*** *Diabetes Prediction* ***

Step1: Importing the libraries.

In [164…
```
import numpy as np
import pandas as pd
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn import svm
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
```

Step 2: Loading a Data

In [166…
```
df = pd.read_excel("diabetes_data.xlsx")
```

In [167…
```
df
```

Out[167…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFu
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	
...	...	...	...	...	...	...	
763	10	101	76	48	180	32.9	
764	2	122	70	27	0	36.8	
765	5	121	72	23	112	26.2	
766	1	126	60	0	0	30.1	
767	1	93	70	31	0	30.4	

768 rows × 9 columns

In [168…
```
df.head()
```

Out[168...

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunc
0	6	148	72	35	0	33.6	(
1	1	85	66	29	0	26.6	(
2	8	183	64	0	0	23.3	(
3	1	89	66	23	94	28.1	(
4	0	137	40	35	168	43.1	2

In [169...

```
df.tail()
```

Out[169...

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFu
763	10	101	76	48	180	32.9	
764	2	122	70	27	0	36.8	
765	5	121	72	23	112	26.2	
766	1	126	60	0	0	30.1	
767	1	93	70	31	0	30.4	

Step3: Performing a mapping or transformation on a specific column

In [171...

```
df.shape
```

Out[171...

```
(768, 9)
```

In [172...

```
df['Outcome'].value_counts()
```

Out[172...

```
Outcome
0    500
1    268
Name: count, dtype: int64
```

Step 4: Creating a new binary column named “Outcome.”by using mapping

In [174...

```
df['Outcome'] = df['Outcome'].map({
    1: 'Diabetic',
    0: 'Non-Diabetic'
})
```

In [175…

```
df
```

Out[175…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFu
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	
...	...	...	...	...	...	...	
763	10	101	76	48	180	32.9	
764	2	122	70	27	0	36.8	
765	5	121	72	23	112	26.2	
766	1	126	60	0	0	30.1	
767	1	93	70	31	0	30.4	

768 rows × 9 columns

In [176…

```
# separating the data and lables
X =df.drop(columns= 'Outcome',axis = 1)
Y = df['Outcome']
```

In [177…

```
X
```

Out[177…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFu
0	6	148	72	35	0	33.6	
1	1	85	66	29	0	26.6	
2	8	183	64	0	0	23.3	
3	1	89	66	23	94	28.1	
4	0	137	40	35	168	43.1	
...	...	...	...	...	...	...	
763	10	101	76	48	180	32.9	
764	2	122	70	27	0	36.8	
765	5	121	72	23	112	26.2	
766	1	126	60	0	0	30.1	
767	1	93	70	31	0	30.4	

768 rows × 8 columns

In [178…

```
Y
```

Out[178…

```
0           Diabetic
1       Non-Diabetic
2           Diabetic
3       Non-Diabetic
4           Diabetic
            ...
763     Non-Diabetic
764     Non-Diabetic
765     Non-Diabetic
766         Diabetic
767     Non-Diabetic
Name: Outcome, Length: 768, dtype: object
```

In [179…

```
df.head()
```

Out[179…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunc
0	6	148	72	35	0	33.6	(
1	1	85	66	29	0	26.6	(
2	8	183	64	0	0	23.3	(
3	1	89	66	23	94	28.1	(
4	0	137	40	35	168	43.1	2

Step 5: Creating a histogram using 'plt.hist' to visualize thedistribution of the “Outcome” column

