practical5-piyusha

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Practical 5: Data Analytics II 1. Implement logistic regression using Python/R to perform classification on Social_Network_Ads.csv dataset. 2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix, accuracy_score,␣
↪classification_report, precision_score, recall_score, f1_score
```

[ ]:
```
from google.colab import files
files.upload()
```

[3]:
```
df = pd.read_csv("Social_Network_Ads.csv")
```

[4]:
```
# check the dataset for missing values and perform EDA
df.head()
```

[4]:

	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

[5]:
```
df.tail()
```

[5]:

	User ID	Gender	Age	EstimatedSalary	Purchased
395	15691863	Female	46	41000	1
396	15706071	Male	51	23000	1
397	15654296	Female	50	20000	1
398	15755018	Male	36	33000	0

```
399  15594041  Female   49           36000          1
```

[6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 5 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   User ID          400 non-null    int64
 1   Gender           400 non-null    object
 2   Age              400 non-null    int64
 3   EstimatedSalary  400 non-null    int64
 4   Purchased        400 non-null    int64
dtypes: int64(4), object(1)
memory usage: 15.8+ KB
```

[7]:
```
df.describe(include="all")
```

[7]:

	User ID	Gender	Age	EstimatedSalary	Purchased
count	4.000000e+02	400	400.000000	400.000000	400.000000
unique	NaN	2	NaN	NaN	NaN
top	NaN	Female	NaN	NaN	NaN
freq	NaN	204	NaN	NaN	NaN
mean	1.569154e+07	NaN	37.655000	69742.500000	0.357500
std	7.165832e+04	NaN	10.482877	34096.960282	0.479864
min	1.556669e+07	NaN	18.000000	15000.000000	0.000000
25%	1.562676e+07	NaN	29.750000	43000.000000	0.000000
50%	1.569434e+07	NaN	37.000000	70000.000000	0.000000
75%	1.575036e+07	NaN	46.000000	88000.000000	1.000000
max	1.581524e+07	NaN	60.000000	150000.000000	1.000000

[8]:
```
df.shape
```

[8]:
```
(400, 5)
```

[9]:
```
df.size
```

[9]:
```
2000
```

[10]:
```
df.ndim
```

[10]:
```
2
```

[11]:
```
df.columns
```

[11]:
```
Index(['User ID', 'Gender', 'Age', 'EstimatedSalary', 'Purchased'],
dtype='object')
```

[12]:
```
df.isnull()
```

[12]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	False	False	False	False	False
1	False	False	False	False	False
2	False	False	False	False	False
3	False	False	False	False	False
4	False	False	False	False	False
..	…	…	…	…	…
395	False	False	False	False	False
396	False	False	False	False	False
397	False	False	False	False	False
398	False	False	False	False	False
399	False	False	False	False	False

[400 rows x 5 columns]

[13]:
```
df.isna().sum()
```

[13]:
```
User ID            0
Gender             0
Age                0
EstimatedSalary    0
Purchased          0
dtype: int64
```

[15]:
```
#select the features and target variable
# Selecting independent variables (features) and dependent variable (target)
X = df[['Age', 'EstimatedSalary']]  # Assuming these are features
y = df['Purchased']  # Target variable
```

[16]:
```
# Splitting dataset into training (80%) and testing (20%) sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)

print("\nTraining Set Size:", X_train.shape)
print("Testing Set Size:", X_test.shape)
```

```
Training Set Size: (320, 2)
Testing Set Size: (80, 2)
```

[17]:
```
# Train the Logistic Regression model
model = LogisticRegression()
```

```
model.fit(X_train, y_train)

# Make predictions on the test set
y_pred = model.predict(X_test)
```

[18]:
```
accuracy = accuracy_score(y_test, y_pred)
print(f"\nAccuracy: {accuracy:.4f}")
```

```
Accuracy: 0.8875
```

