Logistic_Regression

February 27, 2024

1 Logistic Regression

Logistic Regression is based on sigmoid function

1.0.1 Import necessary libraries

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

[ ]:
```
df = pd.read_csv("datasets/Social_Network_Ads.csv")
df.head()
```

[ ]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0

[ ]:
```
df.Purchased.value_counts()
```

[ ]:
```
Purchased
0    257
1    143
Name: count, dtype: int64
```

[ ]:
```
df = df.drop(columns=['User ID'])
```

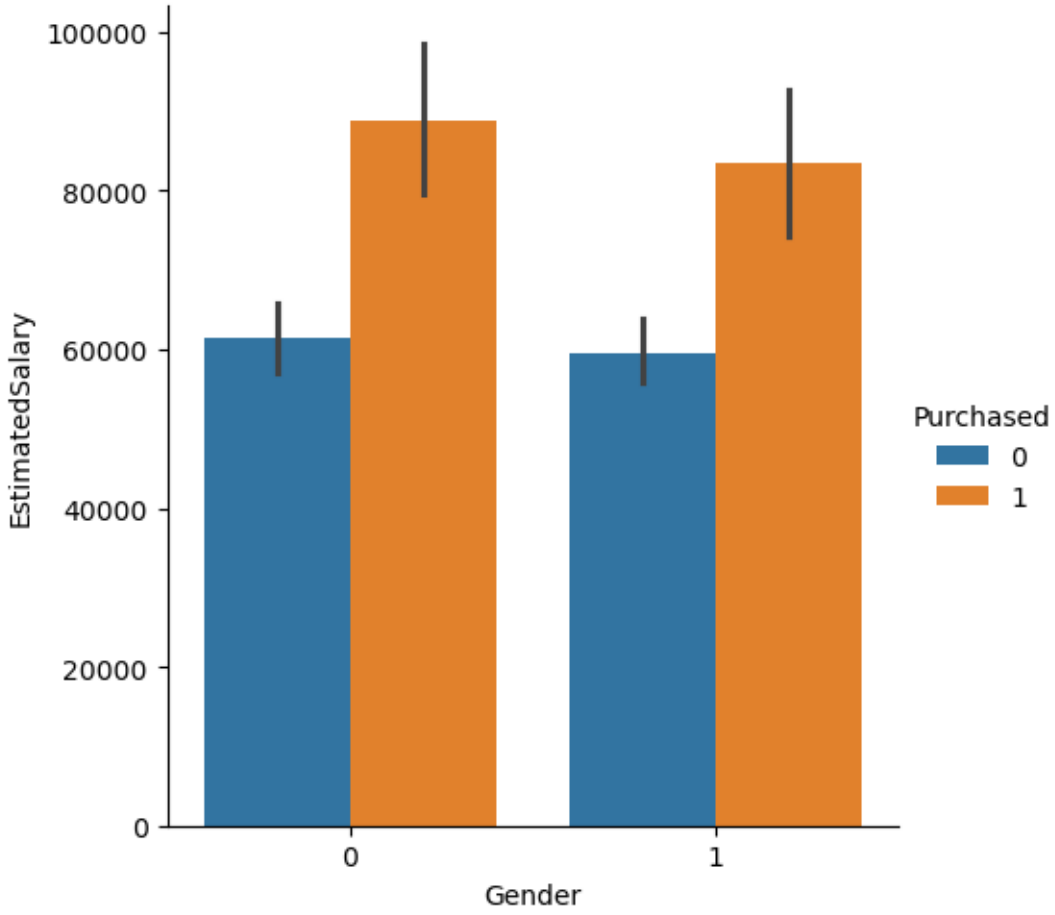
[ ]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df.Gender = le.fit_transform(df.Gender)
df.head()
```

[ ]:

	Gender	Age	EstimatedSalary	Purchased
0	1	19	19000	0
1	1	35	20000	0
2	0	26	43000	0
3	0	27	57000	0
4	1	19	76000	0

[ ]:
```
sns.catplot(x="Gender", y="EstimatedSalary",
            hue="Purchased", kind="bar", data=df)
```

[ ]: <seaborn.axisgrid.FacetGrid at 0x7f4a7d646d90>



[ ]:
```
x = df.drop(columns=['Purchased'])
y = df.Purchased
```

[ ]:
```
from sklearn.preprocessing import MinMaxScaler
scale = MinMaxScaler()
x = pd.DataFrame(scale.fit_transform(x),columns=x.columns)
```