In [181…

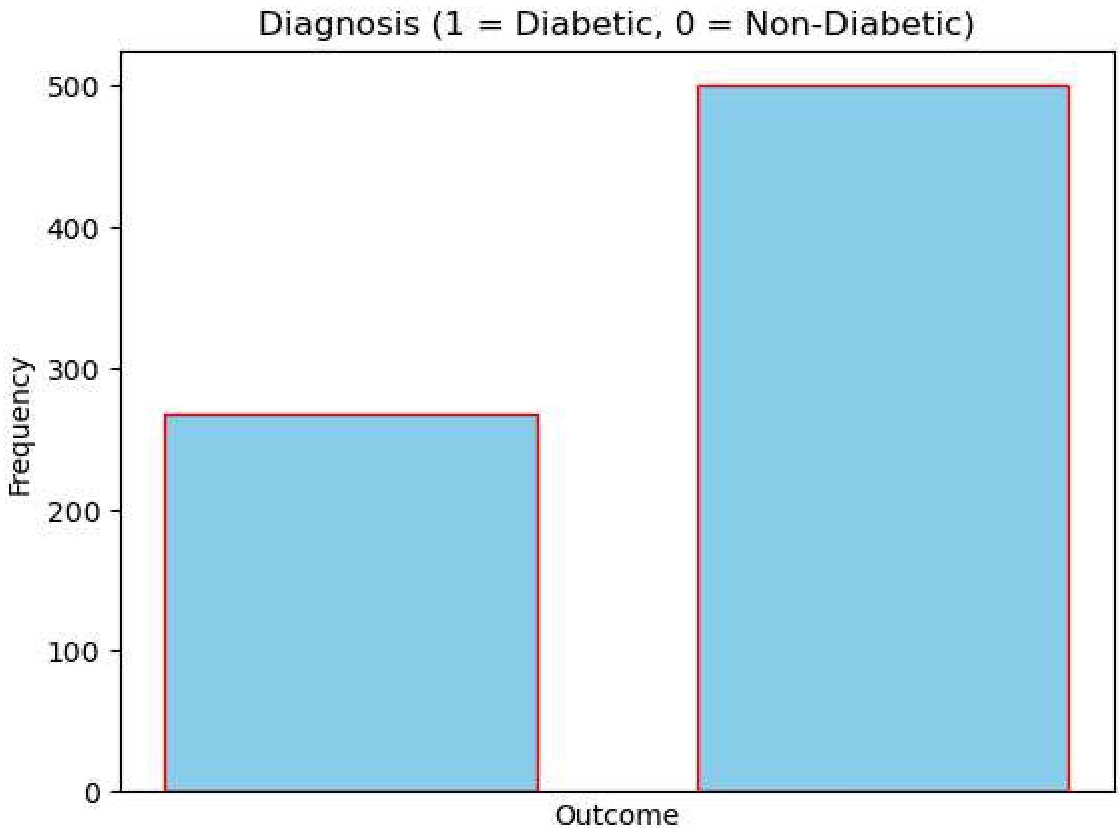
```
df.describe()
```

Out[181…

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	Dia
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	

In [182…

```
# Create histogram for 'Outcome' column
import matplotlib.pyplot as plt

plt.hist(df['Outcome'], bins=2, edgecolor='r', color='skyblue', rwidth=0.7)  # Adju
plt.title('Diagnosis (1 = Diabetic, 0 = Non-Diabetic)')
plt.xlabel('Outcome')
plt.ylabel('Frequency')
plt.show()
```

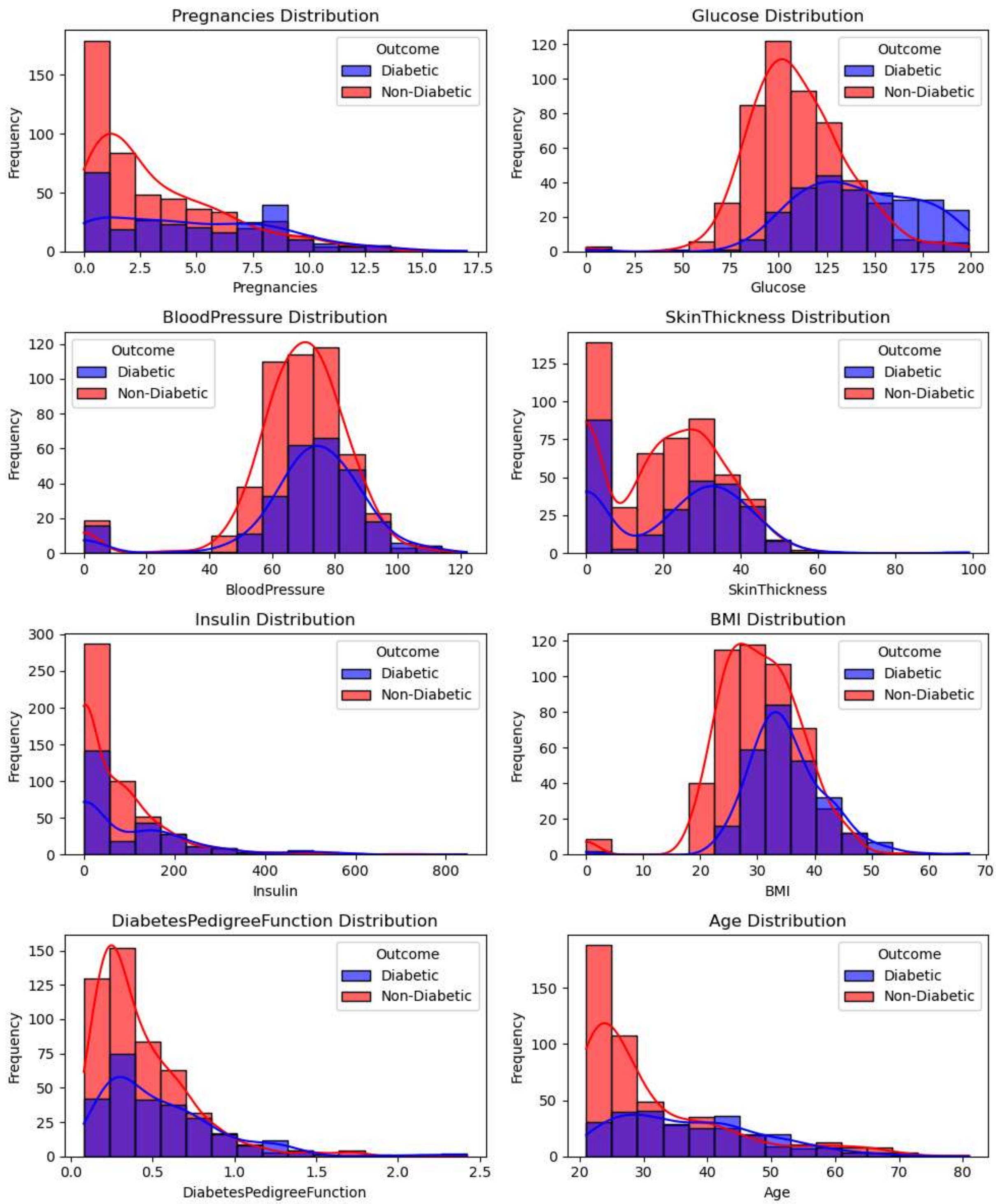


step 6:Creating a set of histograms for various features

In [184…

```
import matplotlib.pyplot as plt
import seaborn as sns

# Define features to visualize
X = ['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
     'BMI', 'DiabetesPedigreeFunction', 'Age']

# Create subplots
plt.figure(figsize=(10, 12))  # Adjust figure size

for i, feature in enumerate(X):
    plt.subplot(4, 2, i + 1)  # Create subplot grid of 4x2

    # Plot histogram using seaborn for better visualization
    sns.histplot(data=df, x=feature, hue='Outcome', kde=True, bins=15, palette=['bl

    # Add title and labels
    plt.title(f'{feature} Distribution')
    plt.xlabel(feature)
    plt.ylabel('Frequency')

# Adjust layout to prevent overlap
plt.tight_layout()
```

```python
# Display the histograms
plt.show()
```



Step 7: Data Standardising

In [208…

```python
from sklearn.preprocessing import StandardScaler

# Define the scaler
scaler = StandardScaler()
```

```python
# Pass actual numeric data, not column names
standardized_data = scaler.fit_transform(df[X])

# Convert to DataFrame (optional, for better readability)
standardized_df = pd.DataFrame(standardized_data, columns=X)

# Display the first few rows
print(standardized_df.head())
```

```
   Pregnancies   Glucose  BloodPressure  SkinThickness   Insulin       BMI  \
0     0.639947  0.848324       0.149641       0.907270 -0.692891  0.204013
1    -0.844885 -1.123396      -0.160546       0.530902 -0.692891 -0.684422
2     1.233880  1.943724      -0.263941      -1.288212 -0.692891 -1.103255
3    -0.844885 -0.998208      -0.160546       0.154533  0.123302 -0.494043
4    -1.141852  0.504055      -1.504687       0.907270  0.765836  1.409746

   DiabetesPedigreeFunction       Age
0                  0.468492  1.425995
1                 -0.365061 -0.190672
2                  0.604397 -0.105584
3                 -0.920763 -1.041549
4                  5.484909 -0.020496
```

