Lab Sheet 2

KNN Implementation

S Abhishek

AM.EN.U4CSE19147

```
# Load Dataset

import pandas as pd

data = pd.read_csv("/content/Diabetes.csv")

# Display First 10 Rows

data.head(15)
```

```
    Pregnancies  Glucose  BloodPressure  ...  DiabetesPedigreeFunction  Age  Outcome
0             6      148             72  ...                     0.627   50        1
1             1       85             66  ...                     0.351   31        0
2             8      183             64  ...                     0.672   32        1
3             1       89             66  ...                     0.167   21        0
4             0      137             40  ...                     2.288   33        1
5             5      116             74  ...                     0.201   30        0
6             3       78             50  ...                     0.248   26        1
7            10      115              0  ...                     0.134   29        0
8             2      197             70  ...                     0.158   53        1
9             8      125             96  ...                     0.232   54        1
10            4      110             92  ...                     0.191   30        0
11           10      168             74  ...                     0.537   34        1
12           10      139             80  ...                     1.441   57        0
13            1      189             60  ...                     0.398   59        1
14            5      166             72  ...                     0.587   51        1

[15 rows x 9 columns]
```

```
# Split Data Set into Train and Test

train_percent = round((data.shape[0]*80)/100)
print("Train Data :",train_percent)

test_percent = round((data.shape[0]*20)/100)
print("Test Data :",test_percent)
```

```
Train Data : 614
Test Data : 154
```

```
XTrain = data[:train_percent]
XTest = data[train_percent:]

print("Train Set :", XTrain.shape, "\nTest Set:", XTest.shape)
```

```
Train Set : (614, 9)
Test Set: (154, 9)
```

```
# Split the dataset into 80% training and 20% testing

from sklearn.model_selection import train_test_split

Y = data.Outcome # Only Target Label

X = data.drop('Outcome',axis=1) # Features
# axis = Whether to drop 0 – labels from the index or 1 – columns.

x_train,x_test,y_train,y_test=train_test_split(X,Y,test_size=0.2)


print(x_train.head(), "\n", y_train.head())
```

```
     Pregnancies  Glucose  BloodPressure  ...   BMI  DiabetesPedigreeFunction  Age
473            7      136             90  ...  29.9                     0.210   50
465            0      124             56  ...  21.8                     0.452   21
72            13      126             90  ...  43.4                     0.583   42
127            1      118             58  ...  33.3                     0.261   23
204            6      103             72  ...  37.7                     0.324   55
```

```
[5 rows x 8 columns]
 473    0
465    0
72     1
127    0
204    0
Name: Outcome, dtype: int64
```

```
from sklearn.preprocessing import StandardScaler

st_scaler=StandardScaler()

x_train=st_scaler.fit_transform(x_train)

x_test=st_scaler.transform(x_test)
```

- We have to execute, scaler=StandardScaler().fit(X_Test)

```
from sklearn.neighbors import KNeighborsClassifier

classifier = KNeighborsClassifier(n_neighbors=5)
classifier.fit(x_train, y_train)
y_pred = classifier.predict(x_test)

print(y_pred)
```

```
[1 0 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 0 1 1 1 0 1 0 1
 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1 1 0 0 0 1 0 1 1 0 1
 0 0 0 1 1 0 0 1 1 0 1 1 0 0 0 1 1 0 0 0 1 0 0 0 1 1 1 1 0 0 0 1 0 0 1 0 0
 0 0 0 0 1 1]
```

```
from sklearn.metrics import classification_report, confusion_matrix

print(confusion_matrix(y_test, y_pred))
print()

print(accuracy_score(y_test, y_pred))
print()
print(classification_report(y_test, y_pred))
```

```
[[87 12]
 [30 25]]

0.7272727272727273

          precision    recall  f1-score   support

        0       0.74      0.88      0.81        99
        1       0.68      0.45      0.54        55

 accuracy                           0.73       154
macro avg       0.71      0.67      0.67       154
weighted avg       0.72      0.73      0.71       154
```

Above confusion matrix shows that there are,

- 87 True Negative cases
- 25 True Positive cases
- 12 False Positive cases
- 30 False Negative cases

```
import numpy as np

print('Actual Outcome 0 :',np.sum(y_test==0))
print('Predicted Outcome 0 :',np.sum(y_pred==0))
print()

print('Actual Outcome 1 :',np.sum(y_test==1))
print('Predicted Outcome 1 :',np.sum(y_pred==1))
```

```
Actual Outcome 0 : 99
Predicted Outcome 0 : 117

Actual Outcome 1 : 55
Predicted Outcome 1 : 37
```

Total number of correct prediction is 87 + 25 = 112

```
from sklearn.metrics import accuracy_score
import matplotlib.pyplot as plt

k = []
accuracy = []
for i in range(2,20,3):

    classifier = KNeighborsClassifier(n_neighbors = i)
    classifier.fit(x_train, y_train)
    y_pred = classifier.predict(x_test)

    print('Now K =',i)
    print()
    print(confusion_matrix(y_test, y_pred))
    print()

    accuracy.append(accuracy_score(y_test, y_pred))

    print(classification_report(y_test, y_pred))
    print()

    k.append(i)

plt.plot(k,accuracy)
plt.xlabel('K Value')
plt.ylabel('Accuracy')
plt.show()
```

```
Now K = 2

[[90  9]
 [32 23]]

              precision    recall  f1-score   support

           0       0.74      0.91      0.81        99
           1       0.72      0.42      0.53        55

    accuracy                           0.73       154
   macro avg       0.73      0.66      0.67       154
weighted avg       0.73      0.73      0.71       154
```

Now K = 5

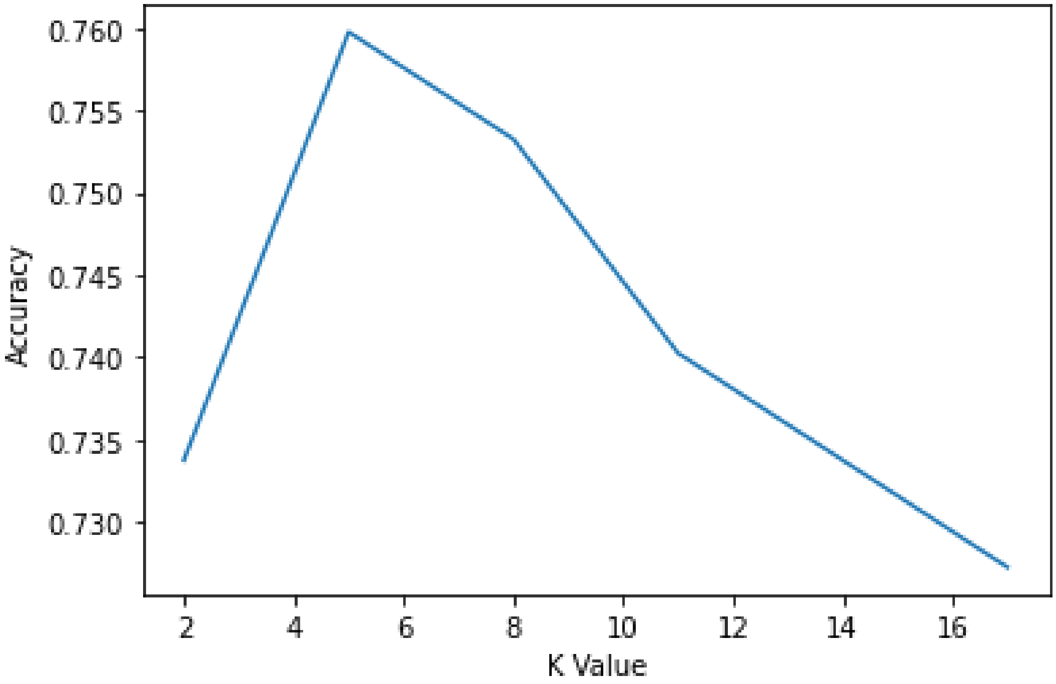
```
[[84 15]
 [22 33]]

              precision    recall  f1-score   support

           0       0.79      0.85      0.82        99
           1       0.69      0.60      0.64        55

    accuracy                           0.76       154
   macro avg       0.74      0.72      0.73       154
weighted avg       0.75      0.76      0.76       154
```