[19]:
```
# Compute confusion matrix
cm = confusion_matrix(y_test, y_pred)

# Extract values
TN, FP, FN, TP = cm.ravel()

# Print confusion matrix and extracted values
print("\nConfusion Matrix:")
print(cm)
print(f"\nTrue Positives (TP): {TP}")
print(f"False Positives (FP): {FP}")
print(f"True Negatives (TN): {TN}")
print(f"False Negatives (FN): {FN}")
```

```
Confusion Matrix:
[[50  2]
 [ 7 21]]

True Positives (TP): 21
False Positives (FP): 2
True Negatives (TN): 50
False Negatives (FN): 7
```

[21]:
```
precision = precision_score(y_test, y_pred)
print(f"\nPrecision: {precision:.4f}")
```

```
Precision: 0.9130
```

[22]:
```
recall = recall_score(y_test, y_pred)
print(f"\nRecall: {recall:.4f}")
```

```
Recall: 0.7500
```

[23]:
```
error_rate = 1 - accuracy
print(f"\nError Rate: {error_rate:.4f}")
```

```
Error Rate: 0.1125
```

[24]:
```
f1 = f1_score(y_test, y_pred)
print(f"\nF1 Score: {f1:.4f}")
```

```
F1 Score: 0.8235
```

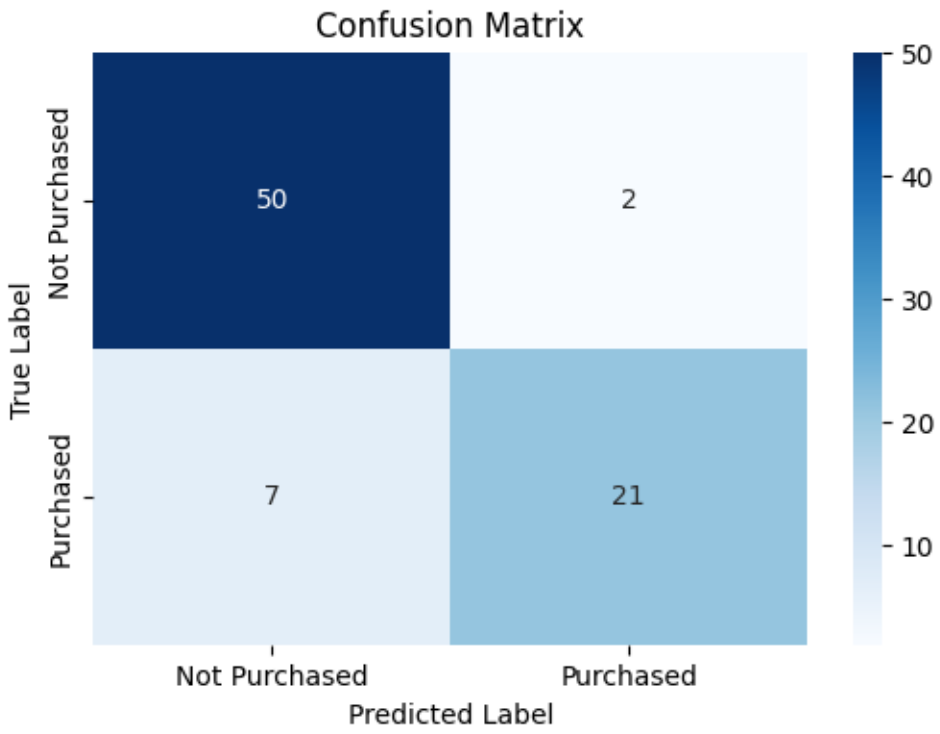
[25]:
```
# Display detailed classification report
print("\nClassification Report:")
print(classification_report(y_test, y_pred))
```

```
Classification Report:
              precision    recall  f1-score   support

           0       0.88      0.96      0.92        52
           1       0.91      0.75      0.82        28

    accuracy                           0.89        80
   macro avg       0.90      0.86      0.87        80
weighted avg       0.89      0.89      0.88        80
```