In [216…

```python
X = standardized_data
Y = df['Outcome']
print(X)
print(Y)
```

```
[[ 0.63994726  0.84832379  0.14964075 ...  0.20401277  0.46849198
   1.4259954 ]
 [-0.84488505 -1.12339636 -0.16054575 ... -0.68442195 -0.36506078
  -0.19067191]
 [ 1.23388019  1.94372388 -0.26394125 ... -1.10325546  0.60439732
  -0.10558415]
 ...
 [ 0.3429808   0.00330087  0.14964075 ... -0.73518964 -0.68519336
  -0.27575966]
 [-0.84488505  0.1597866  -0.47073225 ... -0.24020459 -0.37110101
   1.17073215]
 [-0.84488505 -0.8730192   0.04624525 ... -0.20212881 -0.47378505
  -0.87137393]]
0          Diabetic
1      Non-Diabetic
2          Diabetic
3      Non-Diabetic
4          Diabetic
           ...
763    Non-Diabetic
764    Non-Diabetic
765    Non-Diabetic
766        Diabetic
767    Non-Diabetic
Name: Outcome, Length: 768, dtype: object
```

In [220…

```python
df.groupby('Outcome').mean()
```

Out[220...

Outcome	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	D
Diabetic	4.865672	141.257463	70.824627	22.164179	100.335821	35.142537	
Non-Diabetic	3.298000	109.980000	68.184000	19.664000	68.792000	30.304200	

Step 7: Splitting the data into training and testing

In [232...

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.3, random_sta
```

In [234...

```
train_df, test_df = train_test_split(df)
# Print the sizes of the training and testing sets
print(f'Training set size: {len(train_df)} rows')
print(f'Testing set size: {len(test_df)} rows')
```

```
Training set size: 576 rows
Testing set size: 192 rows
```

Step 8: Training the model by using Support Vector Machine

In [237...

```
model = svm.SVC(kernel = 'linear')
```

In [239...

```
model.fit(X_train,Y_train)
```

Out[239...

```
SVC
SVC(kernel='linear')
```

In [241...

```
X_train_prediction = model.predict(X_train)
training_data_accuracy = accuracy_score(X_train_prediction,Y_train)
```

In [243...

```
print(f'Training Accuracy: {training_data_accuracy:.2f}')
```

```
Training Accuracy: 0.78
```

In [245...

```
X_test_prediction = model.predict(X_test)
testing_data_accuracy = accuracy_score(X_test_prediction,Y_test )
```

In [247...

```
print(f'Testing Accuracy: {testing_data_accuracy:.2f}')
```

```
Testing Accuracy: 0.75
```

Step 9: Classification model

In [250…

```
def classification_model(model, X_train, X_test, Y_train, Y_test, n_folds=5):
 # Train the model
 model.fit(X_train, Y_train)

 # Predict and evaluate
 predictions = model.predict(X_test)
 accuracy = accuracy_score(Y_test, predictions)
 print(f'Testing Accuracy: {accuracy:.2f}')
 # Cross-validation
 cv_scores = cross_val_score(model, X_train, Y_train, cv=n_folds)
 print(f'Mean Cross-Validation Score: {cv_scores.mean():.2f}')
classification_model(model, X_train, X_test, Y_train, Y_test, n_folds=5)
```

```
Testing Accuracy: 0.75
Mean Cross-Validation Score: 0.78
```

Step 10: Logistic Regression model

In [253…

```
logistic_model = LogisticRegression()
classification_model(logistic_model, X_train, X_test, Y_train, Y_test)
# Create a Logistic Regression model
model = LogisticRegression() # Increase max_iter for potential convergence issu
# Train the model
model.fit(X_train, Y_train)
# Make predictions on the test set
y_pred = model.predict(X_test)
# Evaluate the model
accuracy = accuracy_score(Y_test, y_pred)
print(f"Accuracy: {accuracy}")
# Print the confusion matrix
conf_matrix = confusion_matrix(Y_test, y_pred)
print("Confusion Matrix:")
print(conf_matrix)
```

```
Testing Accuracy: 0.74
Mean Cross-Validation Score: 0.77
Accuracy: 0.7359307359307359
Confusion Matrix:
[[ 50  30]
 [ 31 120]]
```

In [ ]: