

AI-based localization and classification of skin disease with erythema

ASSIGNMENT-2

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```
import pandas as pd
```

```
import numpy as np
```

```
import sklearn as sk
```

```
import seaborn as sns
```

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

```
df=data.head(10)
```

Univarient analysis

```
import matplotlib.pyplot as plt
```

```
plt.bar (df['CreditScore'],4)
```

Bivariate Analysis

```
plt.scatter(df['Balance'],df['EstimatedSalary'])
```

Multivariate analysis

```
plt.scatter(df['Age'],df['CreditScore'],df['Cred'])
```

Perform Descriptive statistics on the dataset

data.describe()

	RowNumber	CustomerId	CreditScore	Age	Tenure	Balance	NumOfProducts	HasCrCard
	IsActiveMember		EstimatedSalary	Exited				
count	10000.000000	1.000000e+04	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000
	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000	10000.000000		
mean	5000.500000	1.569094e+07	650.528800	38.921800	5.012800	76485.889288		
	1.530200	0.70550	0.515100	100090.239881	0.203700			
std	2886.89568	7.193619e+04	96.653299	10.487806	2.892174	62397.405202		
	0.581654	0.45584	0.499797	57510.492818	0.402769			
min	1.000000	1.556570e+07	350.000000	18.000000	0.000000	0.000000		
	1.000000	0.000000	0.000000	11.580000	0.000000			
25%	2500.750000	1.562853e+07	584.000000	32.000000	3.000000	0.000000		
	1.000000	0.000000	0.000000	51002.110000	0.000000			
50%	5000.500000	1.569074e+07	652.000000	37.000000	5.000000	97198.540000		
	1.000000	1.000000	1.000000	100193.915000	0.000000			
75%	7500.250000	1.575323e+07	718.000000	44.000000	7.000000	127644.240000		
	2.000000	1.000000	1.000000	149388.247500	0.000000			
max	10000.000000	1.581569e+07	850.000000	92.000000	10.000000	250898.090000		
	4.000000	1.000000	1.000000	199992.480000	1.000000			

Handle missing values

data.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

Finding Outliers

```
sns.boxplot(data['Tenure'])
```

/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, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning

Removing outliers

```
q=data.quantile(q=[0.75,0.5])
```

```
iqr=q.iloc[0]-q.iloc[1]
```

iqr

RowNumber	2499.7500
CustomerId	62495.7500
CreditScore	66.0000
Age	7.0000
Tenure	2.0000
Balance	30445.7000

NumOfProducts 1.0000

HasCrCard 0.0000

IsActiveMember 0.0000

EstimatedSalary 49194.3325

Exited 0.0000

dtype: float64

l=q.iloc[1]-(1.5*iqr)

l['Tenure']

2.0

u=q.iloc[1]+(1.5*iqr)

u['Tenure']

8.0

data['Tenure']=np.where(data['Tenure']>u['Tenure'],u['Tenure'],np.where(data['Tenure']<l['Tenure'],l['Tenure'],data['Tenure']))

sns.boxplot(data['Tenure'])

/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, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning

Check for categorical column and perform encoding

df.info()

RangeIndex: 10 entries, 0 to 9

Data columns (total 14 columns):

#	Column	Non-Null Count	Dtype
---	-----	-----	-----

0	RowNumber	10 non-null	int64
1	CustomerId	10 non-null	int64
2	Surname	10 non-null	object
3	CreditScore	10 non-null	int64
4	Geography	10 non-null	object
5	Gender	10 non-null	object
6	Age	10 non-null	int64
7	Tenure	10 non-null	int64
8	Balance	10 non-null	float64
9	NumOfProducts	10 non-null	int64
10	HasCrCard	10 non-null	int64
11	IsActiveMember	10 non-null	int64
12	EstimatedSalary	10 non-null	float64
13	Exited	10 non-null	int64

