Diabetes-detection

Use the "Run" button to execute the code.

Getting Dataset

In [1]:
```
!pip install jovian opendatasets --upgrade --quiet
```

In [2]:
```
url='https://raw.githubusercontent.com/Asad-cuet/Machine-Learning-Code/master/dataset/diabetes.csv'
```

In [3]:
```
import opendatasets as od
od.download(url)
```

```
Using downloaded and verified file: ./diabetes.csv
```

In [4]:
```
import pandas as pd
raw_df=pd.read_csv('diabetes.csv')
```

In [5]:
```
raw_df
```

Out[5]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunctio
0	6	148	72	35	0	33.6	0.62
1	1	85	66	29	0	26.6	0.35
2	8	183	64	0	0	23.3	0.67
3	1	89	66	23	94	28.1	0.16
4	0	137	40	35	168	43.1	2.28
...	...	...	...	...	...	...	.
763	10	101	76	48	180	32.9	0.17
764	2	122	70	27	0	36.8	0.34
765	5	121	72	23	112	26.2	0.24
766	1	126	60	0	0	30.1	0.34
767	1	93	70	31	0	30.4	0.31

768 rows × 9 columns

Identifying input and target columns

In [6]:
```
input_cols=list(raw_df.columns)[1:-1]  # Excluding last column by range [1:-1]. Python range works as like [ , )
input_cols
```

Out[6]:
```
['Glucose',
 'BloodPressure',
 'SkinThickness',
 'Insulin',
 'BMI',
 'DiabetesPedigreeFunction',
 'Age']
```

In [7]:
```
target_col=list(raw_df.columns)[-1]
target_col
```

Out[7]:
```
'Outcome'
```

Data Preprocessing

Modifying target column

In [8]:
```
raw_df[target_col].unique()
```

Out[8]:
```
array([1, 0])
```

We will convert 1,0 to Yes,No

In [9]:
```
target_col_values = {0:'NO' , 1: 'Yes'}
raw_df[target_col] = raw_df[target_col].map(target_col_values)  #map takes function or dictionary.if value is 0 return 'No', if 1 return 'Yes'
```

In [10]:
```
raw_df[target_col].unique()
```

Out[10]:
```
array(['Yes', 'NO'], dtype=object)
```

Modified done

Remove row where target column is empty

In [11]:
```
raw_df[target_col].unique()
```

Out[11]:
```
array(['Yes', 'NO'], dtype=object)
```

There is no invalid or empty cell. So skipping this step

Splitting Dataset

Three parts:
Training Set (70%) : Train model
Test Set (30%) : Accuracy Measurement
Manual Set (10% of Test Set) : This data will used in single input test

Splitting

In [12]:
```
from sklearn.model_selection import train_test_split
```

In [13]:
```
train_df,test_df=train_test_split(raw_df,test_size=0.3,random_state=42)
```

In [14]:
```
test_df,manual_df=train_test_split(test_df,test_size=0.1,random_state=42)
```

random_state:This is to check and validate the data when running the code multiple times. Setting random_state a fixed value will guarantee that same sequence of random numbers are generated each time you run the code.

In [15]:
```
print('Raw Df Shape:',raw_df.shape)
print('Train Df Shape:',train_df.shape)
print('Test Df Shape:',test_df.shape)
print('Manual Df Shape:',manual_df.shape)
```

```
Raw Df Shape: (768, 9)
Train Df Shape: (537, 9)
Test Df Shape: (207, 9)
Manual Df Shape: (24, 9)
```

Inputs and target

In [16]:
```
train_inputs=train_df[input_cols].copy()
train_target=train_df[target_col].copy()
```

In [17]:
```
test_inputs=test_df[input_cols].copy()
test_target=test_df[target_col].copy()
```

In [18]:
```
manual_inputs=manual_df[input_cols].copy()
manual_target=manual_df[target_col].copy()
```

Identify Numeric & Categorical Column

In [19]:
```
import numpy as np
```

In [20]:
```
numeric_cols=train_inputs.select_dtypes(include=np.number).columns.tolist()
numeric_cols
```

Out[20]:
```
['Glucose',
 'BloodPressure',
 'SkinThickness',
 'Insulin',
 'BMI',
 'DiabetesPedigreeFunction',
 'Age']
```

In [21]:
```
categorical_cols=train_inputs.select_dtypes('object').columns.tolist()
categorical_cols
```

Out[21]:
```
[]
```

There is no categorical column in input columns

Observing Numeric Columns

In [22]:
```
train_inputs[numeric_cols].info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 537 entries, 334 to 102
Data columns (total 7 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   Glucose                   537 non-null    int64  
 1   BloodPressure             537 non-null    int64  
 2   SkinThickness             537 non-null    int64  
 3   Insulin                   537 non-null    int64  
 4   BMI                       537 non-null    float64
 5   DiabetesPedigreeFunction  537 non-null    float64
 6   Age                       537 non-null    int64  
dtypes: float64(2), int64(5)
memory usage: 33.6 KB
```

Look there is no nan values. So we can skip imputation step

In [23]:
```
train_inputs[numeric_cols].describe()
```

Out[23]:

	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunct
count	537.000000	537.000000	537.000000	537.000000	537.000000	537.000(
mean	120.849162	69.685289	20.432030	79.836127	31.975605	0.469(
std	32.339523	18.094374	15.490715	115.196730	7.624495	0.342(
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.078(
25%	99.000000	64.000000	0.000000	0.000000	26.800000	0.241(
50%	117.000000	72.000000	23.000000	36.000000	32.000000	0.374(
75%	139.000000	80.000000	32.000000	129.000000	36.500000	0.612(
max	199.000000	122.000000	63.000000	846.000000	67.100000	2.420(

Look at min value. it is 0.So there is not nan value,nut have 0 value. We need to imputes these 0 values
Look at min and max value. We need to scale the values

Processing Numeric Columns

Imputation

In [24]:
```
# Looking is there missing values
train_inputs[numeric_cols].isna().sum()  # isna() shows all missing data
```

Out[24]:
```
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
dtype: int64
```

In [25]:
```
# converting 0 to nan for imputation
raw_df[numeric_cols]=raw_df[numeric_cols].replace(0,np.nan)
train_inputs[numeric_cols]=train_inputs[numeric_cols].replace(0,np.nan)
test_inputs[numeric_cols]=test_inputs[numeric_cols].replace(0,np.nan)
```

In [26]:
```
from sklearn.impute import SimpleImputer
```

In [27]:
```
imputer=SimpleImputer(strategy='mean') # reaplacing by mean value
```

In [28]:
```
imputer.fit(raw_df[numeric_cols])  # computing mean value from entire dataset.
Beacause traing set, validation set, test set separated now.
                                   # Stored is statistics_
                                   # You can see by imputer.statistics_
```

Out[28]:
```
SimpleImputer()
```

In [29]:
```
train_inputs[numeric_cols]=imputer.transform(train_inputs[numeric_cols])
```

In [30]:
```
test_inputs[numeric_cols]=imputer.transform(test_inputs[numeric_cols])
```

In [31]:
```
manual_inputs[numeric_cols]=imputer.transform(manual_inputs[numeric_cols])
```

In [32]:
```
train_inputs[numeric_cols].describe()
```

Out[32]:

	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunct
count	537.000000	537.000000	537.000000	537.000000	537.000000	537.000(
mean	121.982186	72.247111	28.792601	155.437777	32.277816	0.469(
std	30.138496	12.204823	8.475990	85.039099	6.964619	0.342(
min	44.000000	24.000000	8.000000	14.000000	18.200000	0.078(
25%	100.000000	64.000000	24.000000	120.000000	27.100000	0.241(
50%	118.000000	72.000000	29.153420	155.548223	32.000000	0.374(
75%	139.000000	80.000000	32.000000	155.548223	36.500000	0.612(
max	199.000000	122.000000	63.000000	846.000000	67.100000	2.420(

Now look, min value is not zero

Scaling

In [33]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [34]:
```
scaler=MinMaxScaler()
```

In [35]:
```
scaler.fit(raw_df[numeric_cols])
```

Out[35]:
```
MinMaxScaler()
```

In [36]:
```
train_inputs[numeric_cols]=scaler.transform(train_inputs[numeric_cols])
```

In [37]:
```
test_inputs[numeric_cols]=scaler.transform(test_inputs[numeric_cols])
```

In [38]:
```
manual_inputs[numeric_cols]=scaler.transform(manual_inputs[numeric_cols])
```

In [39]:
```
train_inputs[numeric_cols].describe()
```

Out[39]:

	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunct
count	537.000000	537.000000	537.000000	537.000000	537.000000	537.000(
mean	0.503111	0.492317	0.236876	0.169997	0.287890	0.167(
std	0.194442	0.124539	0.092130	0.102210	0.142426	0.146(
min	0.000000	0.000000	0.010870	0.000000	0.000000	0.000(
25%	0.361290	0.408163	0.184783	0.127404	0.182004	0.069(
50%	0.477419	0.489796	0.240798	0.170130	0.282209	0.126(
75%	0.612903	0.571429	0.271739	0.170130	0.374233	0.228(
max	1.000000	1.000000	0.608696	1.000000	1.000000	1.000(

Scaling Done

Processing Categorical Columns

As there is no categorical columns in the dataset,we skipping this step

Saving Preprocessing Data (Optional)

In [40]:
```
pd.DataFrame(train_inputs).to_csv('train_inputs.csv')
pd.DataFrame(train_target).to_csv('train_target.csv')
```

In [41]:
```
pd.DataFrame(test_inputs).to_csv('test_inputs.csv')
pd.DataFrame(test_target).to_csv('test_target.csv')
```

In [42]:
```
pd.DataFrame(manual_inputs).to_csv('manual_inputs.csv')
pd.DataFrame(manual_target).to_csv('manual_target.csv')
```

In [43]:
```
pd.DataFrame(manual_df).to_csv('manual_df.csv')
```

Training Model

In [44]:
```
from sklearn.linear_model import LogisticRegression
model=LogisticRegression(solver='liblinear')
```

In [45]:
```
model.fit(train_inputs,train_target)
```

Out[45]:
```
LogisticRegression(solver='liblinear')
```

Predicting on Train set,Test set

In [46]:
```
train_preds=model.predict(train_inputs)
```

In [47]:
```
test_preds=model.predict(test_inputs)
```

Testing: Comparing prediction with target values

Accuracy Score

In [48]:
```
from sklearn.metrics import accuracy_score
```

In [49]:
```
accuracy_score(train_target,train_preds)
```

Out[49]:
```
0.7783985102420856
```

In [50]:
```
accuracy_score(test_target,test_preds)
```

Out[50]:
```
0.7584541062801933
```

Confusion Matriix

In [51]:
```
from sklearn.metrics import confusion_matrix
```

In [52]:
```
confusion_matrix(train_target,train_preds,normalize='true')
```

Out[52]:
```
array([[0.90544413, 0.09455587],
       [0.45744681, 0.54255319]])
```

In [53]:
```
confusion_matrix(test_target,test_preds,normalize='true')
```

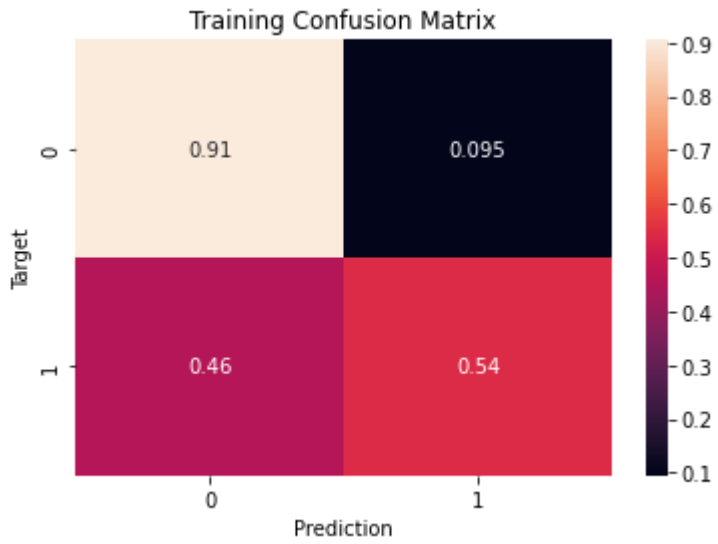
Out[53]:
```
array([[0.84671533, 0.15328467],
       [0.41428571, 0.58571429]])
```

Both in Visualization

In [54]:
```
import matplotlib.pyplot as plt
import seaborn as sns
def predict_and_plot(inputs, targets, name=''):
    preds = model.predict(inputs)

    accuracy = accuracy_score(targets, preds)
    print("Accuracy: {:.2f}%".format(accuracy * 100))

    cf = confusion_matrix(targets, preds, normalize='true')
    plt.figure()
    sns.heatmap(cf, annot=True)
    plt.xlabel('Prediction')
    plt.ylabel('Target')
    plt.title('{} Confusion Matrix'.format(name));

    return accuracy
```

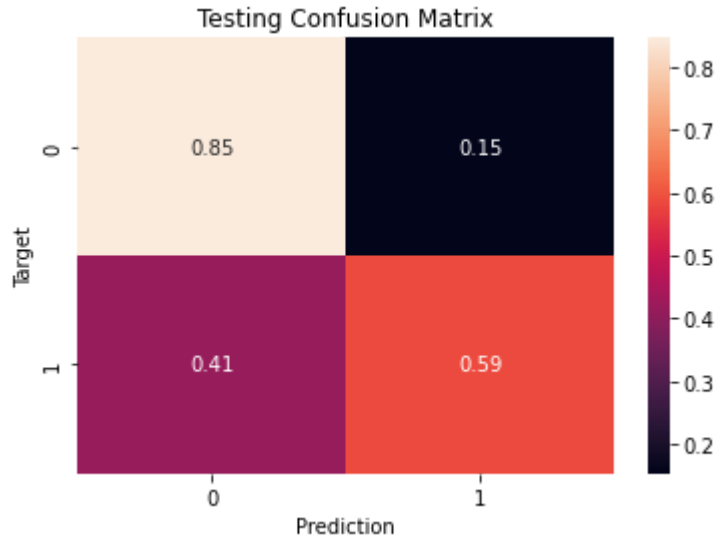
In [55]:
```
training_accuracy = predict_and_plot(train_inputs, train_target, 'Training')
```

```
Accuracy: 77.84%
```



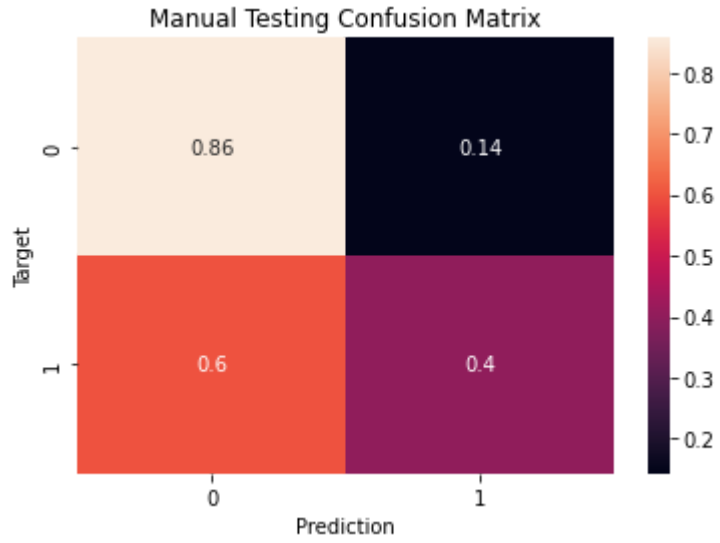
In [56]:
```
test_accuracy = predict_and_plot(test_inputs, test_target, 'Testing')
```

```
Accuracy: 75.85%
```