```
x.head()
```

```
[ ]:    Gender       Age  EstimatedSalary
    0     1.0  0.023810         0.029630
    1     1.0  0.404762         0.037037
    2     0.0  0.190476         0.207407
    3     0.0  0.214286         0.311111
    4     1.0  0.023810         0.451852
```

```
[ ]: 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,random_state= 0)
```

```
[ ]: from sklearn.linear_model import LogisticRegression
     lr = LogisticRegression()
     lr.fit(x_train,y_train)
```

```
[ ]: LogisticRegression()
```

```
[ ]: y_pred = lr.predict(x_test)
```

```
[ ]: lr.predict([[1,35,75000]])
```

```
[ ]: array([1])
```

2 Evaluation

```
[ ]: from sklearn.metrics import accuracy_score
     accuracy_score(y_test,y_pred)
```

```
[ ]: 0.925
```

3 Confusion Matrix

```
[ ]: from sklearn.metrics import confusion_matrix
     confusion_matrix(y_test,y_pred)
```

```
[ ]: array([[58,  0],
            [ 6, 16]])
```

```
[ ]: pd.crosstab(y_test,y_pred)
```

```
[ ]: col_0       0   1
     Purchased
     0          58   0
     1           6  16
```

4 Classification Report

[ ]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.91      1.00      0.95        58
           1       1.00      0.73      0.84        22

    accuracy                           0.93        80
   macro avg       0.95      0.86      0.90        80
weighted avg       0.93      0.93      0.92        80
```

5 AUC - ROC Curve

AUC is the area under the ROC Curve , indicates how well the probabilites from the positive classes are seperated from the negativie class.
ROC => Reciever Operating Characteristics, represents degree or measure of seperability