[26]:
```
# Visualizing confusion matrix
plt.figure(figsize=(6,4))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues", xticklabels=["Not␣
 ↪Purchased", "Purchased"], yticklabels=["Not Purchased", "Purchased"])
plt.xlabel("Predicted Label")
plt.ylabel("True Label")
plt.title("Confusion Matrix")
plt.show()
```

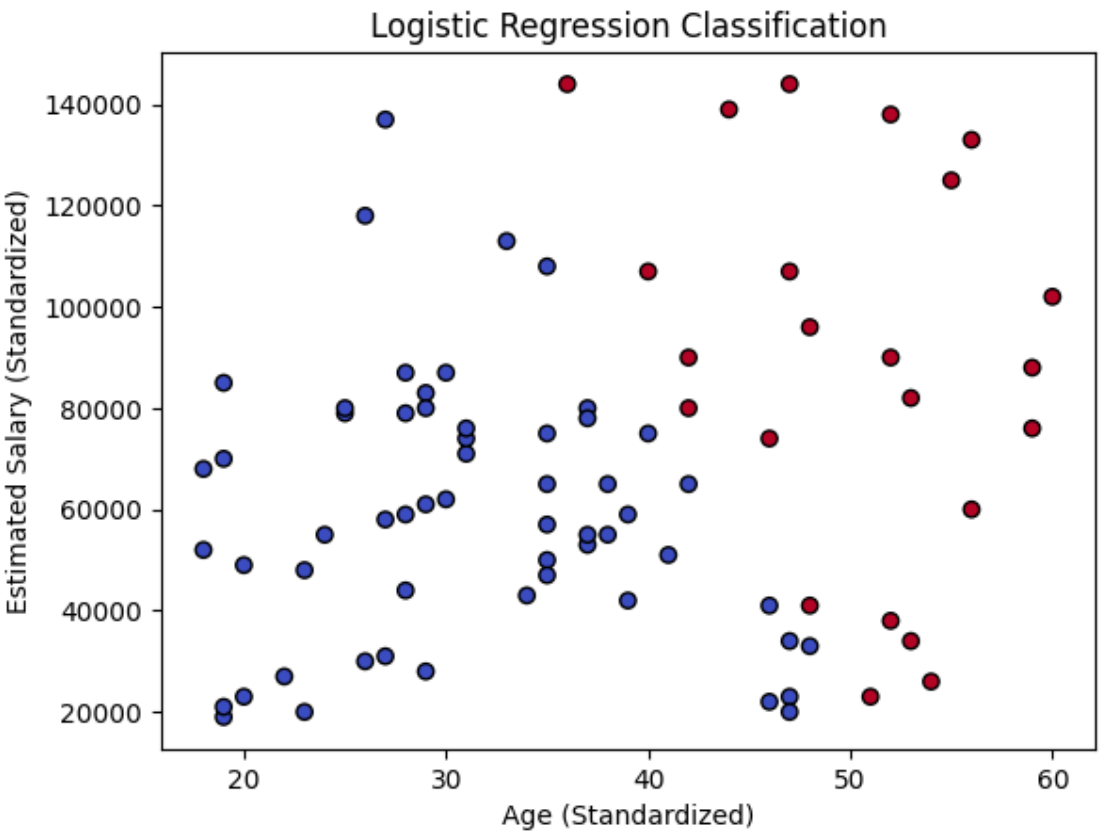


[31]:
```
import matplotlib.pyplot as plt
import seaborn as sns

# Scatter plot of test set predictions
# Accessing DataFrame columns using column names
plt.scatter(X_test['Age'], X_test['EstimatedSalary'], c=y_pred,␣
 ↪cmap='coolwarm', edgecolors='k')

# Labels and title
plt.xlabel('Age (Standardized)')
plt.ylabel('Estimated Salary (Standardized)')
plt.title('Logistic Regression Classification')

plt.show()
```


Logistic Regression Classification
Estimated Salary (Standardized)
140000
120000
100000
80000
60000
40000
20000
20
30
40
50
60
Age (Standardized)