```
dtypes: float64(2), int64(9), object(3)
```

memory usage: 1.2+ KB

```
from sklearn.preprocessing import LabelEncoder
```

```
from collections import Counter as count
```

```
le=LabelEncoder()
```

```
data['Geography']=le.fit_transform(data['Geography'])
```

data

Row	Number	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure		
		Balance	NumOfProducts	HasCrCard	IsActiveMember		EstimatedSalary	Exited		
0	1	15634602	Hargrave	619	0	Female	42	2.0	0.00	1
	1	1	101348.88	1						
1	2	15647311	Hill	608	2	Female	41	2.0	83807.86	1
	0	1	112542.58	0						

2	3	15619304	Onio	502	0	Female	42	8.0	159660.80	3	
	1	0	113931.57	1							
3	4	15701354	Boni	699	0	Female	39	2.0	0.00	2	0
	0	93826.63	0								
4	5	15737888	Mitchell		850	2	Female	43	2.0	125510.82	
	1	1	1	79084.10	0						
...
									
9995	9996	15606229	Obijiaku		771	0	Male	39	5.0	0.00	2
	1	0	96270.64	0							
9996	9997	15569892	Johnstone		516	0	Male	35	8.0	57369.61	
	1	1	1	101699.77	0						
9997	9998	15584532	Liu	709	0	Female	36	7.0	0.00	1	0
	1	42085.58	1								
9998	9999	15682355	Sabbatini		772	1	Male	42	3.0	75075.31	
	2	1	0	92888.52	1						
9999	10000	15628319	Walker	792	0	Female	28	4.0	130142.79	1	
	1	0	38190.78	0							

10000 rows × 14 columns

```
data['Surname']=le.fit_transform(data['Surname'])
```

```
data['Gender']=data['Gender'].replace(['Male','Female'],[0,1])
```

data

RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure				
	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary	Exited					
0	1	15634602	1115	619	0	1	42	2.0	0.00	1	1
	1	101348.88	1								
1	2	15647311	1177	608	2	1	41	2.0	83807.86		1
	0	1	112542.58	0							
2	3	15619304	2040	502	0	1	42	8.0	159660.80		3
	1	0	113931.57	1							

3	4	15701354	289	699	0	1	39	2.0	0.00	2	0
	0	93826.63	0								
4	5	15737888	1822	850	2	1	43	2.0	125510.82	1	
	1	1	79084.10	0							
...
									
9995	9996	15606229	1999	771	0	0	39	5.0	0.00	2	1
	0	96270.64	0								
9996	9997	15569892	1336	516	0	0	35	8.0	57369.61	1	
	1	1	101699.77	0							
9997	9998	15584532	1570	709	0	1	36	7.0	0.00	1	0
	1	42085.58	1								
9998	9999	15682355	2345	772	1	0	42	3.0	75075.31	2	
	1	0	92888.52	1							
9999	10000	15628319	2751	792	0	1	28	4.0	130142.79	1	
	1	0	38190.78	0							

10000 rows × 14 columns

Split the data into dependent and independent variables

```
x=data.iloc[:,0:13]
```

x

RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure				
	Balance	NumOfProducts	HasCrCard	IsActiveMember		EstimatedSalary					
0	1	15634602	1115	619	0	1	42	2.0	0.00	1	1
	1	101348.88									
1	2	15647311	1177	608	2	1	41	2.0	83807.86	1	
	0	1	112542.58								
2	3	15619304	2040	502	0	1	42	8.0	159660.80	3	
	1	0	113931.57								
3	4	15701354	289	699	0	1	39	2.0	0.00	2	0

	0	93826.63										
4	5	15737888	1822	850	2	1	43	2.0	125510.82	1		
	1	1	79084.10									
...
	...											
9995	9996	15606229	1999	771	0	0	39	5.0	0.00	2	1	
	0	96270.64										
9996	9997	15569892	1336	516	0	0	35	8.0	57369.61	1		
	1	1	101699.77									
9997	9998	15584532	1570	709	0	1	36	7.0	0.00	1	0	
	1	42085.58										
9998	9999	15682355	2345	772	1	0	42	3.0	75075.31	2		
	1	0	92888.52									
9999	10000	15628319	2751	792	0	1	28	4.0	130142.79	1		
	1	0	38190.78									

10000 rows × 13 columns

Dependent variables

y=data['Exited']

y

0	1
1	0
2	1
3	0
4	0
	..
9995	0
9996	0

9997 1

9998 1

9999 0

Name:Exited, Length: 10000, dtype: int64

Scale the independent variables

Split the data into training and testing data

