```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import tensorflow as tf
import seaborn as sns
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
```

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

```
Mounted at /content/drive
```

2. Load the data set

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

```
df.head()
```

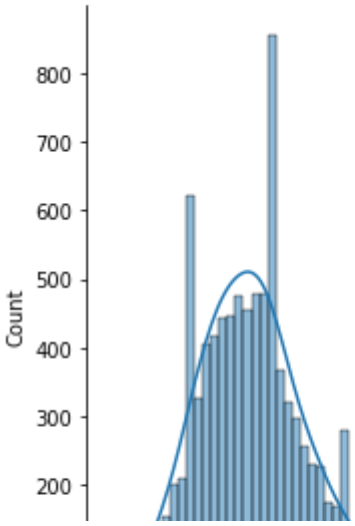
	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	
0	1	15634602	Hargrave	619	France	Female	42	2	
								1	
								8	1
3	4	15701354	Boni	699	France	Female	39	1	
4	5	15737888	Mitchell	850	Spain	Female	43	2	1

3. Data Visualizations

3.1. Univariate Analysis

```
sns.displot(df['Age'], kde=True)
```

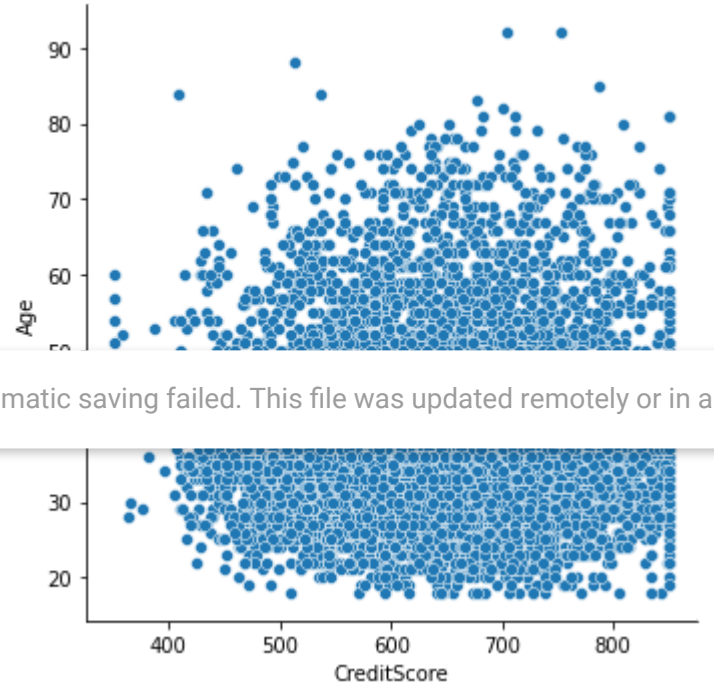
```
<seaborn.axisgrid.FacetGrid at 0x7f0d77a81850>
```



3.2. Bi - Variate Analysis

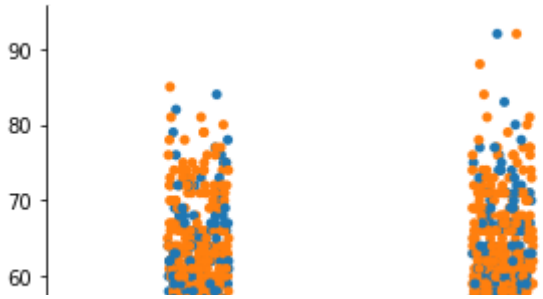

```
sns.relplot(x='CreditScore', y='Age', data=df)
```

```
<seaborn.axisgrid.FacetGrid at 0x7f0d748bf6d0>
```




```
sns.catplot(x='Gender', y='Age', hue='HasCrCard', data=df)
```

```
<seaborn.axisgrid.FacetGrid at 0x7f0d743184d0>
```



