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Assignment No.5
Contents for Theory:
1. Logistic Regression
2. Differentiate between Linear and Logistic Regression
3. Sigmoid Function
4. Types of LogisticRegression
5. Confusion Matrix Evaluation Metrics

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix,
precision_score, recall_score, classification_report
import seaborn as sn

file_path = r'C:/Users/Ashwini/Desktop/diabetes dataset_DSBDA5.csv'
df = pd.read_csv(file_path)
print(df.isnull().sum())
```

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Pregnancies                 50
Glucose                     50
BloodPressure               50
SkinThickness               50
Insulin                     50
BMI                         50
DiabetesPedigreeFunction    50
Age                         50
Outcome                     50
dtype: int64
```

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df.fillna(df.mean(), inplace=True)
X = df.drop(columns=['Outcome'])
Y = df['Outcome']
print(Y.unique())
Y = Y.astype(int)  # Convert to integer, assuming 0 and 1 for binary
classification
X_train, X_test, Y_train, Y_test = train_test_split(X, Y,
test_size=0.2, random_state=42)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
logreg = LogisticRegression()
logreg.fit(X_train_scaled, Y_train)
y_train_pred = logreg.predict(X_train_scaled)
y_test_pred = logreg.predict(X_test_scaled)
train_accuracy = accuracy_score(Y_train, y_train_pred)
print(f'Training Accuracy: {train_accuracy * 100:.2f}%')
```

```
[1.         0.         0.37844612]
Training Accuracy: 79.39%

test_accuracy = accuracy_score(Y_test, y_test_pred)
print(f'Testing Accuracy: {test_accuracy * 100:.2f}%')

Testing Accuracy: 81.11%

train_precision = precision_score(Y_train, y_train_pred)
train_recall = recall_score(Y_train, y_train_pred)
train_cm = confusion_matrix(Y_train, y_train_pred)

print(f'Training Precision: {train_precision:.2f}')
print(f'Training Recall: {train_recall:.2f}')
print('Training Confusion Matrix:')
print(train_cm)

Training Precision: 0.77
Training Recall: 0.53
Training Confusion Matrix:
[[222  19]
 [ 55  63]]

test_precision = precision_score(Y_test, y_test_pred)
test_recall = recall_score(Y_test, y_test_pred)
test_cm = confusion_matrix(Y_test, y_test_pred)

print(f'Testing Precision: {test_precision:.2f}')
print(f'Testing Recall: {test_recall:.2f}')
print('Testing Confusion Matrix:')
print(test_cm)

Testing Precision: 0.81
Testing Recall: 0.64
Testing Confusion Matrix:
[[52  5]
 [12 21]]

print("Training Classification Report:")
print(classification_report(Y_train, y_train_pred))

Training Classification Report:
              precision    recall  f1-score   support

           0       0.80      0.92      0.86       241
           1       0.77      0.53      0.63       118

    accuracy                           0.79       359
   macro avg       0.78      0.73      0.74       359
weighted avg       0.79      0.79      0.78       359
```

```
print("Testing Classification Report:")
print(classification_report(Y_test, y_test_pred))
```

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

           0       0.81      0.91      0.86        57
           1       0.81      0.64      0.71        33

    accuracy                           0.81        90
   macro avg       0.81      0.77      0.79        90
weighted avg       0.81      0.81      0.81        90
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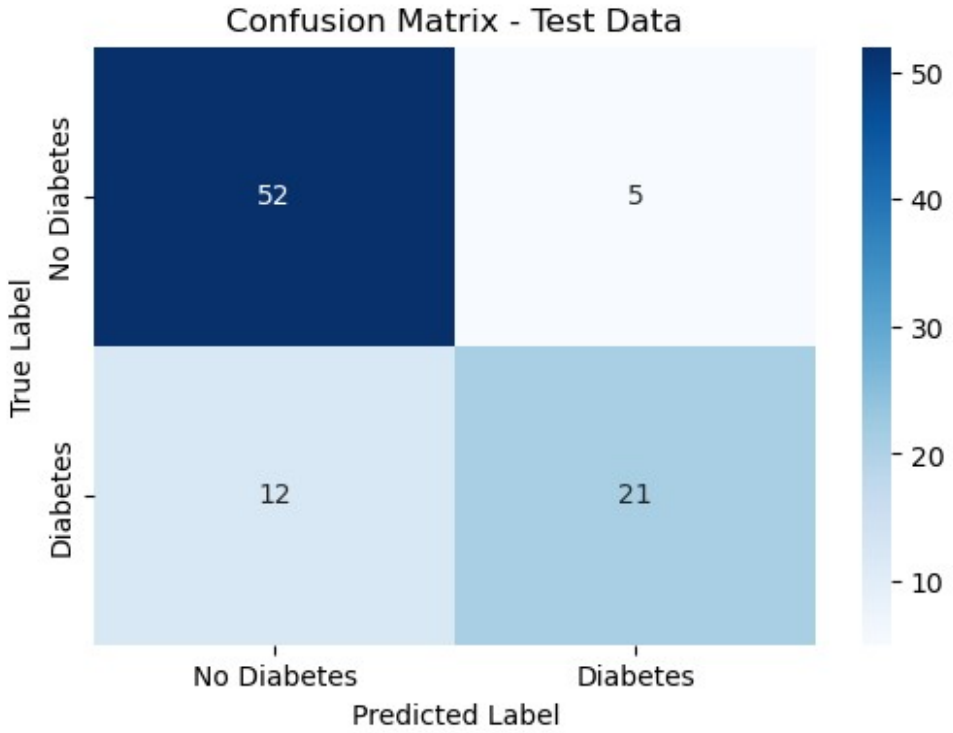
```
plt.figure(figsize=(6, 4))
sns.heatmap(test_cm, annot=True, fmt="d", cmap="Blues",
xticklabels=['No Diabetes', 'Diabetes'], yticklabels=['No Diabetes',
'Diabetes'])
plt.title('Confusion Matrix - Test Data')
plt.ylabel('True Label')
plt.xlabel('Predicted Label')
plt.show()
```




