A04

April 29, 2022

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import math
from sklearn.cluster import KMeans

points = pd.read_csv("Kmeans.csv")
```

[2]:
```
points
```

[2]:
```
      x     y
0  0.10  0.60
1  0.15  0.71
2  0.08  0.90
3  0.16  0.85
4  0.20  0.30
5  0.25  0.50
6  0.24  0.10
7  0.30  0.20
```

[3]:
```
X = np.array(points)
```

K-Means Clustering Implementation

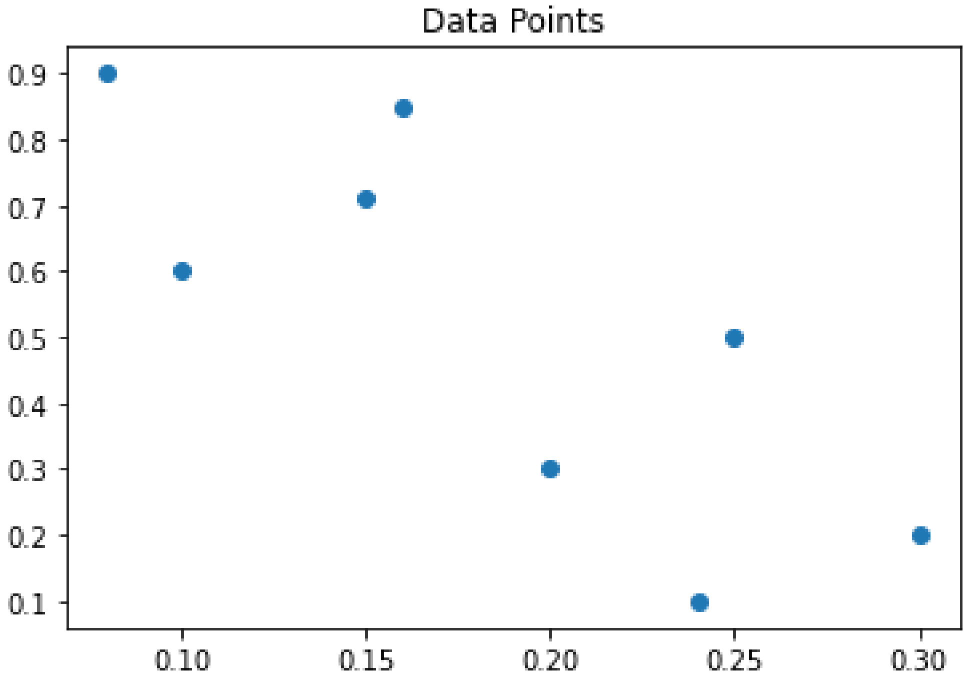
[4]:
```
def dist(A,B):
    xd=(A[0]-B[0])**2
    yd=(A[1]-B[1])**2
    d=math.sqrt(xd+yd)
    return d
```

[5]:
```
def cluster(C1,C2):
    cluster1=list()
    cluster2=list()
    c1=C1
    c2=C2
    for p in X:
        d1=dist(p,C1)
        d2=dist(p,C2)
```

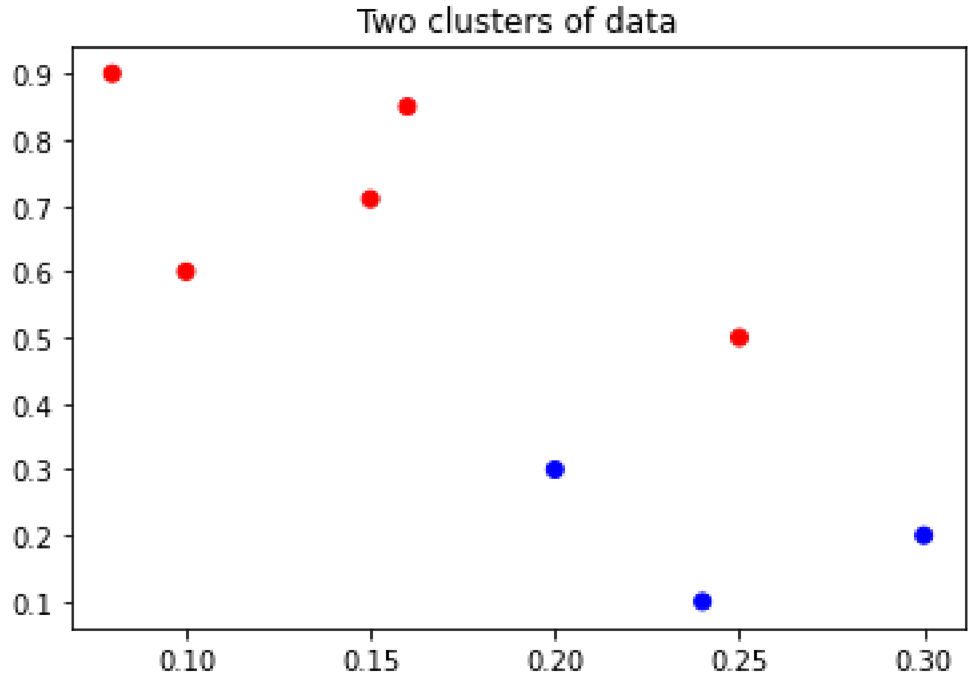
```
      if d1<d2:
        cluster1.append(p.tolist())
      else:
        cluster2.append(p.tolist())

