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2048011

2 - MDS

Machine Learning Lab 9

KNN Classifier

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CHRIST (Deemed to be University)

In [1]:

```
#Import statements
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

Categorical data - IRIS

In [4]:

```
# Assign colum names to the dataset
colnames = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'Class']

# Read dataset in dataframe
data = pd.read_csv("iris.data", names=colnames)
```

In [19]:

```
data.sample(5)
```

Out[19]:

	sepal-length	sepal-width	petal-length	petal-width	Class
5	5.4	3.9	1.7	0.4	Iris-setosa
81	5.5	2.4	3.7	1.0	Iris-versicolor
85	6.0	3.4	4.5	1.6	Iris-versicolor
2	4.7	3.2	1.3	0.2	Iris-setosa
21	5.1	3.7	1.5	0.4	Iris-setosa

Preprocessing

In [7]:

```
data.isnull().sum()
```

Out[7]:

```
sepal-length    0
sepal-width     0
petal-length    0
petal-width     0
Class           0
dtype: int64
```

There are no null values in the dataset.

In [8]:

```
#Dividing dataset into x and y
x = data.drop('Class', axis=1)
y = data['Class']
```

In [9]:

```
#Dividing dataset into training and testing set
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=0.25, random_state=11)
```

Feature Scaling

In [29]:

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
scaler.fit(X_train)

X_train = scaler.transform(X_train)
X_test = scaler.transform(X_test)
```

Model

In [137]:

```
#using weighted euclidean distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=9, metric="euclidean")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

In [102]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[12  0  0]
 [ 0 11  0]
 [ 0  2 13]]

Classification Report
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        12
Iris-versicolor       0.85      1.00      0.92        11
 Iris-virginica       1.00      0.87      0.93        15

       accuracy                           0.95        38
      macro avg       0.95      0.96      0.95        38
   weighted avg       0.96      0.95      0.95        38
```

In [103]:

```
#using hamming distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=9, metric="hamming")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

In [104]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[12  0  0]
 [ 0 10  1]
 [ 0  4 11]]

Classification Report
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        12
Iris-versicolor       0.71      0.91      0.80        11
 Iris-virginica       0.92      0.73      0.81        15

       accuracy                           0.87        38
      macro avg       0.88      0.88      0.87        38
   weighted avg       0.88      0.87      0.87        38
```

Euclidean distance performs better than hamming.

Comparing Error Rate with the K Value

In [79]:

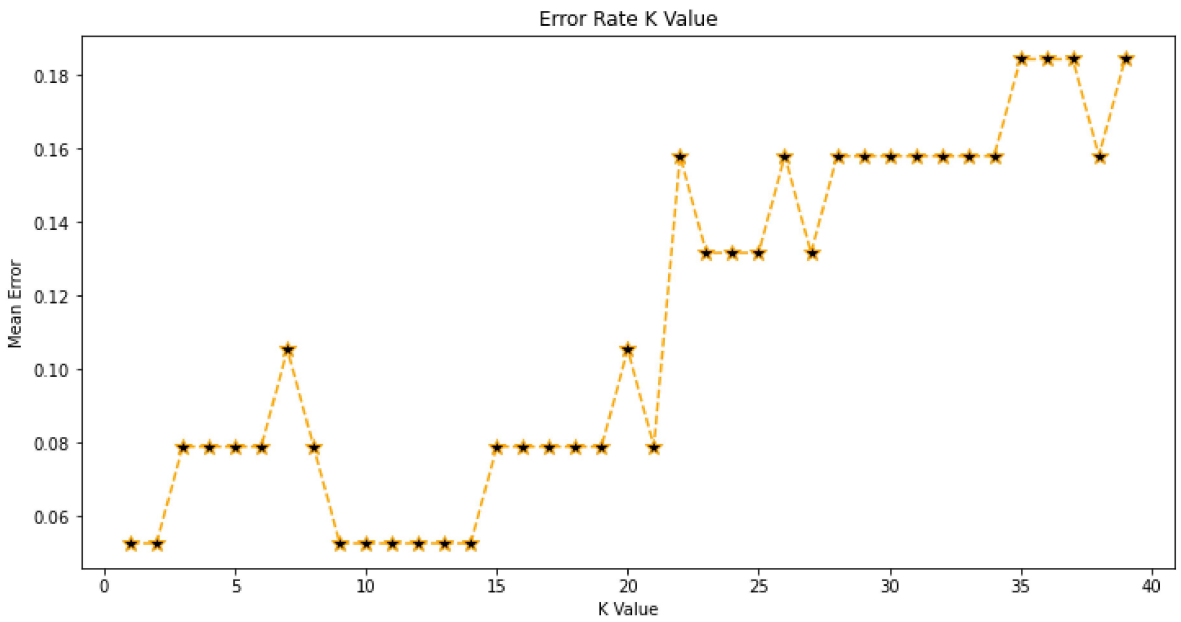
```
error = []

# Calculating error for K values between 1 and 40
for i in range(1, 40):
    knn = KNeighborsClassifier(n_neighbors=i)
    knn.fit(X_train, Y_train)
    pred_i = knn.predict(X_test)
    error.append(np.mean(pred_i != Y_test))
```

