```
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, GridSearchCV
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, roc_curve, auc
from sklearn.preprocessing import StandardScaler

# Load the dataset
url = "https://raw.githubusercontent.com/jbrownlee/Datasets/master/pima-indians-diabetes.data.csv"
names = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin', 'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome']
data = pd.read_csv(url, names=names)

# Split the dataset into features (X) and target (y)
X = data.drop('Outcome', axis=1)
y = data['Outcome']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Feature scaling (Standardization)
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

# Create and tune a Random Forest Classifier
param_grid = {
    'n_estimators': [50, 100, 200],
    'max_depth': [None, 10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4]
}

rf = RandomForestClassifier(random_state=42)
grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, n_jobs=-1)
grid_search.fit(X_train, y_train)
best_rf = grid_search.best_estimator_

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

# Evaluate the model's performance
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy:.2f}")

# Classification Report
print("\nClassification Report:")
print(classification_report(y_test, y_pred))

# Confusion Matrix
print("\nConfusion Matrix:")
print(confusion_matrix(y_test, y_pred))

# ROC curve and AUC
y_prob = best_rf.predict_proba(X_test)[:, 1]
fpr, tpr, thresholds = roc_curve(y_test, y_prob)
roc_auc = auc(fpr, tpr)

# Data Visualization
plt.figure(figsize=(10, 6))
plt.subplot(1, 2, 1)
sns.heatmap(confusion_matrix(y_test, y_pred), annot=True, fmt="d", cmap="Blues")
plt.title("Confusion Matrix")

plt.subplot(1, 2, 2)
plt.plot(fpr, tpr, color='darkorange', lw=2, label=f'ROC curve (area = {roc_auc:.2f})')
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)')
plt.legend(loc='lower right')

plt.tight_layout()
plt.show()
```

OUTPUT:

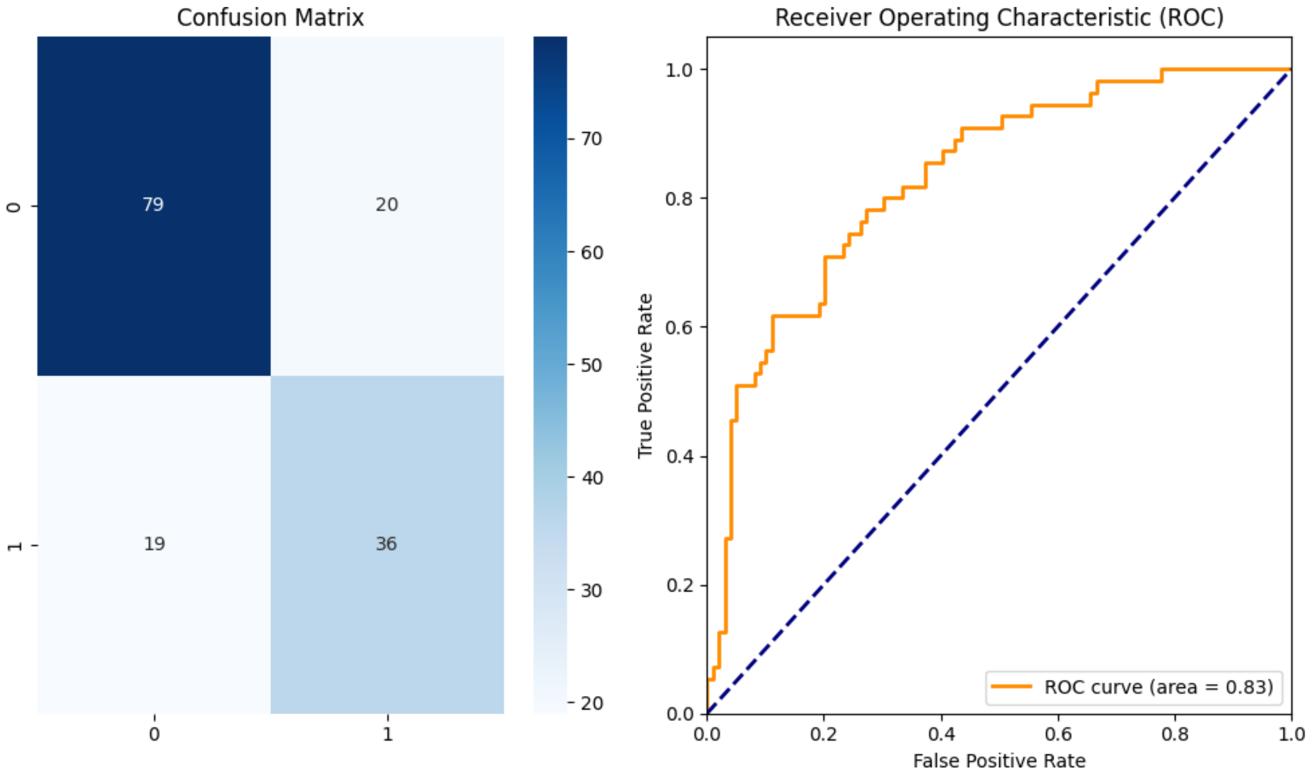
```
Accuracy: 0.75

Classification Report:
              precision    recall  f1-score   support

           0       0.81      0.80      0.80        99
           1       0.64      0.65      0.65        55

    accuracy                           0.75       154
   macro avg       0.72      0.73      0.73       154
weighted avg       0.75      0.75      0.75       154


Confusion Matrix:
[[79 20]
 [19 36]]
```



