Assignment - 2

Python Programming

Assignment Date	21/09/2022
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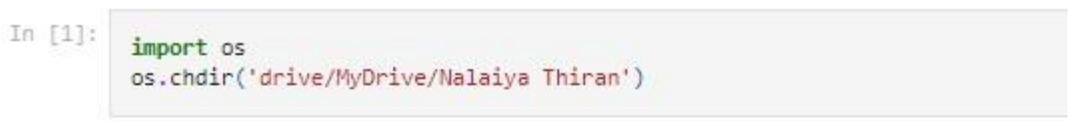
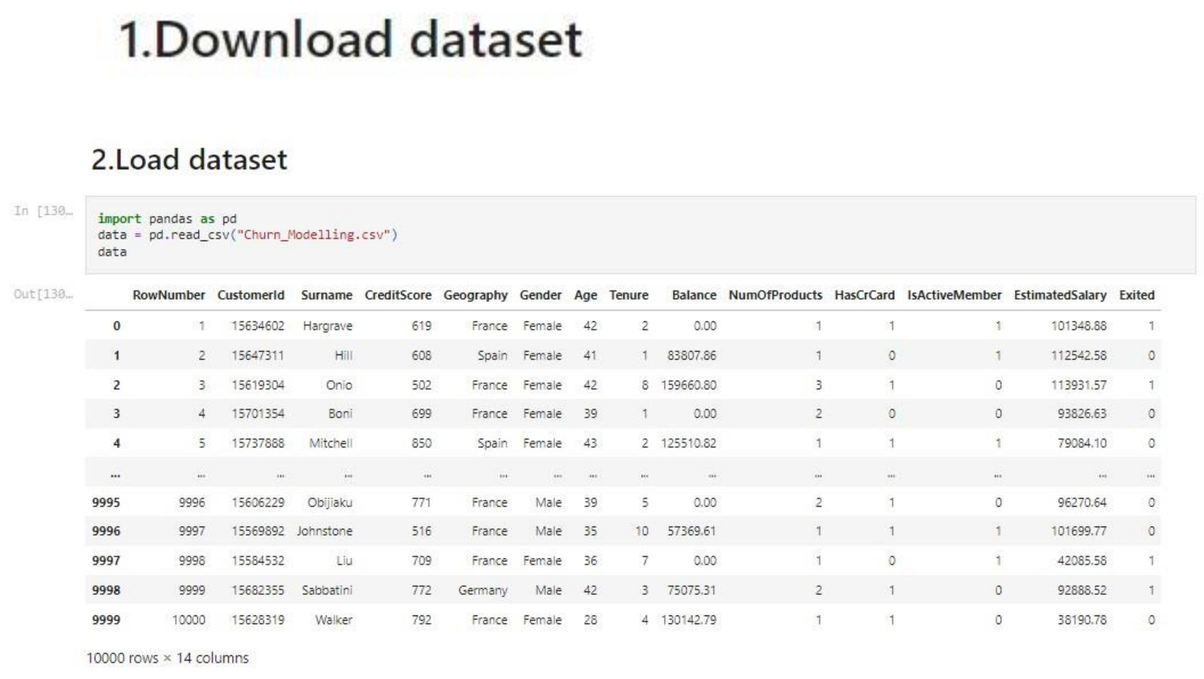
Maximum Mark	2 Mark



```
In [1]:  import os
         os.chdir('drive/MyDrive/Nalaiya Thiran')
```