Now K = 8

```
[[88 11]
 [27 28]]

              precision    recall  f1-score   support

           0       0.77      0.89      0.82        99
           1       0.72      0.51      0.60        55

    accuracy                           0.75       154
   macro avg       0.74      0.70      0.71       154
weighted avg       0.75      0.75      0.74       154
```

```
Now K = 11

[[86 13]
 [27 28]]

              precision    recall  f1-score   support

           0       0.76      0.87      0.81        99
           1       0.68      0.51      0.58        55

    accuracy                           0.74       154
   macro avg       0.72      0.69      0.70       154
weighted avg       0.73      0.74      0.73       154


Now K = 14

[[89 10]
 [31 24]]

              precision    recall  f1-score   support

           0       0.74      0.90      0.81        99
           1       0.71      0.44      0.54        55

    accuracy                           0.73       154
   macro avg       0.72      0.67      0.68       154
weighted avg       0.73      0.73      0.72       154


Now K = 17

[[87 12]
 [30 25]]
```

```
              precision    recall  f1-score   support

           0       0.74      0.88      0.81        99
           1       0.68      0.45      0.54        55

    accuracy                           0.73       154
   macro avg       0.71      0.67      0.67       154
weighted avg       0.72      0.73      0.71       154
```



KNN with Diabetes Dataset

```
df = pd.read_csv('/content/Diabetes.csv')

df.head()
```

```
   Pregnancies  Glucose  BloodPressure  ...  DiabetesPedigreeFunction  Age  Outcome
0            6      148             72  ...                     0.627   50        1
1            1       85             66  ...                     0.351   31        0
2            8      183             64  ...                     0.672   32        1
3            1       89             66  ...                     0.167   21        0
```

```
4          0      137           40  ...                   2.288   33       1

[5 rows x 9 columns]
```

```
from sklearn.model_selection import train_test_split

arr = df.values

X = arr[:,0:8]
Y = arr[:,8]

x_train, x_test, y_train, y_test = train_test_split(X, Y, test_size = 0.20,
random_state=1)

print(x_test)
```

```
[[7.00e+00 1.36e+02 7.40e+01 ... 2.60e+01 6.47e-01 5.10e+01]
 [1.00e+00 1.51e+02 6.00e+01 ... 2.61e+01 1.79e-01 2.20e+01]
 [6.00e+00 1.09e+02 6.00e+01 ... 2.50e+01 2.06e-01 2.70e+01]
 ...
 [8.00e+00 1.88e+02 7.80e+01 ... 4.79e+01 1.37e-01 4.30e+01]
 [5.00e+00 1.36e+02 8.20e+01 ... 0.00e+00 6.40e-01 6.90e+01]
 [4.00e+00 9.00e+01 0.00e+00 ... 2.80e+01 6.10e-01 3.10e+01]]
```

```
Dist = []
row_id = 0
index = 0

euclidean = pd.DataFrame(columns=['Row ID of X Train', 'Row ID of X Test','Distance',
'Outcome'])

for i in range(len(x_train)):

    d = []

    for j in range(len(x_test)):
        l = [i,j]
        diff = x_train[i] - x_test[j]
        dist = np.linalg.norm(diff)

        l.append(dist)
        l.append(y_train[i])

        euclidean.loc[index] = l
        index += 1
        d.append(dist)

    Dist.extend(d)

euclidean
```

```
      Row ID of X Train  Row ID of X Test    Distance  Outcome
0                   0.0               0.0   28.436070      1.0
1                   0.0               1.0  141.348682      1.0
2                   0.0               2.0  138.930183      1.0
3                   0.0               3.0  156.103828      1.0
4                   0.0               4.0   62.659875      1.0
...                 ...               ...         ...      ...
94551             613.0             149.0   61.204806      1.0
94552             613.0             150.0  142.338699      1.0
94553             613.0             151.0   94.890878      1.0
94554             613.0             152.0   64.717931      1.0
94555             613.0             153.0   86.965585      1.0

[94556 rows x 4 columns]
```

```
matrix = euclidean.values

sorted_matrix = matrix[matrix[:,2].argsort()]

data = pd.DataFrame(sorted_matrix,columns=['Row ID of X Train', 'Row ID of X Test','Distance','Outcome'])

data.head()
```

```
   Row ID of X Train  Row ID of X Test  Distance  Outcome
0               67.0              18.0  3.586227      0.0
1              440.0              29.0  3.834006      1.0
2              359.0             100.0  4.240072      0.0
3              281.0              61.0  4.244632      0.0
4              137.0             137.0  4.275231      1.0
```

```
y_pred = []

for i in range(X_test.shape[0]):

    out = data.loc[data['Row ID of X Test']==i].iloc[:5,:]['Outcome'].sum()

    if out > 2:
        y_pred.append(1)

    else:
        y_pred.append(0)

accuracy_score(y_test,y_pred)
```

```
0.7337662337662337
```