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
```

	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	9996	0.162119	Obijiaku	771	France	Male	39	
9996	9997	0.016765	Johnstone	516	France	Male	35	
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						

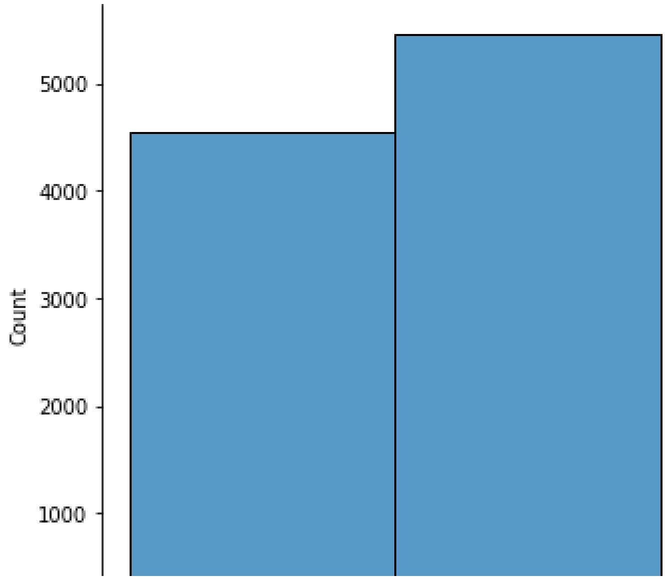
10000 rows × 14 columns

Visualization

a) Univariate analysis

```
sns.displot  (df.Gender)
```

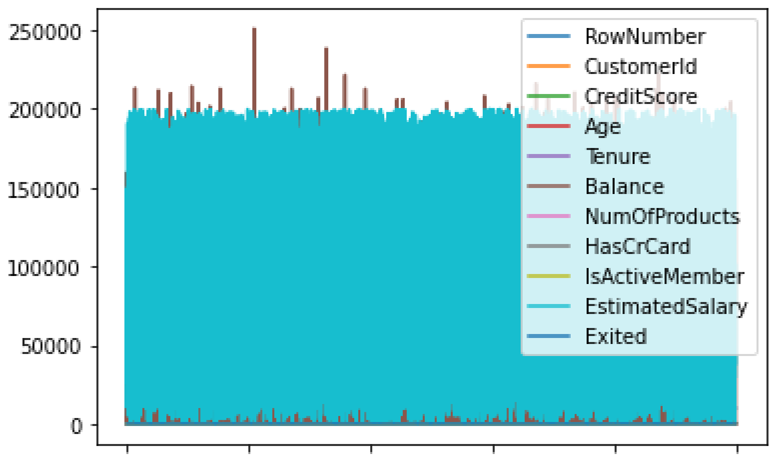
<seaborn.axisgrid.FacetGrid at 0x7fa2127ec990>



b) Bi-Variate

df.plot.line()

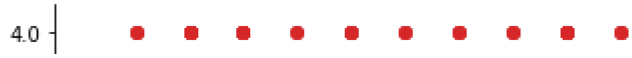
<matplotlib.axes._subplots.AxesSubplot at 0x7fa21262e890>



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
```



Perform descriptive statistics on the dataset

```
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balanc
count	10000.00000	10000.000000	10000.000000	10000.000000	10000.000000	10000.00000
mean	5000.50000	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%	2500.75000	0.251320	584.000000	32.000000	3.000000	0.00000
50%	5000.50000	0.500170	652.000000	37.000000	5.000000	97198.54000
75%	7500.25000	0.750164	718.000000	40.000000	7.000000	127644.24000
max	10000.00000	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
     ...
```

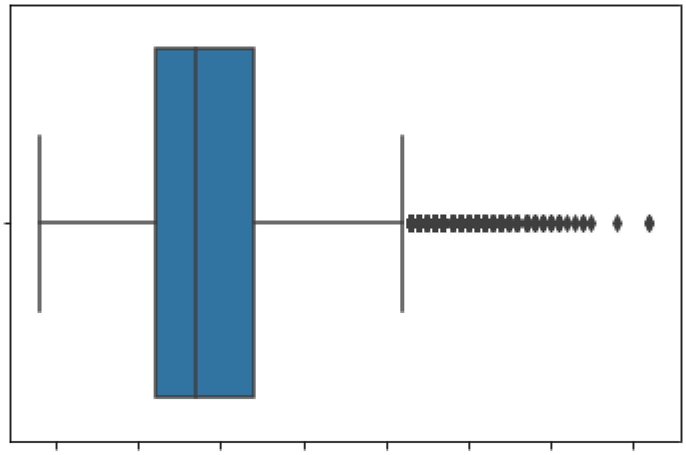
```
sns.boxplot(df['Age'])
```

```
/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
&lt;matplotlib.axes._subplots.AxesSubplot at 0x7fa21390b290&gt;
```

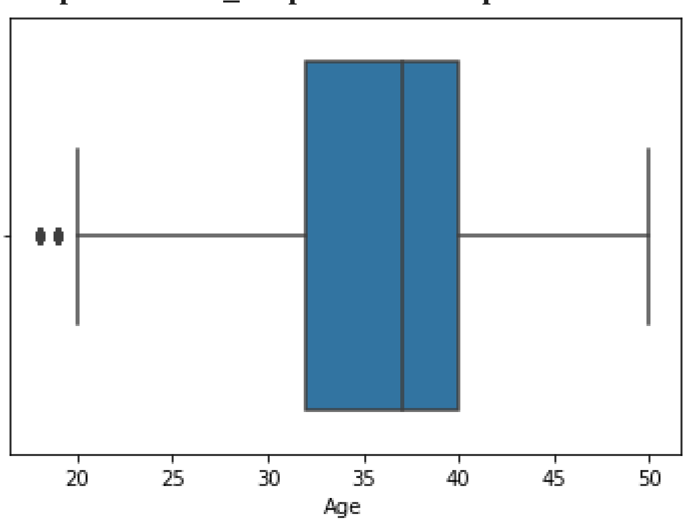


```
df['Age']=np.where(df['Age']>50,40,df['Age'])
df['Age']
```

```
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
&lt;matplotlib.axes._subplots.AxesSubplot at 0x7fa213879fd0&gt;
```




```
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	83807.86	
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)
```