  x1=0
  y1=0
  for i in cluster1:
      x1=x1+i[0]
      y1=y1+i[1]
  x1=x1/len(cluster1)
  y1=y1/len(cluster1)

  centroid1=[x1,y1]

  x2=0
  y2=0
  for i in cluster2:
      x2=x2+i[0]
      y2=y2+i[1]
  x2=x2/len(cluster2)
  y2=y2/len(cluster2)

  centroid2=[x2,y2]

  C1=centroid1
  C2=centroid2

  if centroid1[0]==c1[0] and centroid2[0]==c2[0] and centroid1[1]==c1[1] and centroid2[1]==c2[1]:
      print("Clusters are:")
      print(cluster1)
      print(cluster2)
      if [0.25,0.5] in cluster1:
        print("P6 belongs to cluster 1")
      elif [0.25,0.5] in cluster2:
        print("P6 belongs to cluster 2")
      print("Population of cluster around m2:",len(cluster2))
      print("Updated value of centroids:")
      print("C1:",C1)
      print("C2:",C2)
      P=list()
      for i in X:
        if i.tolist() in cluster1:
          P.append(0)
        else:
          P.append(1)
      # Generate scatter plot for training data
      colors = list(map(lambda x: 'blue' if x == 1 else 'red', P))
      plt.scatter(X[:,0], X[:,1], c=colors, marker="o")
      plt.title('Two clusters of data')
      plt.show()
  else:
      cluster(C1,C2)
```

[6]:

```
plt.scatter(X[:,0], X[:,1], marker="o")
plt.title('Data Points')
plt.show()
# print(X[0],X[7])
C1=X[0]
C2=X[7]
print("Points are:\n",X)
cluster(C1,C2)
```



```
Points are:
 [[0.1  0.6 ]
 [0.15 0.71]
 [0.08 0.9 ]
 [0.16 0.85]
 [0.2  0.3 ]
 [0.25 0.5 ]
 [0.24 0.1 ]
 [0.3  0.2 ]]
Clusters are:
[[0.1, 0.6], [0.15, 0.71], [0.08, 0.9], [0.16, 0.85], [0.25, 0.5]]
[[0.2, 0.3], [0.24, 0.1], [0.3, 0.2]]
P6 belongs to cluster 1
Population of cluster around m2: 3
Updated value of centroids:
C1: [0.148, 0.712]
C2: [0.24666666666666667, 0.20000000000000004]
```



K-Means Clustering using Scikit-Learn

[7]:
```
initial_centriods = np.array([
    [0.1,0.6],
    [0.3,0.2]
],np.float64)
```

[8]:
```
initial_centriods
```

[8]:
```
array([[0.1, 0.6],
       [0.3, 0.2]])
```

[9]:
```
km = KMeans(n_clusters=2,init=initial_centriods,n_init=1)
km.fit(points)
```

