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 snsimport
numpy as np
from matplotlib import pyplot as ply
%matplotlib inline
```

1.Loading dataset

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

```
df
```

	Row number	Customer id	Surname	Credit score	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	0.162119	Obijiaku	771	France	Male	39
	9996	0.016765	Johnstone	516	France	Male	35
	9997	0.075327	Liu	709	France	Female	36

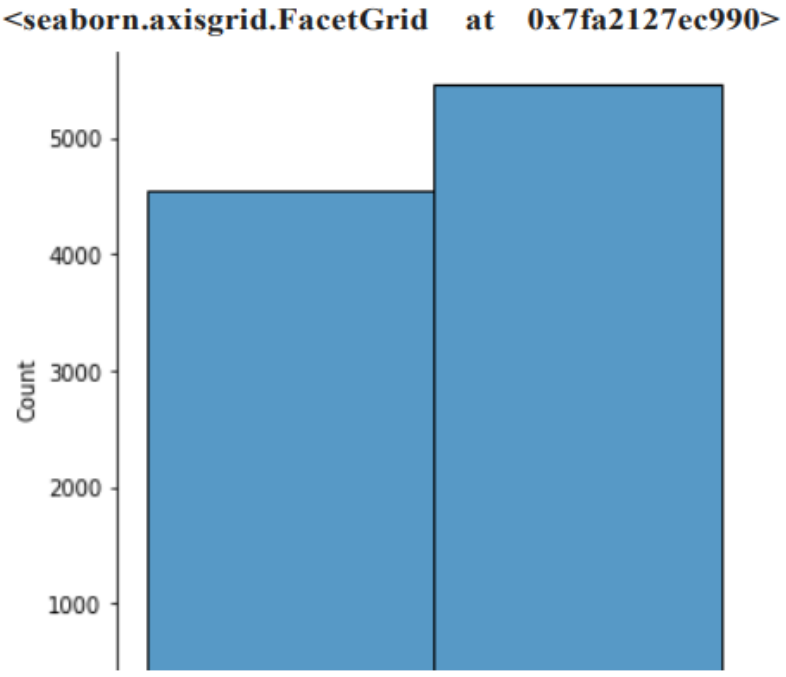
9998	0.466637	Sabbatini	772	Germany	Male	42
9999	0.250483	Walker	792	France	Female	28

10000 rows × 14 columns

Visualization

a) Univariate analysis

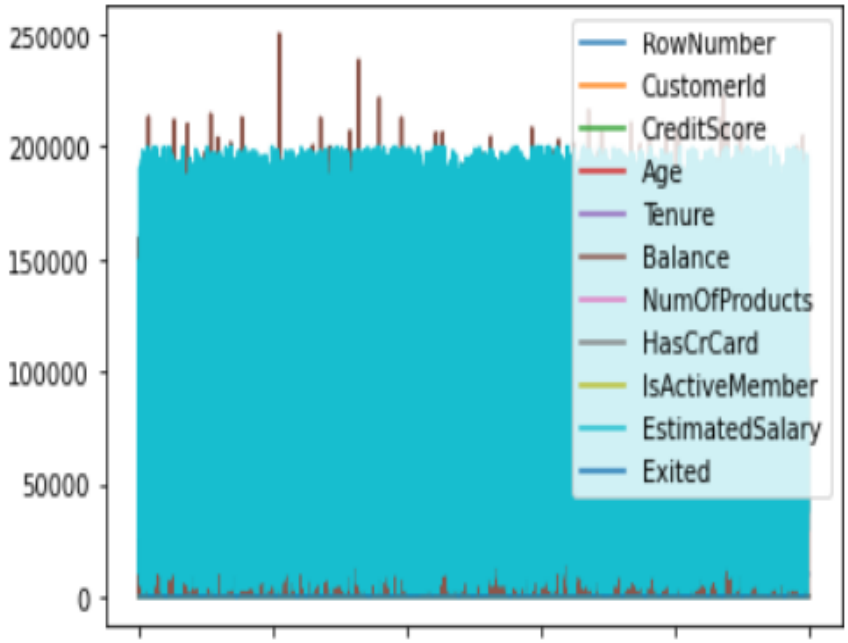
sns.displot (df.Gender)



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
```

Perform descriptive statistics on the dataset

df.describe()

	Row number	Customer id	Credit score	Age	Tenure	Balance
count	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.00000
mean	5000.500000	0.500980	650.528800	36.533900	5.012800	76485.88928
std	2886.89568	0.287757	96.653299	6.473843	2.892174	62397.40520
min	1.00000	0.000000	350.000000	20.000000	0.000000	0.00000
25%	2500.750000	0.251320	584.000000	32.000000	3.000000	0.00000
50%	5000.500000	0.500170	652.000000	37.000000	5.000000	97198.54000
75%	7500.250000	0.750164	718.000000	40.000000	7.000000	127644.24000
max	10000.000000	1.000000	850.000000	50.000000	10.000000	250898.09000

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
        ---
```

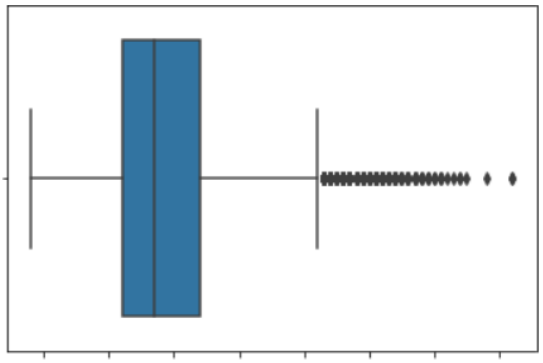
```
sns.boxplot(df['Age'])
```

```
/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>
```

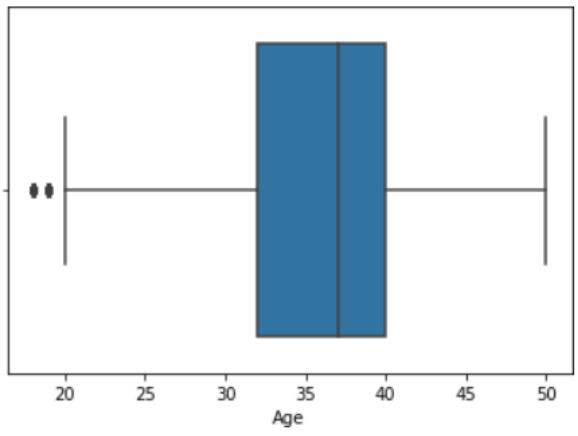


```
df['Age']=np.where(df['Age']>50,40,df['Age'])
df['Age']
```

```
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()
```

	Row number	customer id	surname	Credit score	Geography	Tenure	Balance
0	1	0.275616	Hargrave	619	France	2	0.00
1	2	0.326454	Hill	608	Spain	1	83807.86
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 × 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_splittrain_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)
```