AI Based Diabetics Prediction Project phase 4

*Selecting a machine learning algorithm *

*Training the model *

*Evaluating its performance *

As Per the Mentor of IBM show above we have developed Our Project Using python Programming language and steps and Source code andOutput is give below to Evaluate...Steps By Step Involved In Building Project Shown Below:

Step 1:

- In this code, we use the Pima Indian Diabetes dataset, split it into training and testing sets, and train a Random Forest Classifier. We then evaluate the model's accuracy.

Step 2:

- Import Necessary Libraries: Open a Python environment or Jupyter Notebook and start by importing the required libraries:

```
# This is source code
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
```

Step 3: Load the Dataset: Download the Pima Indian Diabetes dataset (or) any source of dataset can be utilized from this link and save it as aCSV file. Then, load the dataset into your script:

- We have utilized a github public repository as free of cost in our project as show below code representation.

```
# This is Source code
url = "https://raw.githubusercontent.com/jbrownlee/Datasets/master/pima-indians-diabetes.data.csv"
names = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin', 'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome']
data = pd.read_csv(url, names=names)
```

Step 4: Split Data into Features and Target: Separate the dataset into features (X) and the target variable (y):

```
# This is Source code
X = data.drop('Outcome', axis=1)
y = data['Outcome']
```

Step 5: Split Data into Training and Testing Sets:

```
# This is Source code
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

Step 6: Creating (or) Utilizing the Algorithm a Random Forest Classifier and train it on the training data:

```
# This is Source code
model = RandomForestClassifier()
model.fit(X_train, y_train)
```

Step 7: Make Predictions and Evaluate the Model of Trained Dataset using Random Forest Classifier Algorithm:

```
# This is Source code
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy:.2f}")
# Classification Report
print("\nClassification Report:")
print(classification_report(y_test, y_pred))

# Confusion Matrix
print("\nConfusion Matrix:")
print(confusion_matrix(y_test, y_pred))

# ROC curve and AUC
y_prob = best_rf.predict_proba(X_test)[:, 1]
fpr, tpr, thresholds = roc_curve(y_test, y_prob)
roc_auc = auc(fpr, tpr)

# Data Visualization
plt.figure(figsize=(10, 6))
plt.subplot(1, 2, 1)
sns.heatmap(confusion_matrix(y_test, y_pred), annot=True, fmt="d", cmap="Blues")
plt.title("Confusion Matrix")

plt.subplot(1, 2, 2)
plt.plot(fpr, tpr, color='darkorange', lw=2, label=f'ROC curve (area = {roc_auc:.2f})')
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)')
plt.legend(loc='lower right')

plt.tight_layout()
plt.show()
```

- Advanced Model Prediction We have made it above shown in figure. we've added feature scaling, hyperparameter tuning withGridSearchCV, ROC curve and AUC calculation, and data visualization using Matplotlib and Seaborn.

Project Source Code in Github link Below to View: Click Here