

Project Name	A Novel Method For Handwritten Recognition System
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Importing Package

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

```
import pandas as pd
import seaborn as sns
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
```

1.Loading dataset

```
df =pd.read_csv('/content/Churn_Modelling.csv')
```

df

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenur
0	1	0.275616	Hargrave	619	France	Female	42	
1	2	0.326454	Hill	608	Spain	Female	41	
2	3	0.214421	Onio	502	France	Female	42	
3	4	0.542636	Boni	699	France	Female	39	
4	5	0.688778	Mitchell	850	Spain	Female	43	
...
	9995	0.162119	Obijiaku	771	France	Male	39	
	9996							
	6							
	9996	0.016765	Johnstone	516	France	Male	35	
	9997							
	7							
	9997	0.075327	Liu	709	France	Female	36	

```

999
8
9998 0.466637 Sabbatini 772 Germany Male 42
999
9
9999 0.250483 Walker 792 France Female 28
1000
0

```

10000 rows x 14 columns

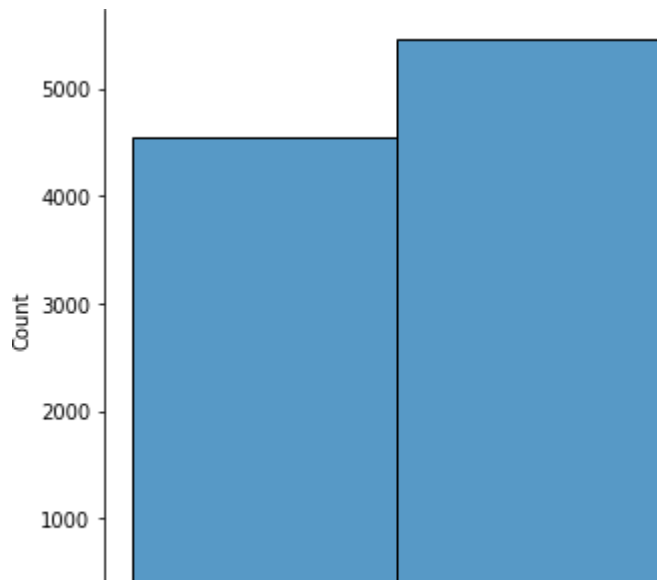
Visualization

a) Univariate analysis

sns.displot (df.Gender)



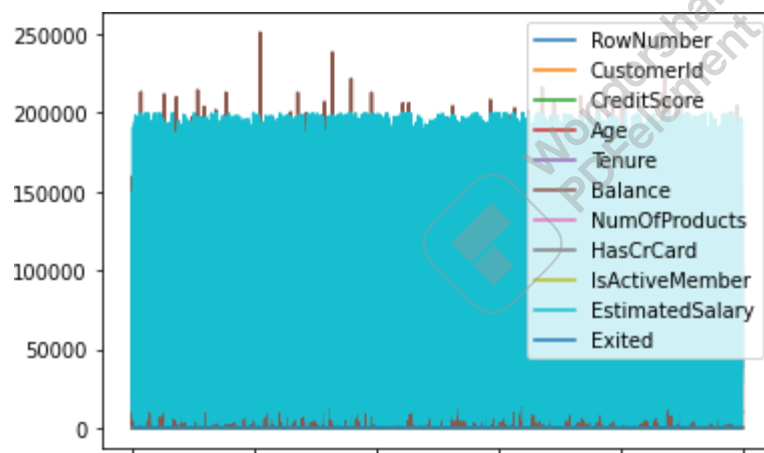
<seaborn.axisgrid.FacetGrid at 0x7fa2127ec990>



b) Bi-Variate

df.plot.line()

<matplotlib.axes._subplots.AxesSubplot at 0x7fa21262e890>



c) Multi Variate

sns.lmplot("Tenure", "NumOfProducts", df, hue="NumOfProducts", fit_reg=False);

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning
FutureWarning

4.0 |

Perform descriptive statistics on the dataset

`df.describe()`

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance
<i>count</i>	10000.00 000	10000.0000 00	10000.0000 00	10000.0000 00	10000.0000 00	10000.0000 0
<i>mean</i>	5000.500 00	0.500980	650.528800	36.533900	5.012800	76485.8892 8
<i>std</i>	2886.895 68	0.287757	96.653299	6.473843	2.892174	62397.4052 0
<i>min</i>	1.00000	0.000000	350.000000	20.000000	0.000000	0.00000
<i>25%</i>	2500.750 00	0.251320	584.000000	32.000000	3.000000	0.00000
<i>50%</i>	5000.500 00	0.500170	652.000000	37.000000	5.000000	97198.5400 0
<i>75%</i>	7500.250 00	0.750164	718.000000	40.000000	7.000000	127644.240 00
<i>max</i>	10000.00 000	1.000000	850.000000	50.000000	10.000000	250898.090 00

Handle the missing values

```
data = pd.read_csv("/content/Churn_Modelling.csv")
pd.isnull(data["Gender"])
```

```
0      False
1      False
2      False
3      False
4      False
...
```

```
sns.boxplot(df['Age'])
```