In [80]:

```
plt.figure(figsize=(12, 6))
plt.plot(range(1, 40), error, color='orange', linestyle='dashed', marker='*',
         markerfacecolor='black', markersize=10)
plt.title('Error Rate K Value')
plt.xlabel('K Value')
plt.ylabel('Mean Error')
```

Out[80]:

```
Text(0, 0.5, 'Mean Error')
```



From the above graph we can tell that error is zero when k is 1 or 2 or it lies between 9 and 14.

Binary data - Breast Cancer

In [107]:

```
from sklearn.datasets import load_breast_cancer
cancer = load_breast_cancer()
fl = pd.DataFrame(cancer['data'], columns=cancer['feature_names'])
fl.head()
```

Out[107]:

	mean radius	mean texture	mean perimeter	mean area	mean smoothness	mean compactness	mean concavity	mean concave points	mear symmetry
0	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	0.241
1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	0.181
2	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	0.206
3	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	0.259
4	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	0.180

5 rows × 30 columns

In [109]:

```
x = fl
y = pd.DataFrame(cancer['target'], columns = ['CancerType'])
```

In [111]:

```
x.shape, y.shape
```

Out[111]:

```
((569, 30), (569, 1))
```

In [115]:

```
#Dividing dataset into training and testing set
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=0.25, random_state=11)
```

Model

In [118]:

```
#using euclidean distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=9, metric="euclidean")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

```
<ipython-input-118-63d2411caa47>:4: DataConversionWarning: A column-vector y
was passed when a 1d array was expected. Please change the shape of y to (n_
samples, ), for example using ravel().
  model.fit(X_train, Y_train)
```

In [119]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[42  8]
 [ 0 93]]

Classification Report
              precision    recall  f1-score   support

           0       1.00      0.84      0.91        50
           1       0.92      1.00      0.96        93

    accuracy                           0.94       143
   macro avg       0.96      0.92      0.94       143
weighted avg       0.95      0.94      0.94       143
```

In [125]:

```
#using jaccard distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=13, metric="jaccard")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

```
<ipython-input-125-5e0d841da6e6>:4: DataConversionWarning: A column-vector y
was passed when a 1d array was expected. Please change the shape of y to (n_
samples, ), for example using ravel().
  model.fit(X_train, Y_train)
```

In [126]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[ 0 50]
 [ 0 93]]

Classification Report
              precision    recall  f1-score   support

           0       0.00      0.00      0.00        50
           1       0.65      1.00      0.79        93

    accuracy                           0.65       143
   macro avg       0.33      0.50      0.39       143
weighted avg       0.42      0.65      0.51       143


D:\Anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1221: Unde
finedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to co
ntrol this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

As we can cleraly see that euclidean distance performs better than jaccard distance.

Numerical data - Diabetes

In [129]:

```
fl = pd.read_csv('diabetes.csv')
fl.sample(5)
```

Out[129]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunct
52	5	88	66	21	23	24.4	0.
56	7	187	68	39	304	37.7	0.
727	0	141	84	26	0	32.4	0.
338	9	152	78	34	171	34.2	0.
487	0	173	78	32	265	46.5	1.

In [138]:

```
x = fl.drop(['Outcome'], axis=1)
y = fl.Outcome
```

In [139]:

```
#Dividing dataset into training and testing set
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(x, y, test_size=0.25, random_state=11)
```

Model

In [140]:

```
#using euclidean distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=9, metric="euclidean")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

In [141]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[107  19]
 [ 35  31]]

Classification Report
              precision    recall  f1-score   support

           0       0.75      0.85      0.80       126
           1       0.62      0.47      0.53        66

    accuracy                           0.72       192
   macro avg       0.69      0.66      0.67       192
weighted avg       0.71      0.72      0.71       192
```

In [142]:

```
#using manhattan distance
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier(n_neighbors=9, metric="manhattan")
model.fit(X_train, Y_train)

y_pred = model.predict(X_test)
```

In [143]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("Confusion Matrix\n", confusion_matrix(Y_test, y_pred))
print("\nClassification Report\n", classification_report(Y_test, y_pred))
```

```
Confusion Matrix
 [[111  15]
 [ 39  27]]

Classification Report
              precision    recall  f1-score   support

           0       0.74      0.88      0.80       126
           1       0.64      0.41      0.50        66

    accuracy                           0.72       192
   macro avg       0.69      0.65      0.65       192
weighted avg       0.71      0.72      0.70       192
```

Model using manhattan distance performed better than euclidean.