In [67]:
```
manual_accuracy = predict_and_plot(manual_inputs, manual_target, 'Manual Testi
ng')
```

```
Accuracy: 66.67%
```



Predicting on Single input

Taking input

In [57]:
```
pd.read_csv('manual_df.csv')
```

Out[57]:

	Unnamed: 0	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedig
0	351	4	137	84	0	0	31.2	
1	210	2	81	60	22	0	27.7	
2	148	5	147	78	0	0	33.7	
3	44	7	159	64	0	0	27.4	
4	356	1	125	50	40	167	33.3	
5	559	11	85	74	0	0	30.1	
6	209	7	184	84	33	0	35.5	
7	145	0	102	75	23	0	0.0	
8	60	2	84	0	0	0	0.0	
9	706	10	115	0	0	0	0.0	
10	465	0	124	56	13	105	21.8	
11	213	0	140	65	26	130	42.6	
12	250	9	106	52	0	0	31.2	
13	165	6	104	74	18	156	29.9	
14	640	0	102	86	17	105	29.3	
15	691	13	158	114	0	0	42.3	
16	218	5	85	74	22	0	29.0	
17	120	0	162	76	56	100	53.2	
18	619	0	119	0	0	0	32.4	
19	136	0	100	70	26	50	30.8	
20	659	3	80	82	31	70	34.2	
21	718	1	108	60	46	178	35.5	
22	637	2	94	76	18	66	31.6	
23	608	0	152	82	39	272	41.5	

In [58]:

```
# All values is required
new_input={
    'Pregnancies':4,
    'Glucose':137,
    'BloodPressure':84,
    'SkinThickness':0,
    'Insulin':0,
    'BMI':31.2,
    'DiabetesPedigreeFunction':0.252,
    'Age':30
}
```

Preprocess the input

We did in the model input: scaling

In [59]:
```
new_input_df=pd.DataFrame([new_input])
new_input_df
```

Out[59]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction
0	4	137	84	0	0	31.2	0.252

In [60]:
```
new_input_df[numeric_cols]=imputer.transform(new_input_df[numeric_cols]) #impu
ting
new_input_df[numeric_cols]=scaler.transform(new_input_df[numeric_cols]) # scal
ing
```

Predicting

In [61]:
```
inputs=inputs=new_input_df[numeric_cols]
```

In [62]:
```
prediction=model.predict(inputs)[0]
prediction
```

Out[62]:
```
'NO'
```

In [63]:
```
probability=model.predict_proba(inputs)[0]
probability
```

Out[63]:
```
array([0.69031315, 0.30968685])
```

Input prediction in 1 function

In [64]:
```
def predictInput(new_input):
    global test_accuracy
    new_input_df=pd.DataFrame([new_input])

    new_input_df[numeric_cols]=imputer.transform(new_input_df[numeric_cols]) #
imputing
    new_input_df[numeric_cols]=scaler.transform(new_input_df[numeric_cols]) #
scaling

    inputs=inputs=new_input_df[numeric_cols]

    prediction=model.predict(inputs)[0]
    probability=model.predict_proba(inputs)[0]

    print('Testing Accuracy of the Model:',round(test_accuracy*100),'%')
    print('Diabetes Result:',prediction)
    if(prediction=='Yes'):
        index=1
    if(prediction=='NO'):
        index=0
    print('Probablity:',round(probability[index]*100),'%')
```

In [65]:
```
new_input={
    'Pregnancies':6,
    'Glucose':104,
    'BloodPressure':74,
    'SkinThickness':18,
    'Insulin':156,
    'BMI':29.9,
    'DiabetesPedigreeFunction':0.722,
    'Age':41
}
```

In [66]:
```
predictInput(new_input)
```

```
Testing Accuracy of the Model: 76 %
Diabetes Result: NO
Probablity: 74 %
```