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning

FutureWarning

9995 False

9996 False

9997 False

9998 False

9999 False

Name: Gender, Length: 10000, dtype: bool

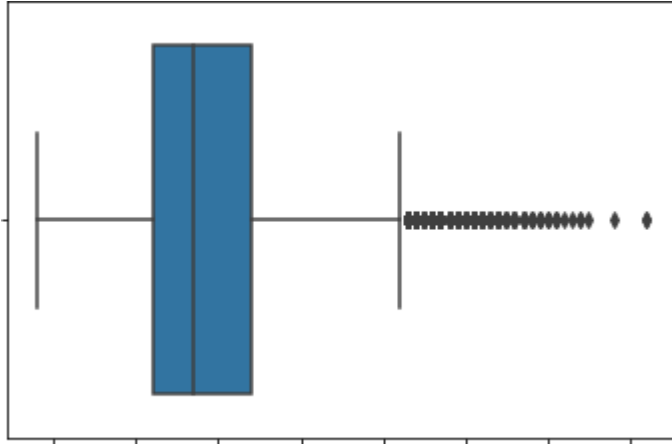
Find the outliers and replace the outliers



`sns.boxplot(df['Age'])`

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning
FutureWarning

<matplotlib.axes._subplots.AxesSubplot at 0x7fa21390b290>



```
df['Age']=np.where(df['Age']>50,40,df['Age'])
df['Age']
```

```
0      42
1      41
2      42
3      39
4      43
```

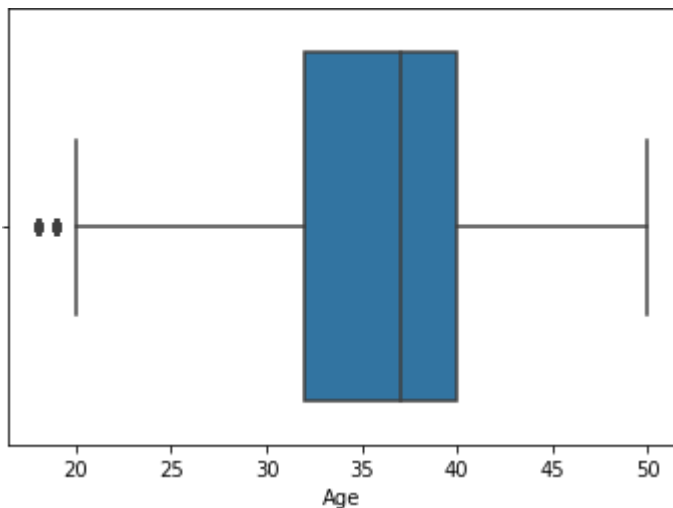
```
--
9995    39
9996    35
9997    36
9998    42
9999    28
```

Name: Age, Length: 10000, dtype: int64

```
sns.boxplot(df['Age'])
```

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning
FutureWarning

<matplotlib.axes._subplots.AxesSubplot at 0x7fa213879fd0>



```
df['Age']=np.where(df['Age']<20,35,df['Age'])
df['Age']
```

```

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

Check for categorical Columns and perform encoding

```
pd.get_dummies(df,columns=["Gender","Age"],prefix=["Age","Gender"]).head()
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Tenure	Balance	Num
0	1	0.275616	Hargrave	619	France	2	0.00	
1	2	0.326454	Hill	608	Spain	1	83807.8	6
2	3	0.214421	Onio	502	France	8	159660.	80
3	4	0.542636	Boni	699	France	1	0.00	
4	5	0.688778	Mitchell	850	Spain	2	125510.	

5 rows x 45 columns

Split the data into dependent and independent Variables

a) Split the data into independent Variables

```

X = df.iloc[:, :-1].values
print(X)

```

```

[[1 0.2756161271095934 'Hargrave' ... 1 1 101348.88]
 [2 0.32645436399201344 'Hill' ... 0 1 112542.58]
 [3 0.21442143454311946 'Onio' ... 1 0 113931.57]

```

```
...  
[9998 0.07532731440183227 'Liu' ... 0 1 42085.58]  
[9999 0.4666365320074064 'Sabbatini' ... 1 0 92888.52]  
[10000 0.25048302125293276 'Walker' ... 1 0 38190.78]]
```

b) Split the data into dependent Variables




```
Y = df.iloc[:, -1].valuesprint
(Y)
```

```
[1 0 1 ... 1 1 0]
```

Scale the independent Variables

```
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
df[["CustomerId"]]= scaler.fit_transform(df[["CustomerId"]])
print(df)
```

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age \
0	1	0.275616	Hargrave	619	France	Female	42
1	2	0.326454	Hill	608	Spain	Female	41
2	3	0.214421	Onio	502	France	Female	42
3	4	0.542636	Boni	699	France	Female	39
4	5	0.688778	Mitchell	850	Spain	Female	43
...
9995	9996	0.162119	Obijiaku	771	France	Male	39
9996	9997	0.016765	Johnstone	516	France	Male	35
9997	9998	0.075327	Liu	709	France	Female	36
9998	9999	0.466637	Sabbatini	772	Germany	Male	42
9999	10000	0.250483	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	Exited
0	101348.88	1
1	112542.58	0
2	113931.57	1
3	93826.63	0
4	79084.10	0
...
9995	96270.64	0
9996	101699.77	0
9997	42085.58	1
9998	92888.52	1
9999	38190.78	0

```
[10000 rows x 14 columns]
```

Split the data into training and testing

```
from sklearn.model_selection import train_test_split
train_size=0.8
X = df.drop(columns = ['Tenure']).copy()
y = df['Tenure']
X_train, X_rem, y_train, y_rem = train_test_split(X,y, train_size=0.8)test_size=0.5
X_valid, X_test, y_valid, y_test = train_test_split(X_rem,y_rem,test_size=0.5)
print(X_train.shape),
print(y_train.shape)
print(X_valid.shape), print(y_valid.shape)
print(X_test.shape), print(y_test.shape)
```

(8000, 13)

(8000,)

(1000, 13)

(1000,)

(1000, 13)

(1000,)

(None, None)