1.Download dataset

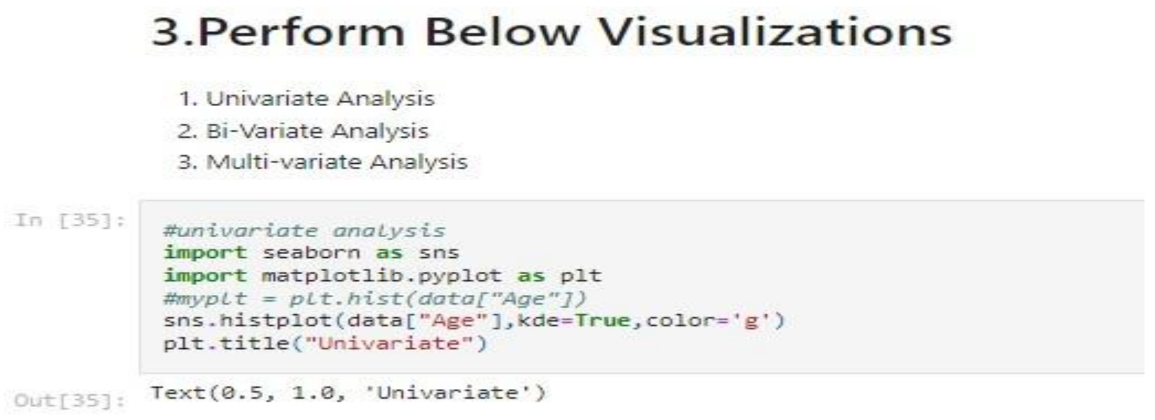
2.Load dataset

```
In [130…  import pandas as pd
          data = pd.read_csv("Churn_Modelling.csv")
          data
```

Out[130…

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	15634602	Hargrave	619	France	Female	42	2	0.00	1	1	1	101348.88	1
1	2	15647311	Hill	608	Spain	Female	41	1	83807.86	1	0	1	112542.58	0
2	3	15619304	Onio	502	France	Female	42	8	159660.80	3	1	0	113931.57	1
3	4	15701354	Boni	699	France	Female	39	1	0.00	2	0	0	93826.63	0
4	5	15737888	Mitchell	850	Spain	Female	43	2	125510.82	1	1	1	79084.10	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9995	9996	15606229	Obijiaku	771	France	Male	39	5	0.00	2	1	0	96270.64	0
9996	9997	15569892	Johnstone	516	France	Male	35	10	57369.61	1	1	1	101699.77	0
9997	9998	15584532	Liu	709	France	Female	36	7	0.00	1	0	1	42085.58	1
9998	9999	15682355	Sabbatini	772	Germany	Male	42	3	75075.31	2	1	0	92888.52	1
9999	10000	15628319	Walker	792	France	Female	28	4	130142.79	1	1	0	38190.78	0

10000 rows × 14 columns

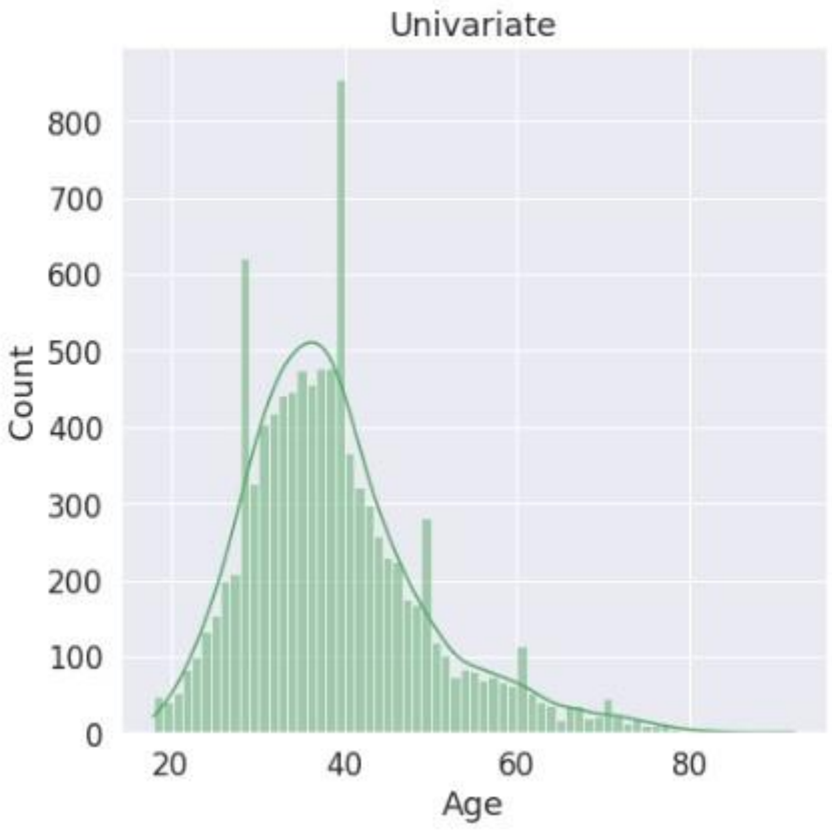


3.Perform Below Visualizations

1. Univariate Analysis
2. Bi-Variate Analysis
3. Multi-variate Analysis

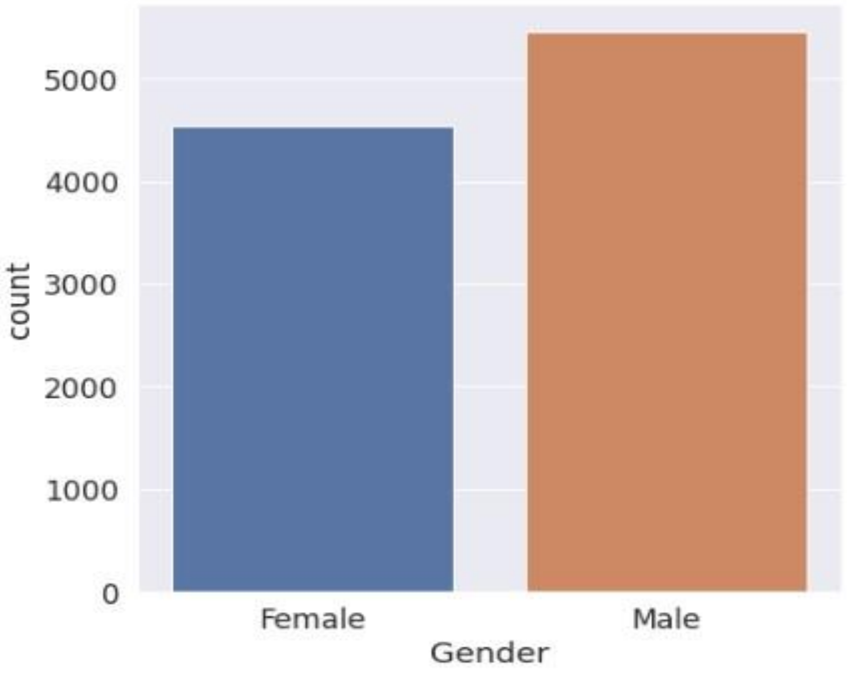
```
In [35]:  #univariate analysis
          import seaborn as sns
          import matplotlib.pyplot as plt
          #myplt = plt.hist(data["Age"])
          sns.histplot(data["Age"],kde=True,color='g')
          plt.title("Univariate")

Out[35]:  Text(0.5, 1.0, 'Univariate')
```



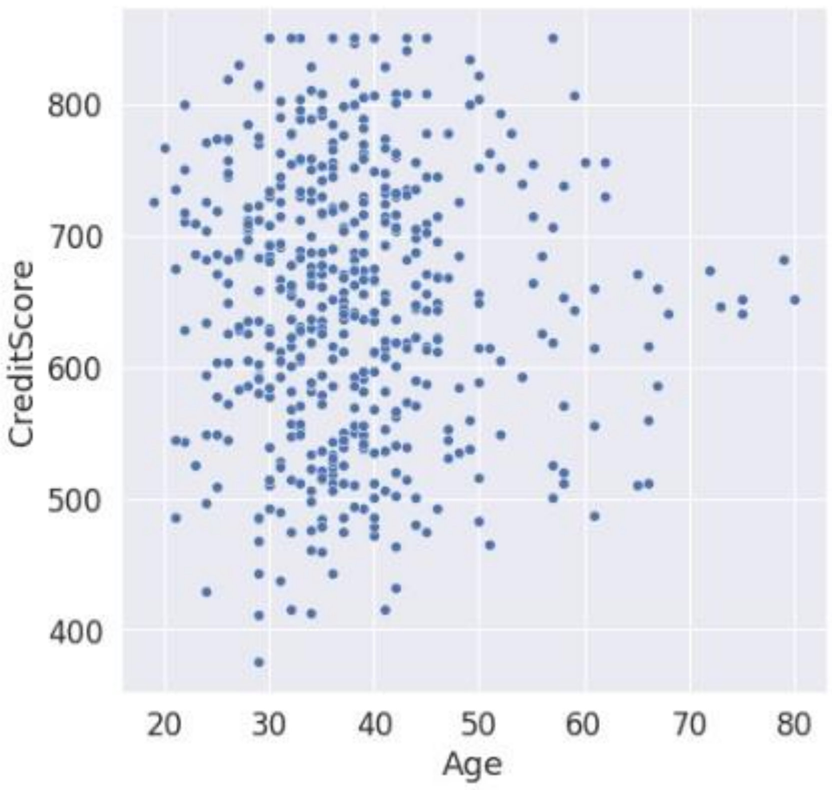
In [42]:
```
#bivariate analysis 1
sns.countplot(x='Gender', data = data)
```

Out[42]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f30022e0610>
```

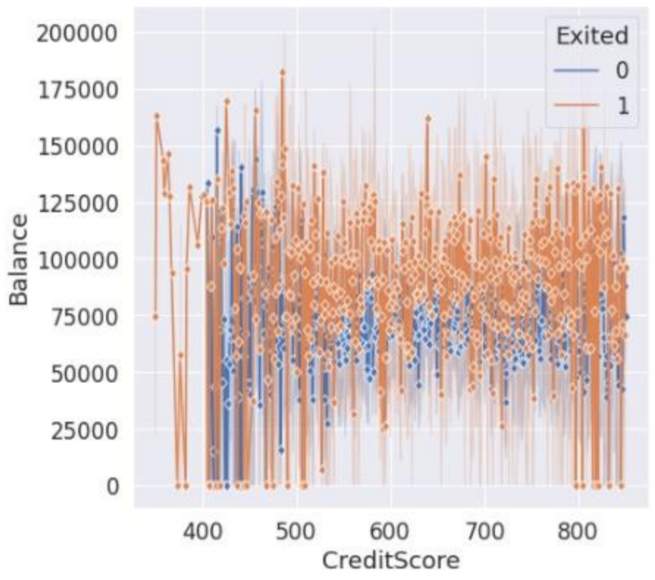


```
In [54]:  #bivariate analysis 2
           df = data.head(500)
           sns.scatterplot(x='Age',y='CreditScore', data=df)

Out[54]:   <matplotlib.axes._subplots.AxesSubplot at 0x7f2ffadce150>
```



```
In [ ]:  #multivariate analysis
         sns.set(rc={'figure.figsize':(7,7)})
         sns.set(font_scale=1.5)
         fig=sns.lineplot(x=data['CreditScore'], y=data['Balance'] ,markevery=1,marker='d' ,data=data, hue=data['Exited'] )
```



4.Perform descriptive statistics on the dataset.

```
In [6]:
numeric_columns = data[['CreditScore', 'Age','Tenure','Balance', 'NumOfProducts', 'HasCrCard', 'IsActiveMember', "EstimatedSalary","Exited"]]
print("Numerical Data Descriptive Statistics")
numeric_columns.describe(include = 'all')
```

```
Numerical Data Descriptive Statistics
```

Out[6]:

	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.00000	10000.000000	10000.000000	10000.000000
mean	650.528800	38.921800	5.012800	76485.889288	1.530200	0.70550	0.515100	100090.239881	0.203700
std	96.653299	10.487806	2.892174	62397.405202	0.581654	0.45584	0.499797	57510.492818	0.402769
min	350.000000	18.000000	0.000000	0.000000	1.000000	0.00000	0.000000	11.580000	0.000000
25%	584.000000	32.000000	3.000000	0.000000	1.000000	0.00000	0.000000	51002.110000	0.000000
50%	652.000000	37.000000	5.000000	97198.540000	1.000000	1.00000	1.000000	100193.915000	0.000000
75%	718.000000	44.000000	7.000000	127644.240000	2.000000	1.00000	1.000000	149388.247500	0.000000
max	850.000000	92.000000	10.000000	250898.090000	4.000000	1.00000	1.000000	199992.480000	1.000000

```
In [7]:
print("String Columns Description")
data.describe(include=['object'])
```

```
String Columns Description
```

Out[7]:

	Surname	Geography	Gender
count	10000	10000	10000
unique	2932	3	2
top	Smith	France	Male
freq	32	5014	5457

5.Handle the Missing values