```
from sklearn.preprocessing import scale
```

```
scale(x)
```

```
array([[ -1.73187761, -0.78321342, -0.46418322, ...,  0.64609167,
         0.97024255,  0.02188649],
       [ -1.7315312 , -0.60653412, -0.3909112 , ..., -1.54776799,
         0.97024255,  0.21653375],
       [ -1.73118479, -0.99588476,  0.62898807, ...,  0.64609167,
        -1.03067011,  0.2406869 ],
       ...,
       [  1.73118479, -1.47928179,  0.07353887, ..., -1.54776799,
         0.97024255, -1.00864308],
       [  1.7315312 , -0.11935577,  0.98943914, ...,  0.64609167,
        -1.03067011, -0.12523071],
       [  1.73187761, -0.87055909,  1.4692527 , ...,  0.64609167,
        -1.03067011, -1.07636976]])
```

```
from sklearn.model_selection import train_test_split
```

```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2)
```

```
x_train
```

RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	EstimatedSalary
8814	8815	15589725	2927	740	0	1	51	4.0	0.00	2	1	
	1	178929.84										
9826	9827	15686917	2661	789	2	1	40	4.0	0.00	2	1	
	0	137402.27										
3858	3859	15658449	529	695	0	0	45	8.0	43134.65		1	
	0	1	77330.35									
4961	4962	15632521	427	689	1	0	45	2.0	130170.82		2	
	1	0	150856.38									
2147	2148	15574167	923	665	0	0	33	2.0	101286.11		1	
	1	1	159840.51									
...
	...											
8676	8677	15576124	1885	582	0	0	41	2.0	40488.76		1	
	1	0	128528.83									
3926	3927	15581280	124	714	1	0	29	6.0	92887.13		1	
	1	1	69578.49									
1619	1620	15770309	1736	656	0	0	18	8.0	151762.74		1	
	0	1	127014.32									
5404	5405	15801417	1288	657	0	0	37	4.0	82500.28		1	
	1	1	115260.72									
6286	6287	15805884	98	637	0	1	41	8.0	0.00	2	1	
	0	145477.36										

8000 rows × 13 columns

x_train.shape

(8000, 13)

y_train

8814 0

9826 0

3858 0

4961 0

2147 0

..

8676 0

3926 0

1619 0

5404 0

6286 0

Name: Exited, Length: 8000, dtype: int64

y_train.shape

(8000,)

x_test

RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age	Tenure				
	Balance	NumOfProducts	HasCrCard		IsActiveMember	EstimatedSalary					
6955	6956	15697042	985	738	2	0	35	8.0	127290.61	1	
	1	0	16081.62								
839	840	15727915	110	507	0	0	36	4.0	83543.37	1	
	0	0	140134.43								
8857	8858	15810826	487	624	0	0	36	6.0	0.00	2	0
	0	84749.96									
1314	1315	15644833	764	675	0	0	54	2.0	0.00	1	1
	0	149583.67									
2852	2853	15771483	106	609	0	0	40	6.0	0.00	2	1
	1	97416.34									
...
	...										
4074	4075	15609676	1944	718	0	1	35	2.0	167924.95	1	
	1	0	43024.64								

3565	3566	15598700	1259	676	2	1	30	5.0	0.00	2	0
	1	157888.50									
4161	4162	15611371	2446	736	0	0	43	4.0	176134.54	1	
	1	1	52856.88								
454	455	15726631	1178	758	0	1	39	6.0	127357.76	1	
	0	1	56577.00								
8191	8192	15759480	1081	644	0	1	40	8.0	139180.97	1	
	1	1	19959.67								

2000 rows × 13 columns

x_test.shape

(2000, 13)

y_test

6955 0

839 0

8857 0

1314 1

2852 0

..

4074 0

3565 0

4161 0

454 0

8191 0

Name: Exited, Length: 2000, dtype: int64

y_test.shape

(2000,)