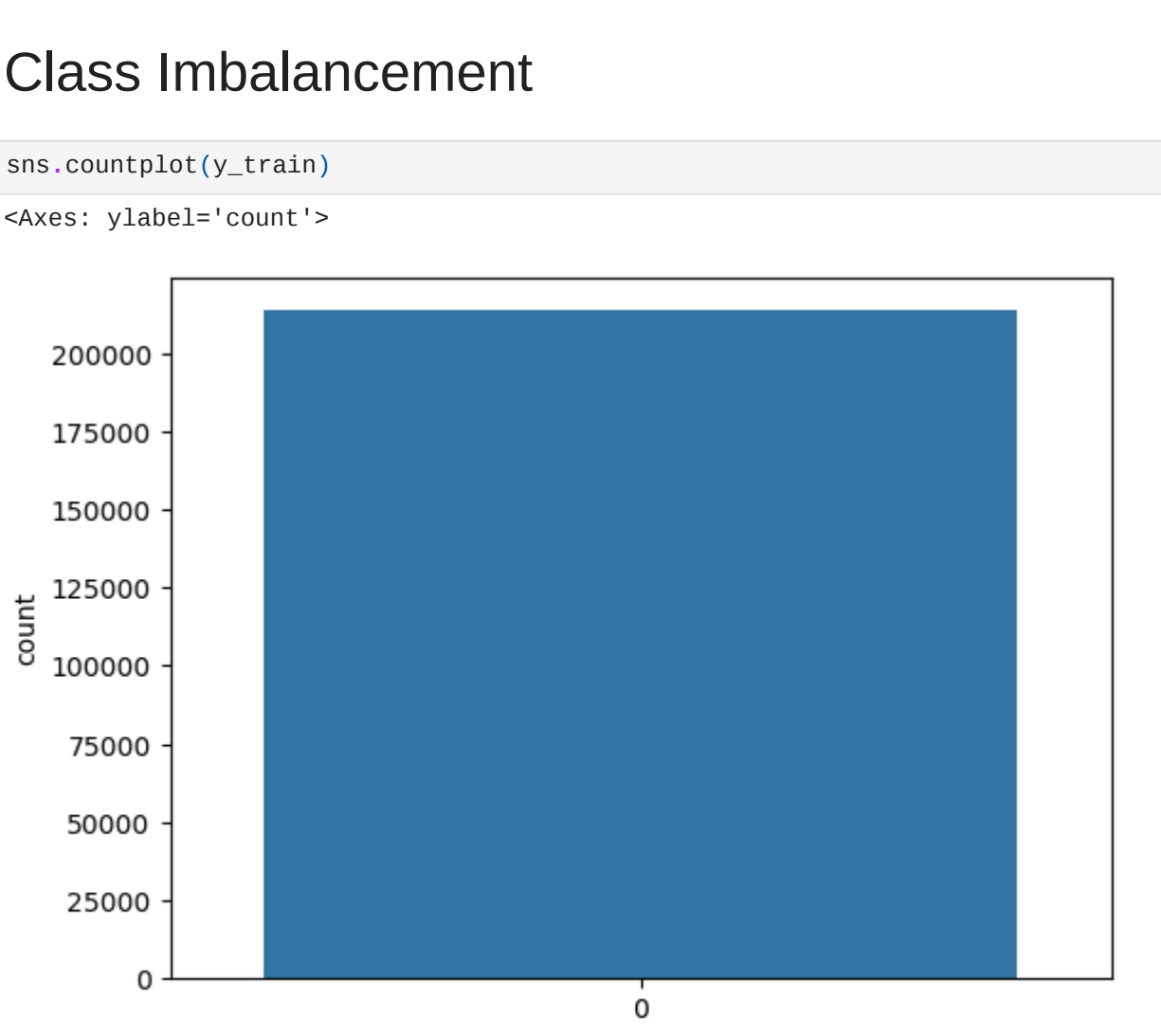
```python
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier()
# training
model.fit(x_train, y_train)
# testing
y_pred = model.predict(x_test)
print(classification_report(y_test, y_pred))
print("F1 Score:",f1_score(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00     71079
           1       0.95      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 Imbalancement

```python
sns.countplot(y_train)
```

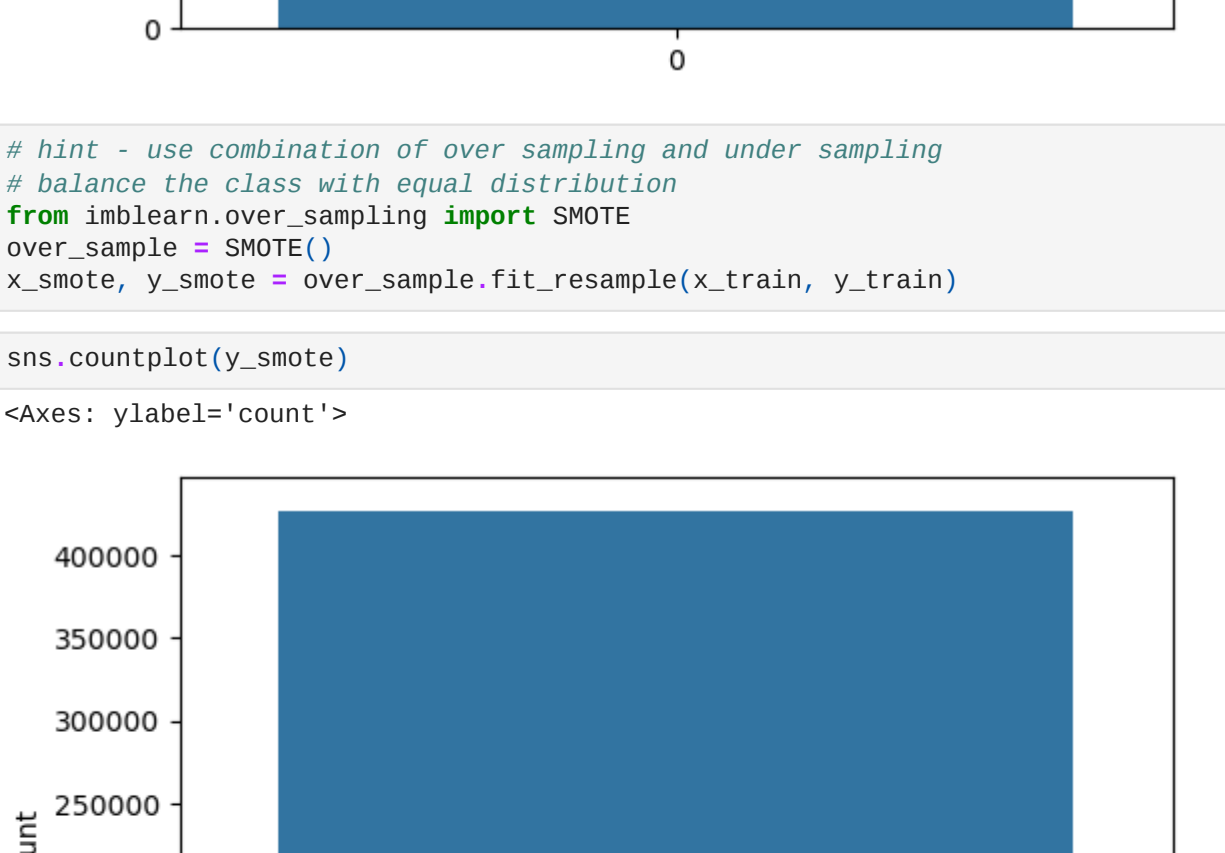
```
<Axes: ylabel='count'>
```



```python
# hint - use combination of over sampling and under sampling
# balance the class with equal distribution
from imblearn.over_sampling import SMOTE
over_sample = SMOTE()
x_smote, y_smote = over_sample.fit_resample(x_train, y_train)
```

```python
sns.countplot(y_smote)
```

```
<Axes: ylabel='count'>
```



```python
from sklearn.linear_model import LogisticRegression
model = LogisticRegression()
# training
model.fit(x_smote, y_smote)
# 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      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: 0.1116231438812084
```

```python
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier(n_jobs=-1)
# training
model.fit(x_smote, y_smote)
# 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       0.88      0.80      0.83       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: 0.8340425531914893
```

```
                *****************END OF CODE********************
```

```
          ***********************THANK YOU***********************
```