```
from sklearn.metrics import roc_curve, roc_auc_score

fpr, tpr, thresholds = roc_curve(Y_test,
logreg.predict_proba(X_test_scaled)[:, 1])
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auc = roc_auc_score(Y_test, y_test_pred)
print(f'AUC: {auc:.2f}')
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AUC: 0.77
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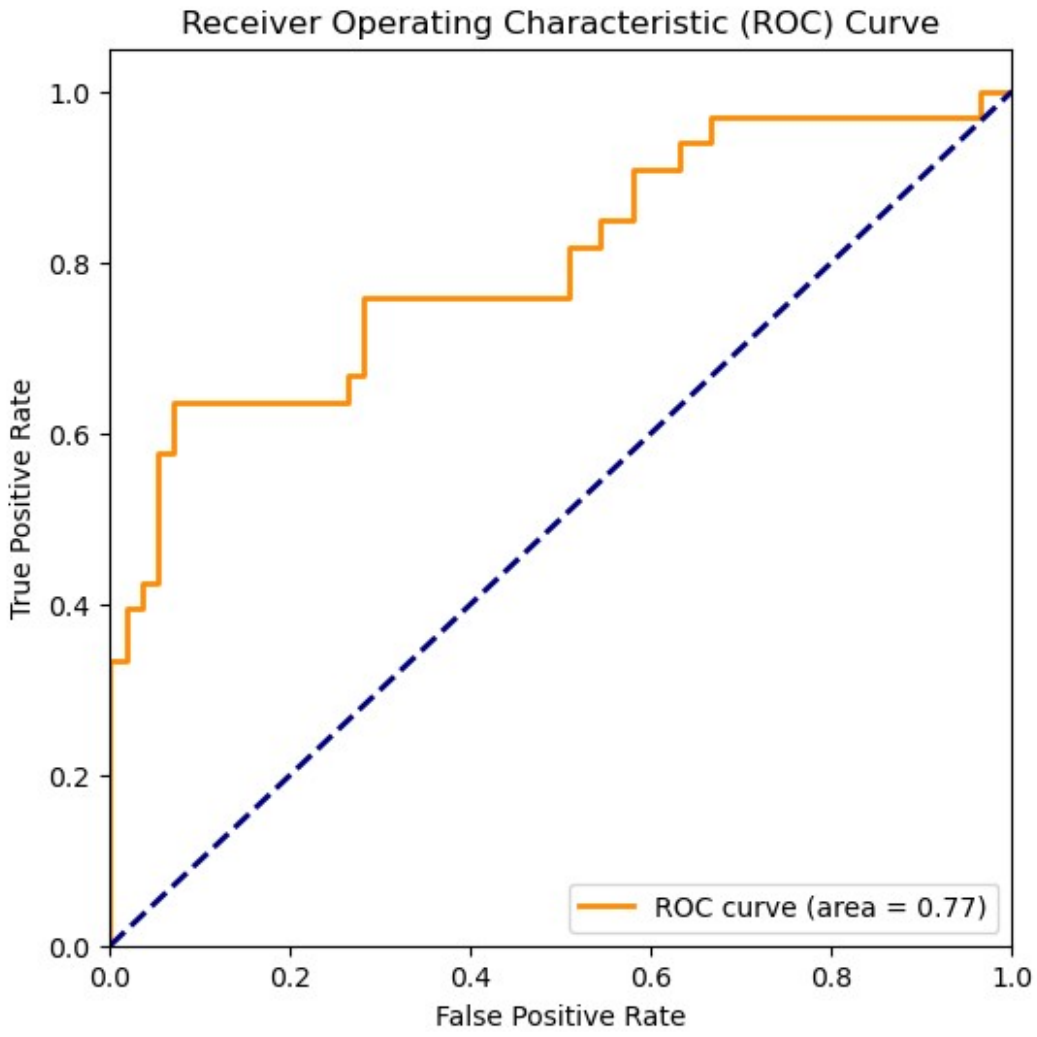
```
# Plot the ROC curve
plt.figure(figsize=(6, 6))
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend(loc='lower right')
plt.show()
```



Name: Habibsaeed Mukebil
R_no.: 13235