```
In [57]:
data.isnull().sum().sum()
```

```
Out[57]: 0
```

```
In [56]:
data['Tenure'].isna().sum()
```

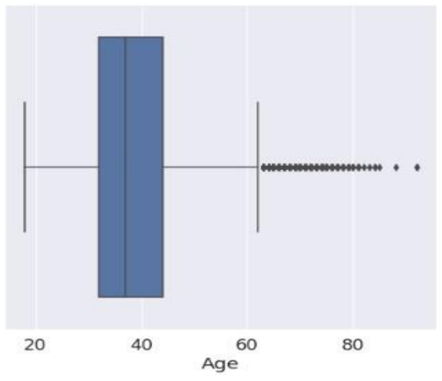
```
Out[56]: 0
```

6.Find the outliers and replace the outliers

```
In [115…
#use only the required column
df2 = pd.DataFrame(data['Age'],columns = ['Age'])
sns.boxplot(df2.Age,data = data)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, t
he only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretatio
n.
  FutureWarning
```

```
Out[115… <matplotlib.axes._subplots.AxesSubplot at 0x7f2ff8938550>
```



In [104…

```
df2
```

Out[104…

	Age
0	42
1	41
2	42
3	39
4	43
...	...
9995	39
9996	35
9997	36
9998	42
9999	28

10000 rows × 1 columns

In [117…

```
#upper_extreme = q3+1.5*IQR
#lower_extreme = q1-1.5*IQR
#IQR = q3-q1

qnt = df2.quantile(q=[0.25,0.75])
qnt
```

Out[117…

	Age
0.25	32.0
0.75	44.0

In [106…

```
IQR = qnt.loc[0.75] - qnt.loc[0.25]
upper_extreme = qnt.loc[0.75]+1.5*IQR
lower_extreme = qnt.loc[0.25]-1.5*IQR
lower_extreme
```

Out[106…

```
Age    14.0
dtype: float64
```

In [84]:

```
upper_extreme
#now we got the upper extreme which is the outlier so replace it now
```

Out[84]:

```
Age    62.0
dtype: float64
```

In [191…

```
med = df2['Age'].median()
med
```

Out[191…

```
37.0
```

In [185…

```
upper_extreme
```

Out[185…

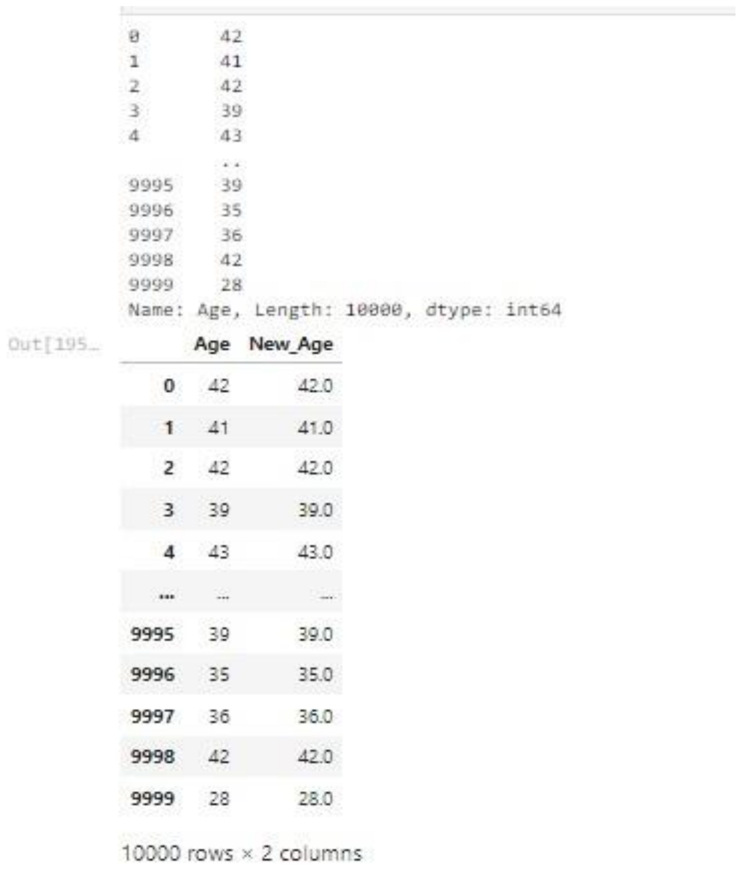
```
Age    62.0
dtype: float64
```

In [195…

```
#treating outliers using capping
#here 14 is lower_extreme
#62 is upper_extreme
import numpy as np

print(df2['Age'])
df2["New_Age"] = df2["Age"].map(
    lambda x: med
    if x < 14 else x)
df2["New_Age"] = df2['Age'].map(lambda x:med
                                 if x > 62 else x)
df2
```

```
0        42
```



```
0       42
1       41
2       42
3       39
4       43
        ..
9995    39
9996    35
9997    36
9998    42
9999    28
Name: Age, Length: 10000, dtype: int64
```

Out[195…

	Age	New_Age
0	42	42.0
1	41	41.0
2	42	42.0
3	39	39.0
4	43	43.0
...	...	...
9995	39	39.0
9996	35	35.0
9997	36	36.0
9998	42	42.0
9999	28	28.0

10000 rows × 2 columns

7.Check for categorical columns and perform encoding

In [125…

```
#extracting categorical columns
print(data['Geography'].unique())
print(data['Gender'].unique())
```

```
['France' 'Spain' 'Germany']
['Female' 'Male']
```

In [122…

```
data2 = data.copy()
data2['Gender'].replace(['Female','Male'],[0,1],inplace=True)
data2['Geography'].replace(['France','Spain','Germany'],[0,1,2],inplace=True)
data2
```

Out[122…

	RowNumber	CreditScore	Geography	Gender	Age	Tenure	Balance	EstimatedSalary
0	1	619	0	0	42	2	0.00	101348.88
1	2	608	1	0	41	1	83807.86	112542.58
2	3	502	0	0	42	8	159660.80	113931.57
3	4	699	0	0	39	1	0.00	93826.63
4	5	850	1	0	43	2	125510.82	79084.10
...	...	...	...	...	...	...	...	...
9995	9996	771	0	1	39	5	0.00	96270.64
9996	9997	516	0	1	35	10	57369.61	101699.77
9997	9998	709	0	0	36	7	0.00	42085.58
9998	9999	772	2	1	42	3	75075.31	92888.52
9999	10000	792	0	0	28	4	130142.79	38190.78

10000 rows × 8 columns

In [152…

```
d2 = pd.get_dummies(data,columns = ['Geography','Gender'])
d2
```

Out[152…

	RowNumber	CustomerId	Surname	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited	Geography_France	Geogra
0	1	15634602	Hargrave	619	42	2	0.00	1	1	1	101348.88	1	1	
1	2	15647311	Hill	608	41	1	83807.86	1	0	1	112542.58	0	0	
2	3	15619304	Onio	502	42	8	159660.80	3	1	0	113931.57	1	1	
3	4	15701354	Boni	699	39	1	0.00	2	0	0	93826.63	0	1	
4	5	15737888	Mitchell	850	43	2	125510.82	1	1	1	79084.10	0	0	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
9995	9996	15606229	Obijiaku	771	39	5	0.00	2	1	0	96270.64	0	1	
9996	9997	15569892	Johnstone	516	35	10	57369.61	1	1	1	101699.77	0	1	
9997	9998	15584532	Liu	709	36	7	0.00	1	0	1	42085.58	1	1	
9998	9999	15682355	Sabbatini	772	42	3	75075.31	2	1	0	92888.52	1	0	
9999	10000	15628319	Walker	792	28	4	130142.79	1	1	0	38190.78	0	1	

10000 rows × 17 columns

8.Split the data into dependent and independent variables.

n [138…

```
col= data.iloc[:,:-1].columns
print(col)

#dependant variable
y = data.iloc[:,-1:].columns
print(y)
```

```
Index(['RowNumber', 'CustomerId', 'Surname', 'CreditScore', 'Geography',
       'Gender', 'Age', 'Tenure', 'Balance', 'NumOfProducts', 'HasCrCard',
       'IsActiveMember', 'EstimatedSalary'],
      dtype='object')
Index(['Exited'], dtype='object')
```

n [139…

```
dep_data_var = data[col]
print(dep_data_var)

print(data[y])
```

```
      RowNumber  CustomerId    Surname  CreditScore Geography  Gender  Age  \
0             1    15634602   Hargrave          619    France  Female   42
1             2    15647311       Hill          608     Spain  Female   41
2             3    15619304       Onio          502    France  Female   42
3             4    15701354       Boni          699    France  Female   39
4             5    15737888   Mitchell          850     Spain  Female   43
...         ...         ...        ...          ...       ...     ...  ...
9995       9996    15606229   Obijiaku          771    France    Male   39
9996       9997    15569892  Johnstone          516    France    Male   35
9997       9998    15584532        Liu          709    France  Female   36
9998       9999    15682355  Sabbatini          772   Germany    Male   42
9999      10000    15628319     Walker          792    France  Female   28

      Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  \
0          2       0.00              1          1               1
1          1   83807.86              1          0               1
2          8  159660.80              3          1               0
3          1       0.00              2          0               0
4          2  125510.82              1          1               1
...      ...        ...            ...        ...             ...
9995       5       0.00              2          1               0
9996      10   57369.61              1          1               1
9997       7       0.00              1          0               1
9998       3   75075.31              2          1               0
9999       4  130142.79              1          1               0

      EstimatedSalary
0           101348.88
1           112542.58
2           113931.57
3            93826.63
4            79084.10
...               ...
9995         96270.64
9996        101699.77
9997         42085.58
9998         92888.52
9999         38190.78

[10000 rows x 13 columns]
      Exited
0          1
1          0
2          1
3          0
4          0
...      ...
9995       0
9996       0
9997       1
9998       1
9999       0

[10000 rows x 1 columns]
```

9.Scale the independent variables

```
In [157…
```

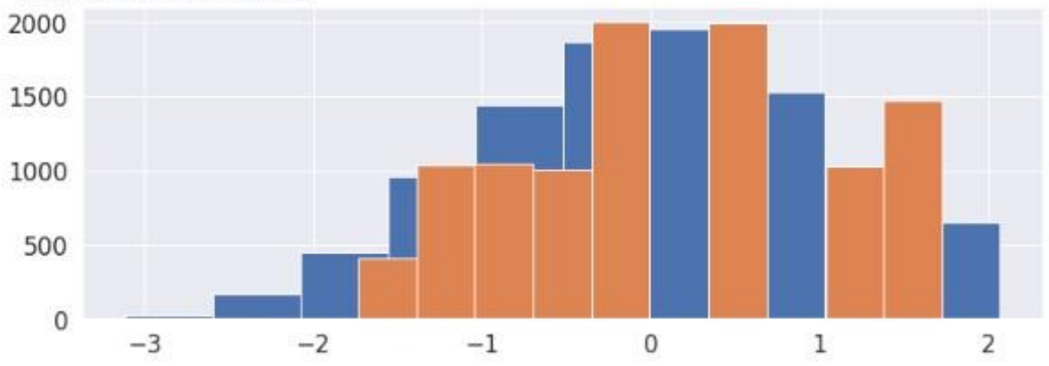
```python
import pandas as pd
import matplotlib.pyplot as plt
# Import StandardScaler
from sklearn.preprocessing import StandardScaler

fig, ax = plt.subplots(figsize=(12, 4))
cols = ['CreditScore','Tenure','EstimatedSalary']

scaler = StandardScaler()
x_std = scaler.fit_transform(data[cols])

ax.hist(x_std[:,0])
ax.hist(x_std[:,1])
```

```
Out[157…
(array([ 413., 1035., 1048., 1009., 2001.,    0., 1995.,    0., 1025.,
        1474.]),
 array([-1.73331549, -1.38753759, -1.04175968, -0.69598177, -0.35020386,
        -0.00442596,  0.34135195,  0.68712986,  1.03290776,  1.37868567,
         1.72446358]),
 <a list of 10 Patch objects>)
```



10.Split the data into training and testing

```
In [173…
```

```python
from sklearn.model_selection import train_test_split
x = data['Age'].values
print(x)
y = data.iloc[:,-1].values
print(y)
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.33, random_state=42)
print(X_train)
print("Total Training data ",len(X_train))
```

```
[42 41 42 ... 36 42 28]
[1 0 1 ... 1 1 0]
[29 37 49 ... 38 43 51]
Total Training data  6700
```