Machine Learning Laboratory

(410302)

BE Sem I Honors in AI/ML

Academic Year: 2021-22

Lab Assignment No. 8

Name: Aboli Marathe

Roll Number: 41301

Branch: Department of Computer Engineering

Lab Exercise 1

1. Use iris flower dataset from sklearn library and try to form clusters of flowers using petal width and length features. Drop other two features for simplicity.
2. Figure out if any pre-processing such as scaling would help here
3. Draw elbow plot and from that figure out optimal value of k

```
import pandas as pd
import numpy as np
from sklearn import datasets
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
import sklearn.metrics as sm
from sklearn.preprocessing import StandardScaler
%matplotlib inline
```

```
iris = datasets.load_iris()
print iris.data
```

```
      [6.1 3.  4.6 1.4]
      [5.8 2.6 4.  1.2]
      [5.  2.3 3.3 1. ]
      [5.6 2.7 4.2 1.3]
      [5.7 3.  4.2 1.2]
      [5.7 2.9 4.2 1.3]
      [6.2 2.9 4.3 1.3]
      [5.1 2.5 3.  1.1]
      [5.7 2.8 4.1 1.3]
      [6.3 3.3 6.  2.5]
      [5.8 2.7 5.1 1.9]
      [7.1 3.  5.9 2.1]
```

```
 [7.1 3.  5.9 2.1]
 [6.3 2.9 5.6 1.8]
 [6.5 3.  5.8 2.2]
 [7.6 3.  6.6 2.1]
 [4.9 2.5 4.5 1.7]
 [7.3 2.9 6.3 1.8]
 [6.7 2.5 5.8 1.8]
 [7.2 3.6 6.1 2.5]
 [6.5 3.2 5.1 2. ]
 [6.4 2.7 5.3 1.9]
 [6.8 3.  5.5 2.1]
 [5.7 2.5 5.  2. ]
 [5.8 2.8 5.1 2.4]
 [6.4 3.2 5.3 2.3]
 [6.5 3.  5.5 1.8]
 [7.7 3.8 6.7 2.2]
 [7.7 2.6 6.9 2.3]
 [6.  2.2 5.  1.5]
 [6.9 3.2 5.7 2.3]
 [5.6 2.8 4.9 2. ]
 [7.7 2.8 6.7 2. ]
 [6.3 2.7 4.9 1.8]
 [6.7 3.3 5.7 2.1]
 [7.2 3.2 6.  1.8]
 [6.2 2.8 4.8 1.8]
 [6.1 3.  4.9 1.8]
 [6.4 2.8 5.6 2.1]
 [7.2 3.  5.8 1.6]
 [7.4 2.8 6.1 1.9]
 [7.9 3.8 6.4 2. ]
 [6.4 2.8 5.6 2.2]
 [6.3 2.8 5.1 1.5]
 [6.1 2.6 5.6 1.4]
 [7.7 3.  6.1 2.3]
 [6.3 3.4 5.6 2.4]
 [6.4 3.1 5.5 1.8]
 [6.  3.  4.8 1.8]
 [6.9 3.1 5.4 2.1]
 [6.7 3.1 5.6 2.4]
 [6.9 3.1 5.1 2.3]
 [5.8 2.7 5.1 1.9]
 [6.8 3.2 5.9 2.3]
 [6.7 3.3 5.7 2.5]
 [6.7 3.  5.2 2.3]
 [6.3 2.5 5.  1.9]
 [6.5 3.  5.2 2. ]
 [6.2 3.4 5.4 2.3]
 [5.9 3.  5.1 1.8]]
```

```
print iris.target_names
```

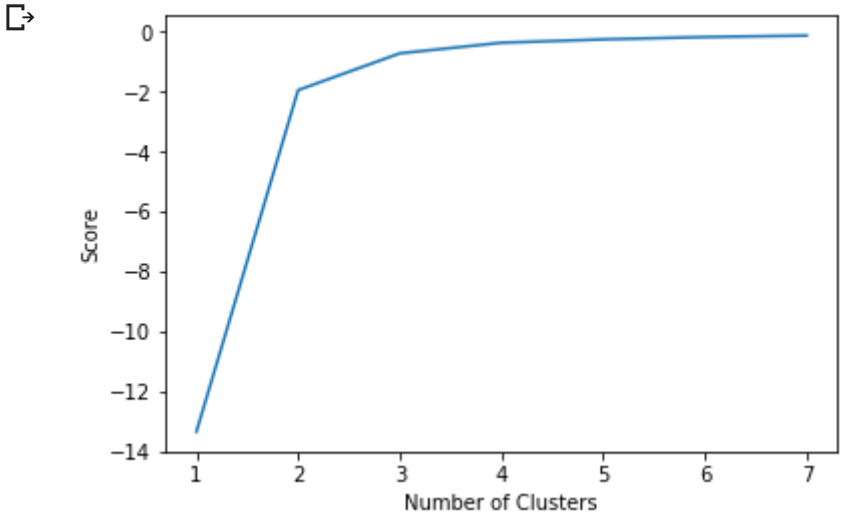
```
['setosa' 'versicolor' 'virginica']
```

```
print iris.target
```

```
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2
```

```
       2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
       2 2]
```

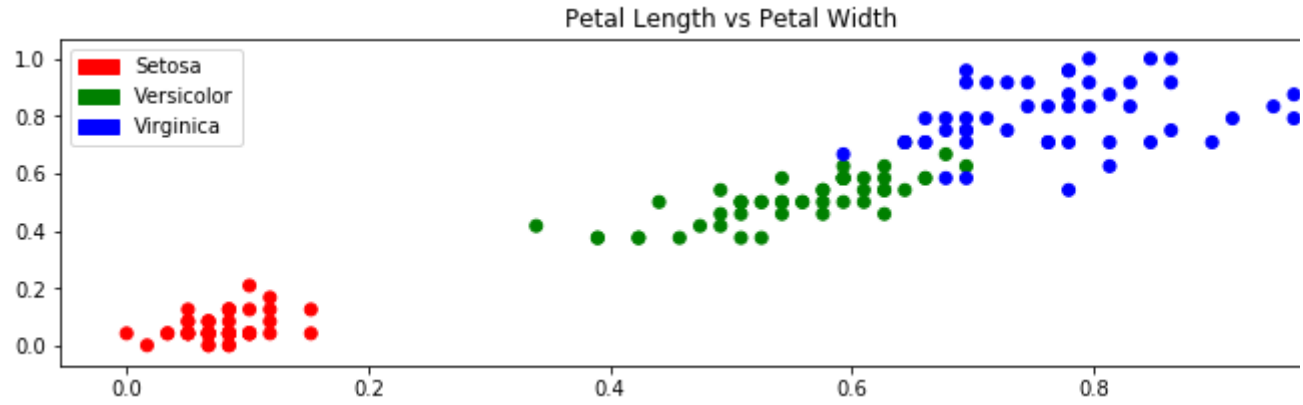
```
x = pd.DataFrame(iris.data, columns=['Sepal Length', 'Sepal Width', 'Petal Length', 'Petal
y = pd.DataFrame(iris.target, columns=['Target'])


def dataset_minmax(dataset):
  minmax = list()
  for i in range(len(dataset[0])):
    col_values = [row[i] for row in dataset]
    value_min = min(col_values)
    value_max = max(col_values)
    minmax.append([value_min, value_max])
  return minmax


# Scaling
x =  (x - x.min()) / (x.max() - x.min())


K_clusters = range(1,8)
kmeans = [KMeans(n_clusters=i) for i in K_clusters]
Y_axis = x[['Petal Length']]
X_axis = x[['Petal Width']]
score = [kmeans[i].fit(Y_axis).score(Y_axis) for i in range(len(kmeans))]
plt.plot(K_clusters, score)
plt.xlabel('Number of Clusters')
plt.ylabel('Score')
plt.show()
```




```
plt.figure(figsize=(12,3))
colors = np.array(['red', 'green', 'blue'])
iris_targets_legend = np.array(iris.target_names)
red_patch = mpatches.Patch(color='red', label='Setosa')
green_patch = mpatches.Patch(color='green', label='Versicolor')
blue_patch = mpatches.Patch(color='blue', label='Virginica')


plt.scatter(x['Petal Length'], x['Petal Width'], c= colors[y['Target']])
plt.title('Petal Length vs Petal Width')
```

```
plt.legend(handles=[red_patch, green_patch, blue_patch])
```

```
<matplotlib.legend.Legend at 0x7ffb71b54990>
```




```
iris_k_mean_model = KMeans(n_clusters=3)
iris_k_mean_model.fit(x)
```

```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
    n_clusters=3, n_init=10, n_jobs=None, precompute_distances='auto',
    random_state=None, tol=0.0001, verbose=0)
```

```
print iris_k_mean_model.labels_
```

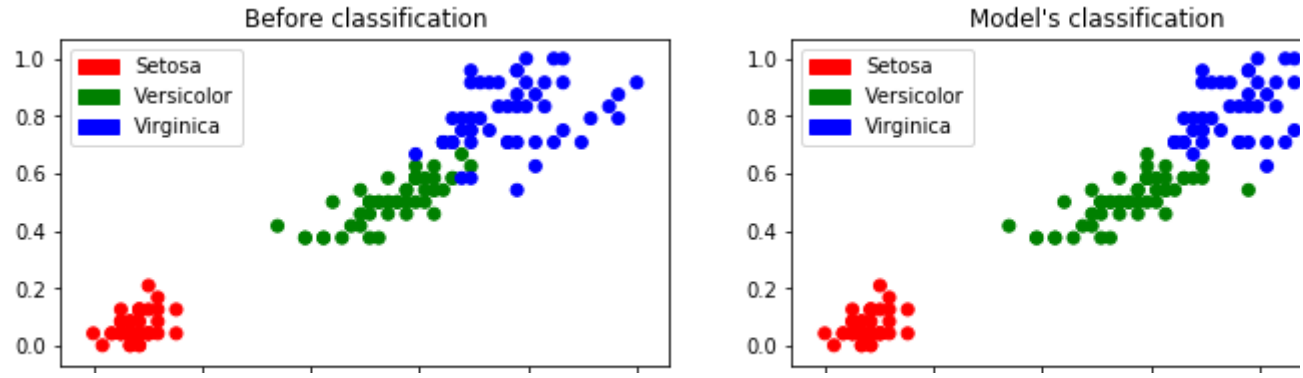
```
[1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0
 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 0 2 2 2 2
 2 2 2 2 2 2 2 2 0 2 2 2 2 2 2 2 2 2 2 2 2 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 2 2]
```

```
print iris_k_mean_model.cluster_centers_
```

```
[[0.55867014 0.51041667]
 [0.07830508 0.06083333]
 [0.7740113  0.81510417]]
```

```
plt.figure(figsize=(12,3))

colors = np.array(['red', 'green', 'blue'])

predictedY = np.choose(iris_k_mean_model.labels_, [1, 0, 2]).astype(np.int64)

plt.subplot(1, 2, 1)
plt.scatter(x['Petal Length'], x['Petal Width'], c=colors[y['Target']])
plt.title('Before classification')
plt.legend(handles=[red_patch, green_patch, blue_patch])

plt.subplot(1, 2, 2)
plt.scatter(x['Petal Length'], x['Petal Width'], c=colors[predictedY])
plt.title("Model's classification")
plt.legend(handles=[red_patch, green_patch, blue_patch])
```

```
<matplotlib.legend.Legend at 0x7ffb71b5ff10>
```




```
sm.accuracy_score(predictedY, y['Target'])
```

```
0.96
```

Interpretation of Confusion Matrix

Correctly identifed all 0 classes as 0's correctly classified 48 class 1's but miss-classified 2 class 1's as class 2 correctly classified 36 class 2's but miss-classified 14 class 2's as class 1

```
sm.confusion_matrix(predictedY, y['Target'])
```

```
array([[50,  0,  0],
       [ 0, 48,  4],
       [ 0,  2, 46]])
```

Conclusion

We have learnt how the K-means algorithm works and a method of finding the optimal number of clustering using the elbow method. The algorithm gives 96% accuracy on the Iris dataset clustering.

✓ 0s completed at 12:38 AM