3.3. Multi - Variate Analysis

```
sns.pairplot(df)
```

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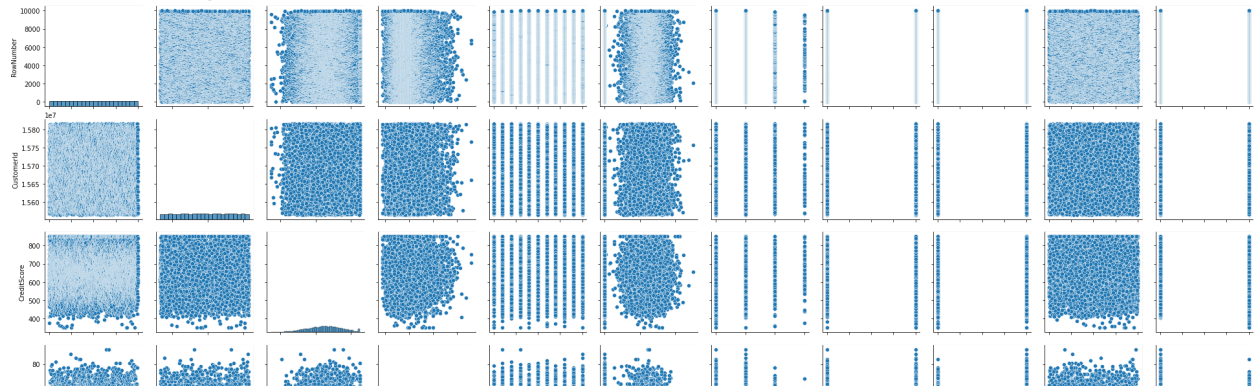
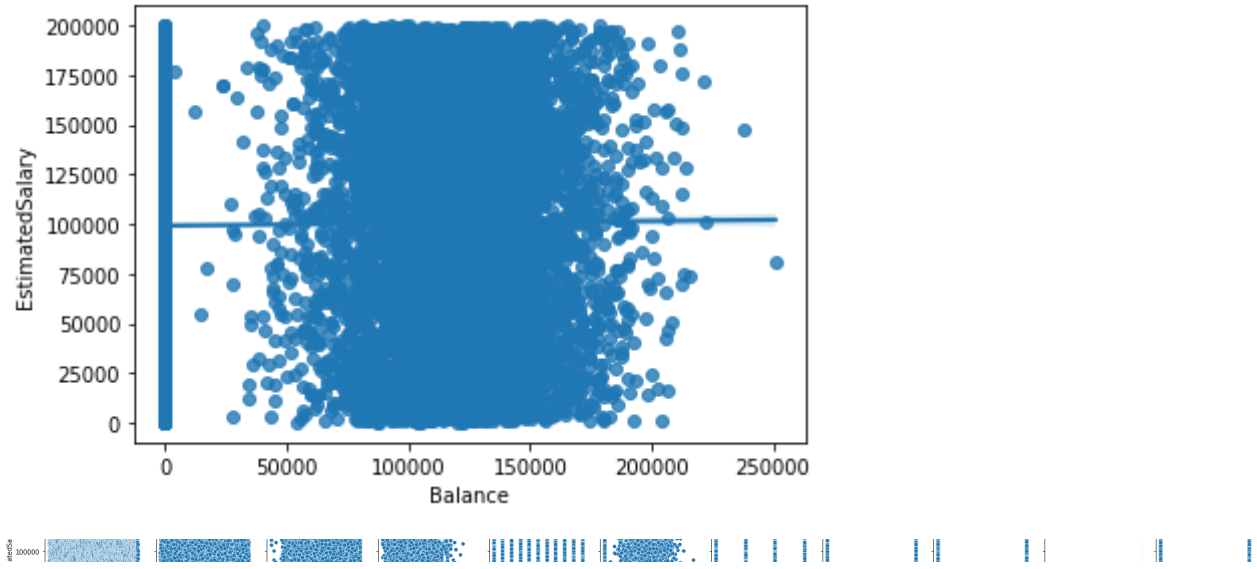
```
<seaborn.axisgrid.PairGrid at 0x7f0d6f8cd0d0>
```



```
sns.regplot(x='Balance', y='EstimatedSalary', data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0d6c6fe710>
```



4. Descriptive Statistics


```
df.describe()
```

	RowNumber	CustomerId	CreditScore	Age	Tenure	Ba
count	10000.00000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.0
mean	5000.50000	1.569094e+07	650.528800	38.921800	5.012800	76485.8
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.4
min	1.00000	1.556570e+07	350.000000	18.000000	0.000000	0.0
25%	2500.75000	1.562853e+07	584.000000	32.000000	3.000000	0.0
50%	5000.50000	1.569074e+07	652.000000	37.000000	5.000000	97198.5
75%	7500.25000	1.575323e+07	718.000000	44.000000	7.000000	127644.2
max	10000.00000	1.581569e+07	850.000000	92.000000	10.000000	250898.0

5. Handle the Missing values

```
df.isnull().sum()
```

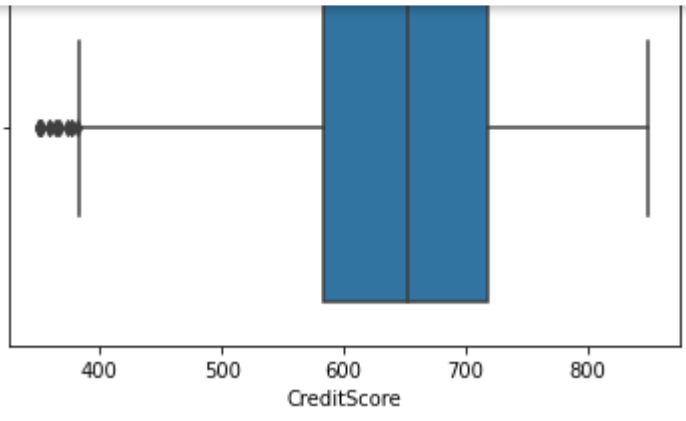
```
RowNumber          0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

The datset does not contain any missing values, So no need for null value handling!!!

6. Find the outliers and replace the outliers

```
sns.boxplot(x='CreditScore',data=df)
```

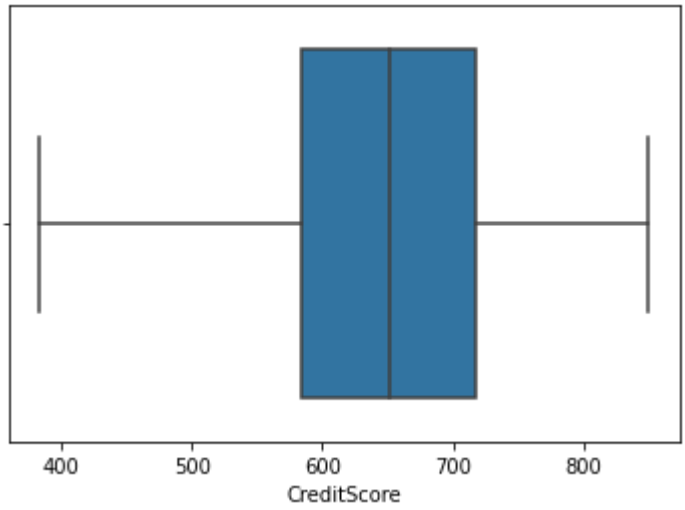
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0d6c620d10>
```


```
Q1 = df['CreditScore'].quantile(0.25)
Q3 = df['CreditScore'].quantile(0.75)
IQR = Q3 - Q1
whisker_width = 1.5
lower_whisker = Q1 - (whisker_width*IQR)
upper_whisker = Q3 + (whisker_width*IQR)
df['CreditScore']=np.where(df['CreditScore']>upper_whisker,upper_whisker,np.where(df['Crec
```

```
sns.boxplot(x='CreditScore',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0d7485ff90>
```



7. Check for Categorical columns and perform encoding

```
df['Geography'].unique()
ct= ColumnTransformer([('oh', OneHotEncoder(), [4])], remainder="passthrough")
```

8. Split the data into dependent and independent variables.

```
x=df.iloc[:,0:12].values
y=df.iloc[:,12:14].values
x[0:5,:]
```



```
array([[1.0, 0.0, 0.0, 1, 15634602, 'Hargrave', 619.0, 'Female', 42, 2,
        0.0, 1, 1, 1],
       [0.0, 0.0, 1.0, 2, 15647311, 'Hill', 608.0, 'Female', 41, 1,
        83807.86, 1, 0, 1],
       [1.0, 0.0, 0.0, 3, 15619304, 'Onio', 502.0, 'Female', 42, 8,
        159660.8, 3, 1, 0],
       [1.0, 0.0, 0.0, 4, 15701354, 'Boni', 699.0, 'Female', 39, 1, 0.0,
        2, 0, 0],
```

```
       [0.0, 0.0, 1.0, 5, 15737888, 'Mitchell', 850.0, 'Female', 43, 2,
        125510.82, 1, 1, 1]], dtype=object)
```

```
#DEPENDENT VARIABLES
y[0:5,:]
```

```
array([[1.0134888e+05, 1.0000000e+00],
       [1.1254258e+05, 0.0000000e+00],
       [1.1393157e+05, 1.0000000e+00],
       [9.3826630e+04, 0.0000000e+00],
       [7.9084100e+04, 0.0000000e+00]])
```

9. Scale the independent variables

```
sc= StandardScaler()
x[:,8:12]=sc.fit_transform(x[:,8:12])
x[0:5,:]
```

```
array([[1.0, 0.0, 0.0, 1, 15634602, 'Hargrave', 619.0, 'Female',
        0.29351742289674765, -1.041759679225302, -1.2258476714090163,
        -0.911583494040172, 1, 1],
       [0.0, 0.0, 1.0, 2, 15647311, 'Hill', 608.0, 'Female',
        0.19816383219544578, -1.387537586562431, 0.11735002143511637,
        -0.911583494040172, 0, 1],
       [1.0, 0.0, 0.0, 3, 15619304, 'Onio', 502.0, 'Female',
        0.29351742289674765, 1.0329077647974714, 1.333053345722891,
        2.5270566192762067, 1, 0],
       [1.0, 0.0, 0.0, 4, 15701354, 'Boni', 699.0, 'Female',
        0.007456650792842043, -1.387537586562431, -1.2258476714090163,
        -0.911583494040172, 1, 1]], dtype=object)
```

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10. Split the data into training and testing

```
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.3, random_state=0)
```

```
x_train
```

```
array([[1.0, 0.0, 0.0, ..., 0.8077365626180174, 1, 1],
       [1.0, 0.0, 0.0, ..., 0.8077365626180174, 1, 0],
       [1.0, 0.0, 0.0, ..., -0.911583494040172, 0, 1],
       ...,
       [1.0, 0.0, 0.0, ..., 0.8077365626180174, 1, 0],
       [0.0, 0.0, 1.0, ..., 0.8077365626180174, 1, 1],
       [0.0, 1.0, 0.0, ..., -0.911583494040172, 1, 0]], dtype=object)
```

```
x_test
```

```
array([[0.0, 1.0, 0.0, ..., -0.911583494040172, 1, 1],
       [1.0, 0.0, 0.0, ..., -0.911583494040172, 1, 0],
       [0.0, 0.0, 1.0, ..., -0.911583494040172, 1, 1],
       ...,
       [1.0, 0.0, 0.0, ..., 0.8077365626180174, 1, 1],
       [1.0, 0.0, 0.0, ..., -0.911583494040172, 1, 1],
       [0.0, 1.0, 0.0, ..., -0.911583494040172, 1, 1]], dtype=object)
```

```
y_train
```

```
array([[5.5796830e+04, 1.0000000e+00],
       [1.9823020e+04, 0.0000000e+00],
       [1.3848580e+04, 0.0000000e+00],
       ...,
       [1.8142987e+05, 0.0000000e+00],
       [1.4875016e+05, 0.0000000e+00],
       [1.1885526e+05, 1.0000000e+00]])
```

```
y_test
```

```
array([[1.9285267e+05, 0.0000000e+00],
       [1.2870210e+05, 1.0000000e+00],
       [7.5732250e+04, 0.0000000e+00],
       ...,
       [1.6740029e+05, 0.0000000e+00],
       [7.0849470e+04, 0.0000000e+00],
       [3.3759410e+04, 1.0000000e+00]])
```

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