[ ]:
```
probability = lr.predict_proba(x_test)[:,-1]
probability
```

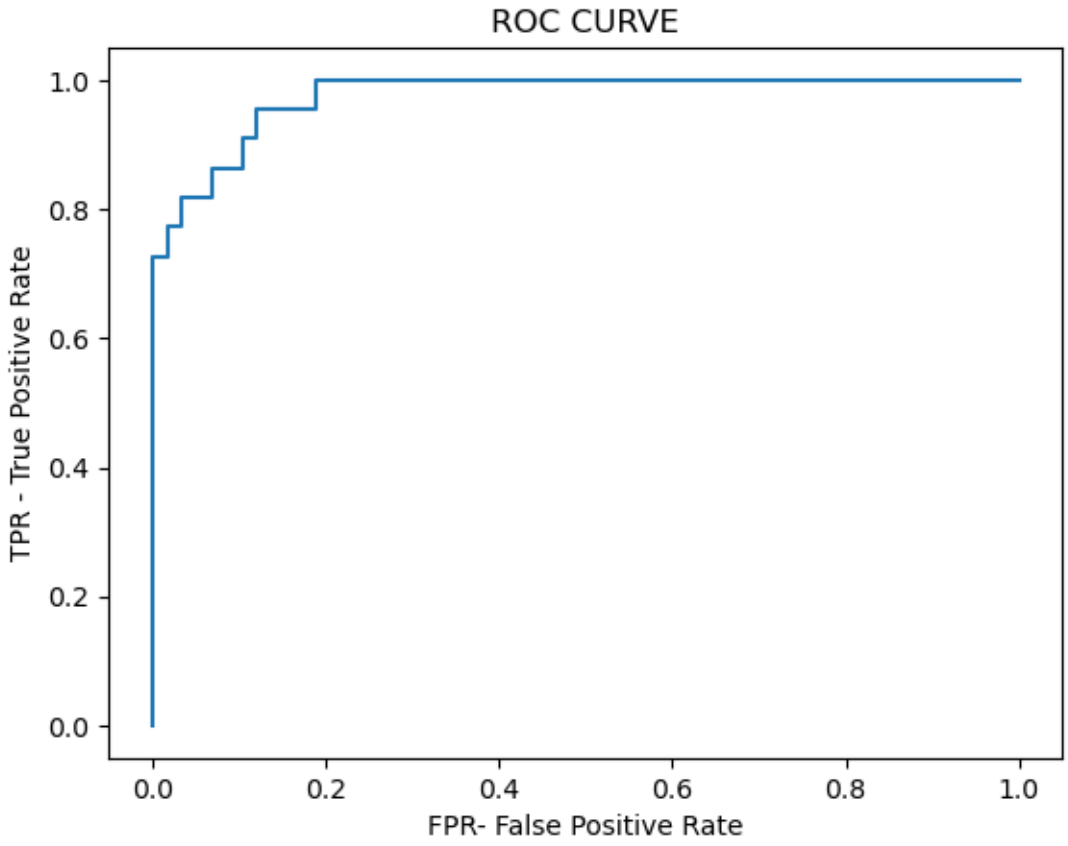
[ ]:
```
array([0.2144872 , 0.25275401, 0.27923866, 0.18905548, 0.19283512,
       0.05077814, 0.07141131, 0.61971028, 0.04489232, 0.45763683,
       0.11656137, 0.10458125, 0.2498842 , 0.39023091, 0.07753816,
       0.3782384 , 0.33667398, 0.06841339, 0.91815959, 0.12317974,
       0.18405501, 0.8529991 , 0.32802683, 0.73435186, 0.03755646,
       0.87354905, 0.17728525, 0.1753795 , 0.27483994, 0.25154865,
       0.08930984, 0.34527554, 0.78827655, 0.24277786, 0.07252234,
       0.03360677, 0.08785064, 0.15688678, 0.0996113 , 0.48076385,
       0.16428821, 0.33335936, 0.15340067, 0.11910455, 0.66423454,
       0.09922975, 0.34848964, 0.7865558 , 0.05454283, 0.70785041,
       0.92388136, 0.11649016, 0.21455017, 0.42591222, 0.88868144,
       0.35155547, 0.18309699, 0.13003618, 0.44394933, 0.03255284,
       0.08417465, 0.78880947, 0.05821796, 0.40782162, 0.02307795,
       0.89114604, 0.12344655, 0.09967335, 0.28809901, 0.44088787,
       0.5335957 , 0.28599525, 0.06358761, 0.30925421, 0.16693299,
       0.05815957, 0.48368077, 0.34056698, 0.58621915, 0.74080225])
```

[ ]:
```
from sklearn.metrics import roc_curve,roc_auc_score
print(roc_auc_score(y_test, probability))
fpr,tpr,thresholds = roc_curve(y_test, probability)
```

```
0.975705329153605
```

[ ]:
```
plt.plot(fpr,tpr)
plt.xlabel('FPR- False Positive Rate')
plt.ylabel('TPR - True Positive Rate')
plt.title("ROC CURVE")
```

[ ]:
```
Text(0.5, 1.0, 'ROC CURVE')
```



6 Classification report

[ ]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

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           1       1.00      0.73      0.84        22

    accuracy                           0.93        80
   macro avg       0.95      0.86      0.90        80
```

```
weighted avg       0.93      0.93      0.92        80
```

7 Conclusion :

- The model is performing good with accuracy of 0.93 .
- The classification reports are suggesting good measures, indicating that it is a good model .

[ ]: