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Import laibray and unzip file

```
from google.colab import files

# Upload a file
uploaded = files.upload()

# Access the uploaded file
for filename in uploaded.keys():
    print('Uploaded file:', filename)
```

Choose Files archive (5).zip

- **archive (5).zip**(application/x-zip-compressed) - 45560822 bytes, last modified: 5/8/2023 - 6% done

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
<ipython-input-5-0740ab1c83e7> in <cell line: 4>()
      2 
      3 # Upload a file
----> 4 uploaded = files.upload()
      5 
      6 # Access the uploaded file

                                3 frames
/usr/local/lib/python3.10/dist-packages/google/colab/_message.py in
read_reply_from_input(message_id, timeout_sec)
     94     reply = _read_next_input_message()
     95     if reply == _NOT_READY or not isinstance(reply, dict):
---> 96       time.sleep(0.025)
     97       continue
     98     if (

KeyboardInterrupt: 
```

SEARCH STACK OVERFLOW

```
# Read the extracted files
import numpy as np
import pandas as pd
import matplotlib as plt
import warnings
import seaborn as sns
import plotly.graph_objs as go
import plotly.figure_factory as ff
from plotly import tools
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
init_notebook_mode(connected=True)


import gc
from datetime import datetime
from sklearn.model_selection import train_test_split
from sklearn.model_selection import KFold
from sklearn.metrics import roc_auc_score
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import AdaBoostClassifier
#from catboost import CatBoostClassifier
from sklearn import svm
import lightgbm as lgb
from lightgbm import LGBMClassifier
import xgboost as xgb
# Disable DeprecationWarning
warnings.filterwarnings("ignore", category=DeprecationWarning)

# Your code here

# Enable DeprecationWarning again
warnings.filterwarnings("default", category=DeprecationWarning)

import zipfile
zip_file_path = '/content/archive (5).zip'
# Extract the zip file
with zipfile.ZipFile(zip_file_path, 'r') as zip_ref:
    zip_ref.extractall('/content/target_directory/')

#with tarfile.open("/content/archive (5) (1).zip", "r:gz") as gzip_file:
 #   gzip_file.extractall()
```

Read Tha Data

```
data_df = pd.read_csv("/content/target_directory/creditcard.csv")
data_df
```

	Time	V1	V2	V3	V4	V5	V6	V7
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.23959
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.07880
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.79146
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.23760
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.59294
...	...	...	...	...	...	...	...	..
284802	172786.0	-11.881118	10.071785	-9.834783	-2.066656	-5.364473	-2.606837	-4.91821
284803	172787.0	-0.732789	-0.055080	2.035030	-0.738589	0.868229	1.058415	0.02433
284804	172788.0	1.919565	-0.301254	-3.249640	-0.557828	2.630515	3.031260	-0.29682
284805	172788.0	-0.240440	0.530483	0.702510	0.689799	-0.377961	0.623708	-0.68618
284806	172792.0	-0.533413	-0.189733	0.703337	-0.506271	-0.012546	-0.649617	1.57700

284807 rows × 31 columns

Check the data

```
print("Credit Card Fraud Detection data -  rows:",data_df.shape[0]," columns:", data_df.shape
```

```
Credit Card Fraud Detection data -  rows: 284807  columns: 31
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning:

`should_run_async` will not call `transform_cell` automatically in the future. Please p
```

Glimpse the data

```
data_df.head()
```

	Time	V1	V2	V3	V4	V5	V6	V7	V8
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436

Check missing data

```
data_df.isnull().sum()
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning:

`should_run_async` will not call `transform_cell` automatically in the future. Please p

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
```

Check data unbalance

To check data imbalance in Python, you can use the value_counts() function to count the number of occurrences of each class in a pandas dataframe. For example:

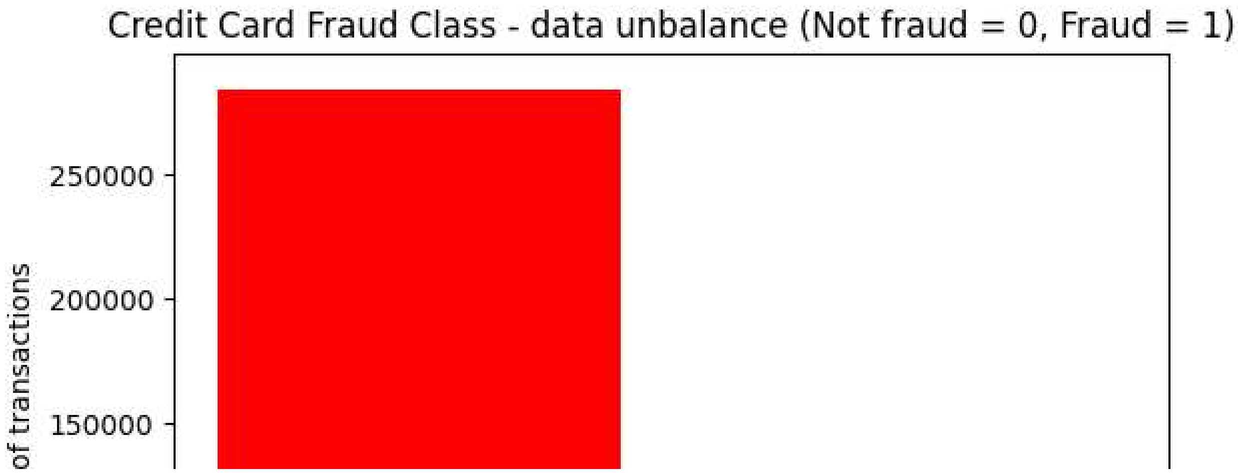
```
# Count the number of occurrences of each class
class_counts = data_df['class'].value_counts()
#class_counts

# Print the class counts
print(class_counts)
```

```
     0    284315
     1       492
     Name: class, dtype: int64
```

```
#temp = data_df["class"].value_counts()
#df = pd.DataFrame({'class': temp.index,'values': temp.values})
```

```
     /usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning:

     `should_run_async` will not call `transform_cell` automatically in the future. Please p
```

```
import matplotlib.pyplot as plt

class_count = data_df['class'].value_counts()
plt.bar(class_count.index, class_count.values, color='red')
plt.title('Credit Card Fraud Class - data unbalance (Not fraud = 0, Fraud = 1)')
plt.xlabel('Class')
plt.ylabel('Number of transactions')
plt.show()
```



Data exploration

```
"""
class_0 = data_df.loc[data_df['class'] == 0]["Time"]
class_1 = data_df.loc[data_df['class'] == 1]["Time"]

hist_data = [class_0, class_1]
group_labels = ['Not Fraud', 'Fraud']
"""
```

```
'\nclass_0 = data_df.loc[data_df[\'class\'] == 0]["Time"]\nclass_1 = data_df.loc[data_
df[\'class\'] == 1]["Time"]\n\nhist_data = [class_0, class_1]\ngroup_labels = [\'Not F
raud\', \'Fraud\']\n'
```

```
#class_0
```

```
#class_1
```

```
#print(hist_data)
```

```
#print(group_labels)
```

```
# import necessary libraries
import plotly.figure_factory as ff
from plotly.offline import iplot

# create separate data frames for fraud and non-fraud transactions
class_0 = data_df.loc[data_df['class'] == 0]["Time"]
class_1 = data_df.loc[data_df['class'] == 1]["Time"]

# create histogram data and labels
hist_data = [class_0, class_1]
group_labels = ['Not Fraud', 'Fraud']
```

```
# create density plot
fig = ff.create_distplot(hist_data, group_labels, show_hist=False, show_rug=False)

# update plot layout and display
fig['layout'].update(title='Credit Card Transactions Time Density Plot', xaxis=dict(title='Ti
iplot(fig, filename='dist_only')
```

```
data_df['Hour'] = data_df['Time'].apply(lambda x: np.floor(x / 3600))
print("Hour",data_df['Hour'])
tmp = data_df.groupby(['Hour', 'class'])['Amount'].aggregate(['min', 'max', 'count', 'sum', '
df = pd.DataFrame(tmp)
#df.columns = ['Hour', 'class', 'Min', 'Max', 'Transactions', 'Sum', 'Mean', 'Median', 'Var']
df.head()
```

```
Hour 0          0.0
1          0.0
2          0.0
3          0.0
4          0.0
          ...
284802    47.0
284803    47.0
284804    47.0
284805    47.0
284806    47.0
Name: Hour, Length: 284807, dtype: float64
```

	Hour	class	min	max	count	sum	mean	median	var
0	0.0	0	0.0	7712.43	3961	256572.87	64.774772	12.990	45615.821201
1	0.0	1	0.0	529.00	2	529.00	264.500000	264.500	139920.500000

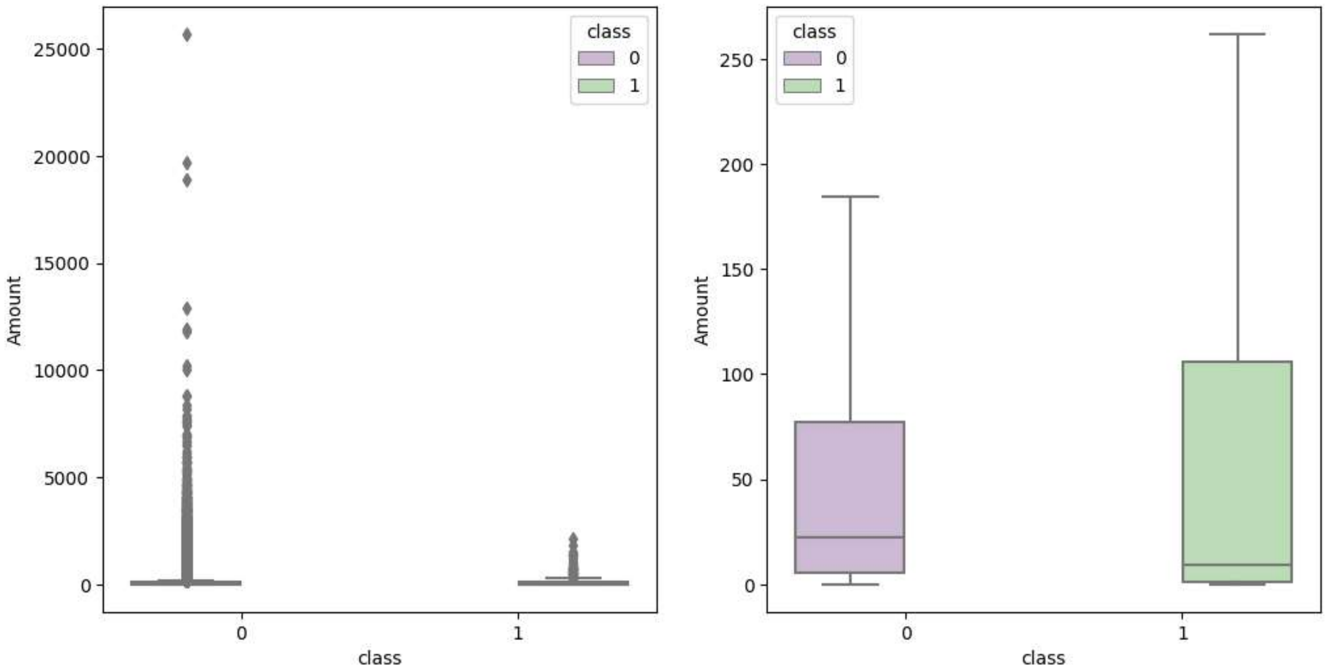
```
# create a new column "Hour" by dividing the "Time" column by 3600 and rounding down
data_df['Hour'] = (data_df['Time'] / 3600).apply(np.floor)

# group the data by the hour and class and calculate some descriptive statistics for the "Amo
df = data_df.groupby(['Hour', 'class'])['Amount'].agg(['min', 'max', 'count', 'sum', 'mean',
df.columns = ['Hour', 'class', 'Min', 'Max', 'Transactions', 'Sum', 'Mean', 'Median', 'Var']
df.head()
```

	Hour	class	Min	Max	Transactions	Sum	Mean	Median	Var
0	0.0	0	0.0	7712.43	3961	256572.87	64.774772	12.990	45615.821201
1	0.0	1	0.0	529.00	2	529.00	264.500000	264.500	139920.500000
2	1.0	0	0.0	1769.69	2215	145806.76	65.826980	22.820	20053.615770
3	1.0	1	59.0	239.93	2	298.93	149.465000	149.465	16367.832450
4	2.0	0	0.0	4002.88	1555	106989.39	68.803466	17.900	45355.430437

```
"""fig, (ax1, ax2) = plt.subplots(ncols=2, figsize=(18,6))
s = sns.lineplot(ax = ax1, x="Hour", y="Sum", data=data_df.loc[data.Class==0])
s = sns.lineplot(ax = ax2, x="Hour", y="Sum", data=data.loc[data.Class==1], color="red")
plt.suptitle("Total Amount")
plt.show();"""
#np.array(df['Class'].tolist())
"""fig, (ax1, ax2) = plt.subplots(ncols=2, figsize=(18,6))
sns.lineplot(ax=ax1, x="Hour", y="Sum", data=data_df.loc[df.Class==0])
sns.lineplot(ax=ax2, x="Hour", y="Sum", data=data_df.loc[df.Class==1], color="red")
fig.suptitle("Total Amount")
plt.show()"""
```

```
    'fig, (ax1, ax2) = plt.subplots(ncols=2, figsize=(18,6))\nsns.lineplot(ax=ax1, x="Hou
```

```
fig, (ax1, ax2) = plt.subplots(ncols=2, figsize=(12,6))
s = sns.boxplot(ax = ax1, x="class", y="Amount", hue="class",data=data_df, palette="PRGn",shc
s = sns.boxplot(ax = ax2, x="class", y="Amount", hue="class",data=data_df, palette="PRGn",shc
plt.show();
```



```
tmp = data_df[['Amount','class']].copy()
class_0 = tmp.loc[tmp['class'] == 0]['Amount']
class_1 = tmp.loc[tmp['class'] == 1]['Amount']
class_0.describe()
```

```
    count    284315.000000
    mean         88.291022
    std         250.105092
    min           0.000000
    25%           5.650000
    50%          22.000000
    75%          77.050000
    max       25691.160000
    Name: Amount, dtype: float64
```

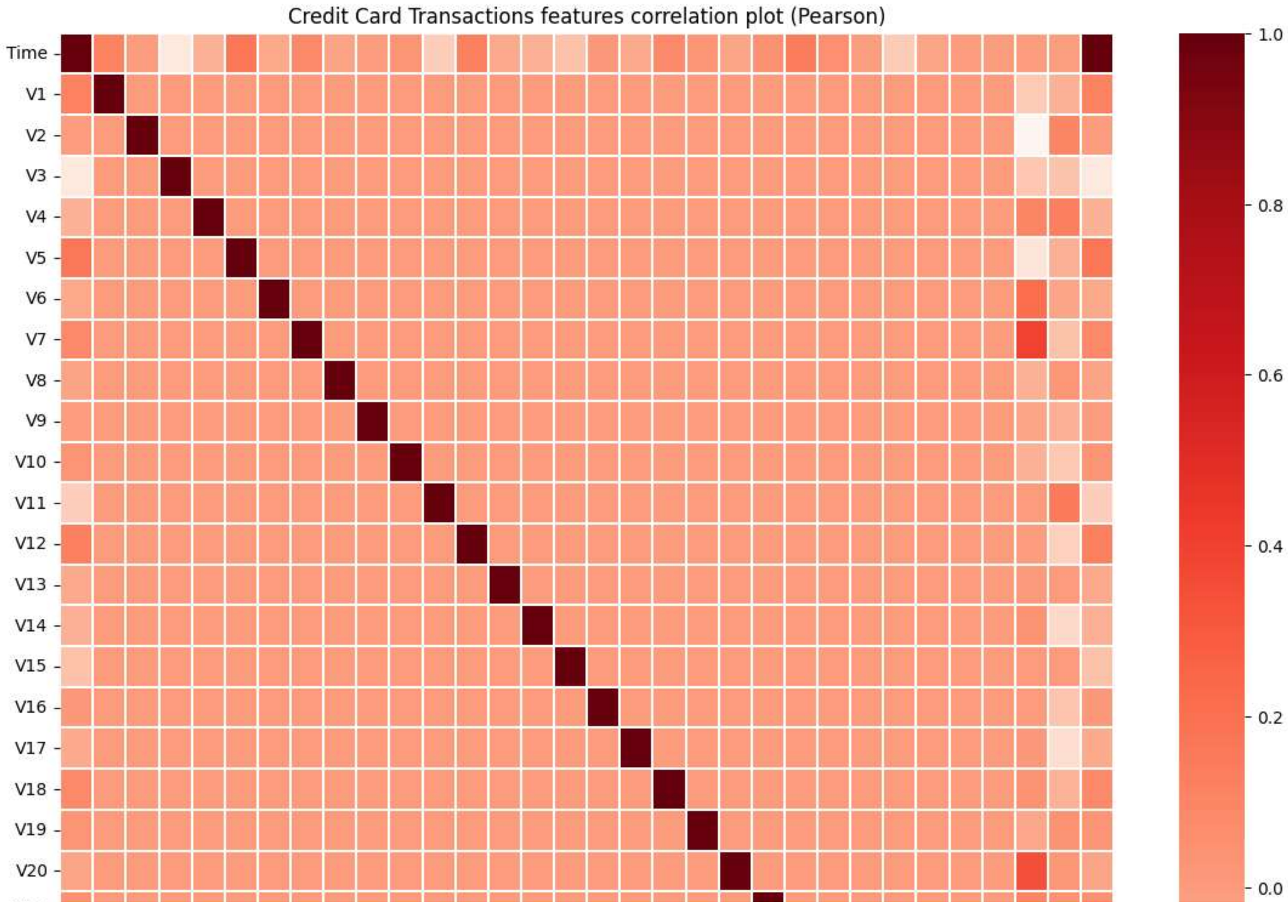
```
class_1.describe()
```

```
count     492.000000
mean      122.211321
std       256.683288
min         0.000000
25%         1.000000
50%         9.250000
75%       105.890000
max      2125.870000
Name: Amount, dtype: float64
```

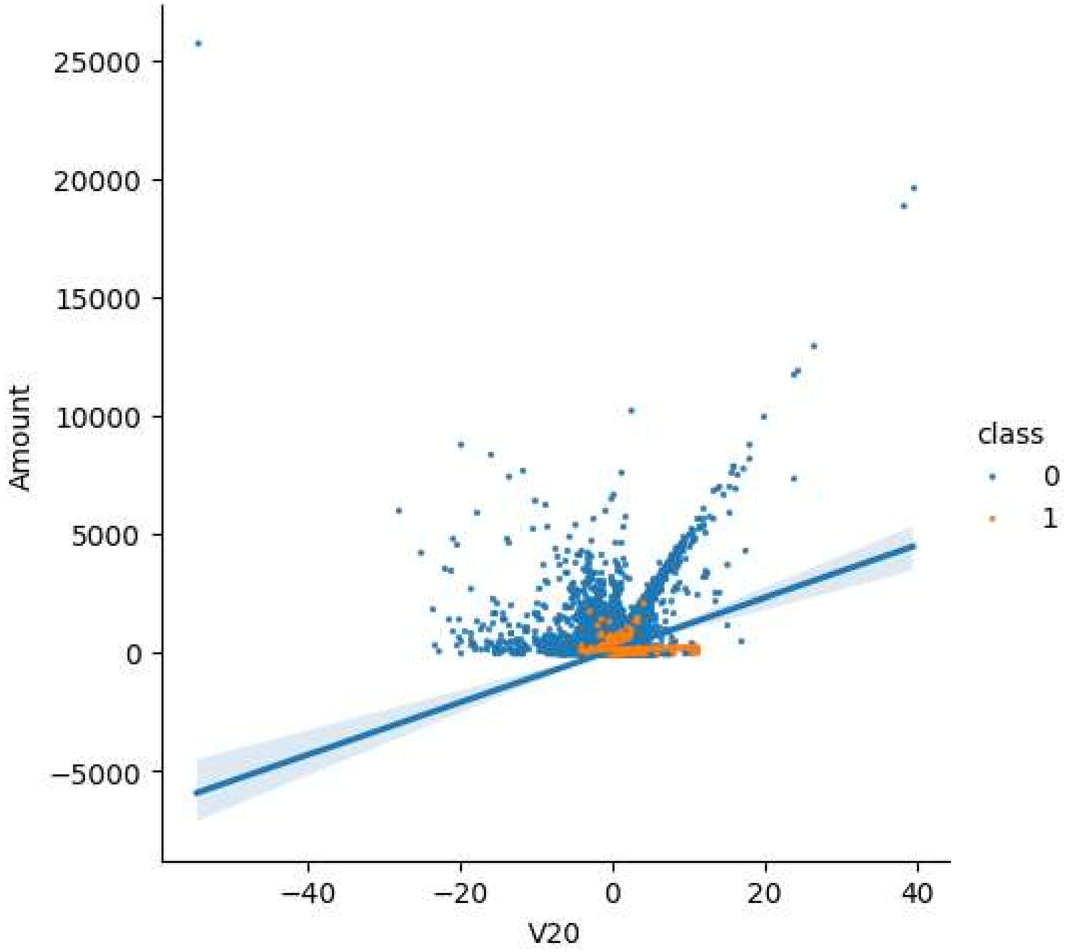
```
fraud = data_df.loc[data_df['class'] == 1]

trace = go.Scatter(
    x = fraud['Time'],y = fraud['Amount'],
    name="Amount",
     marker=dict(
                color='rgb(238,23,11)',
                line=dict(
                    color='red',
                    width=1),
                opacity=0.5,
            ),
    text= fraud['Amount'],
    mode = "markers"
)
data = [trace]
layout = dict(title = 'Amount of fraudulent transactions',
          xaxis = dict(title = 'Time [s]', showticklabels=True),
          yaxis = dict(title = 'Amount'),
          hovermode='closest'
         )
fig = dict(data=data, layout=layout)
iplot(fig, filename='fraud-amount')
```

Features correlation

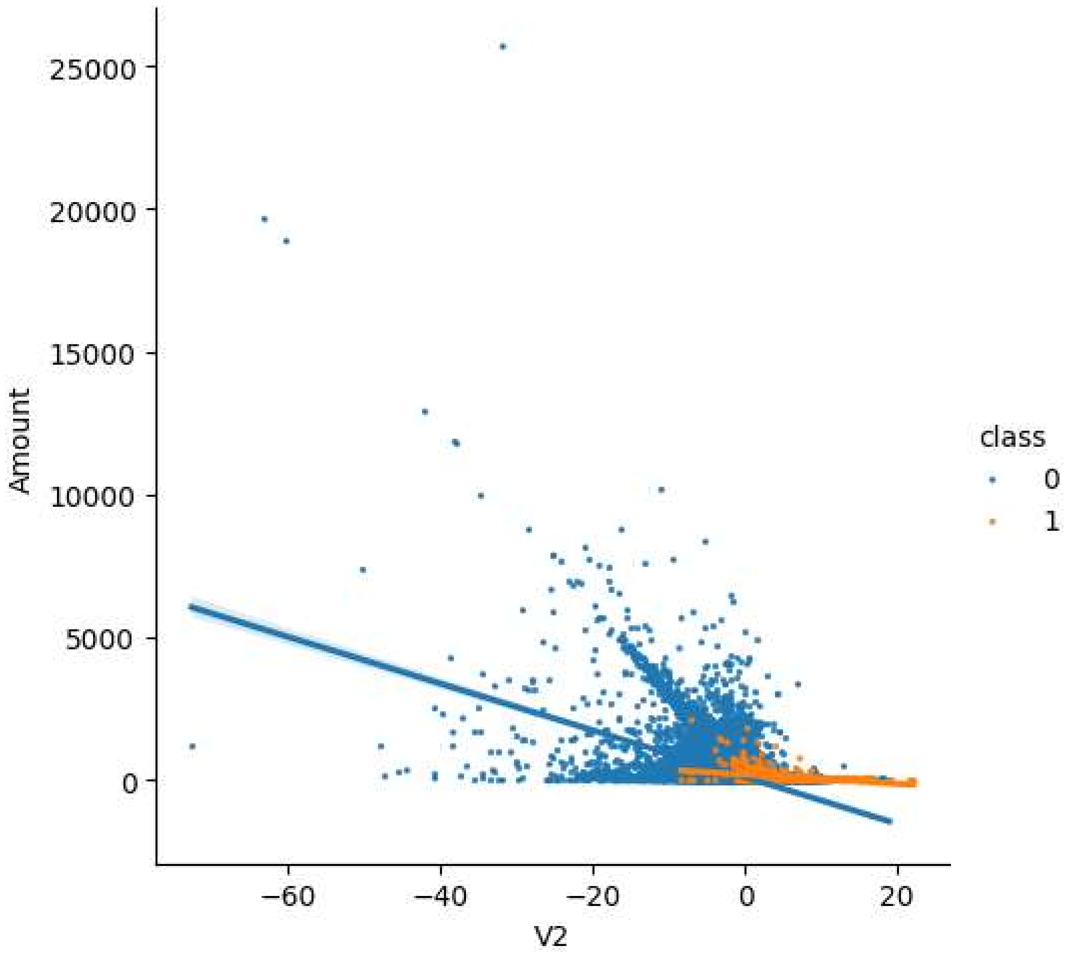
```
plt.figure(figsize = (14,14))
plt.title('Credit Card Transactions features correlation plot (Pearson)')
corr = data_df.corr()
sns.heatmap(corr,xticklabels=corr.columns,yticklabels=corr.columns,linewidths=.1,cmap="Reds")
plt.show()
```



```
s = sns.lmplot(x='V20', y='Amount',data=data_df, hue='class', fit_reg=True,scatter_kws={'s':2
s = sns.lmplot(x='V7', y='Amount',data=data_df, hue='class', fit_reg=True,scatter_kws={'s':2}
plt.show()
```



```
s = sns.lmplot(x='V2', y='Amount',data=data_df, hue='class', fit_reg=True,scatter_kws={'s':2}
s = sns.lmplot(x='V5', y='Amount',data=data_df, hue='class', fit_reg=True,scatter_kws={'s':2}
plt.show()
```



```
var = data_df.columns.values

i = 0
t0 = data_df.loc[data_df['class'] == 0]
t1 = data_df.loc[data_df['class'] == 1]

sns.set_style('whitegrid')
plt.figure()
fig, ax = plt.subplots(8,4,figsize=(16,28))

for feature in var:
    i += 1
    plt.subplot(8,4,i)
    sns.kdeplot(t0[feature], bw=0.5,label="class = 0")
    sns.kdeplot(t1[feature], bw=0.5,label="class = 1")
```

```
        plt.xlabel(feature, fontsize=12)
        locs, labels = plt.xticks()
        plt.tick_params(axis='both', which='major', labelsize=12)
    plt.show();
```

```
The `bw` parameter is deprecated in favor of `bw_method` and `bw_adjust`.
Setting `bw_method=0.5`, but please see the docs for the new parameters
and update your code. This will become an error in seaborn v0.13.0.


<ipython-input-59-a730841953e9>:14: UserWarning:



The `bw` parameter is deprecated in favor of `bw_method` and `bw_adjust`.
Setting `bw_method=0.5`, but please see the docs for the new parameters
and update your code. This will become an error in seaborn v0.13.0.


<ipython-input-59-a730841953e9>:15: UserWarning:



The `bw` parameter is deprecated in favor of `bw_method` and `bw_adjust`.
Setting `bw_method=0.5`, but please see the docs for the new parameters
and update your code. This will become an error in seaborn v0.13.0.


<ipython-input-59-a730841953e9>:14: UserWarning:



The `bw` parameter is deprecated in favor of `bw_method` and `bw_adjust`.
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and update your code. This will become an error in seaborn v0.13.0.


<ipython-input-59-a730841953e9>:14: UserWarning:



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Setting `bw_method=0.5`, but please see the docs for the new parameters
and update your code. This will become an error in seaborn v0.13.0.


<ipython-input-59-a730841953e9>:15: UserWarning:



The `bw` parameter is deprecated in favor of `bw_method` and `bw_adjust`.
Setting `bw_method=0.5`, but please see the docs for the new parameters
```

Predictive models

```
target = 'class'
predictors = ['Time', 'V1', 'V2', 'V3', 'V4', 'V5', 'V6', 'V7', 'V8', 'V9', 'V10',\
       'V11', 'V12', 'V13', 'V14', 'V15', 'V16', 'V17', 'V18', 'V19',\
       'V20', 'V21', 'V22', 'V23', 'V24', 'V25', 'V26', 'V27', 'V28',\
       'Amount']
```

Split data in train, test and validation set

```
train_df, test_df = train_test_split(data_df, test_size=0.2, random_state=40, shuffle=True )
train_df, valid_df = train_test_split(train_df, test_size=0.2, random_state=40, shuffle=True
```

RandomForestClassifier

Define model parameters

```
clf = RandomForestClassifier(n_jobs=4,
                             random_state=2018,
                             criterion=10,
                             n_estimators=16,
                             verbose=False)
```

```
clf
```

```
▾                    RandomForestClassifier
RandomForestClassifier(criterion=10, n_estimators=16, n_jobs=4,
                       random_state=2018, verbose=False)
```

```
#clf.fit(train_df[predictors], train_df[target].values)

# Define the predictor variables and target variable
#predictors = ['Feature1', 'Feature2', 'Feature3']
#target = 'Target'

# Create an instance of the Random Forest classification model
#clf = RandomForestClassifier()
```