```
# y_pred = km.predict(X)
# print(y_pred)
```

[9]:

```
KMeans(init=array([[0.1, 0.6],
       [0.3, 0.2]]), n_clusters=2, n_init=1)
```

[10]:

```
print(km.labels_)
```

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

Which cluster does P6 belong to?

[11]:

```
cluster_index = km.labels_[5]                    #array is 0 indexed, so P6␣
 ↪will be present at 5th index
print("P6 belongs to cluster {}".format(cluster_index+1))
```

```
P6 belongs to cluster 1
```

What is the population of cluster around m2?

[12]:

```
count=0
for i in km.labels_:
    if i == 1:                              # "1" represents 2nd(M2) cluster
        count+=1
print("Population of Cluster around M2 is {}".format(count))
```

```
Population of Cluster around M2 is 3
```

What is updated value of m1 and m2?

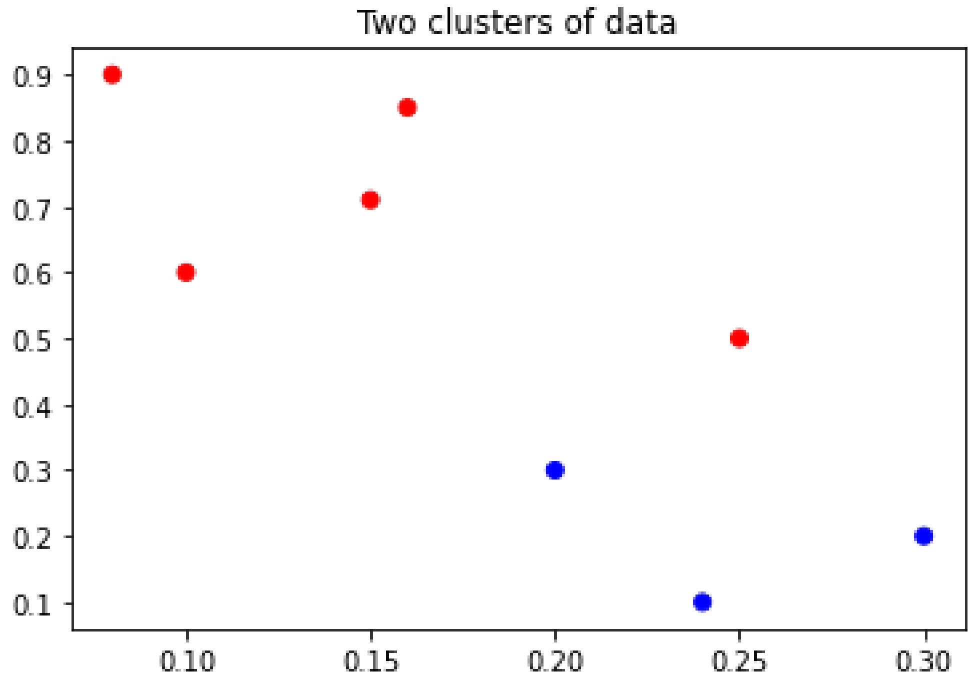
[13]:

```
print("Updated values of M1 and M2 are {} and {} respectively".format(km.
 ↪cluster_centers_[0],km.cluster_centers_[1]))
```

```
Updated values of M1 and M2 are [0.148 0.712] and [0.24666667 0.2       ]
respectively
```

[14]:

```
colors = list(map(lambda x: 'blue' if x == 1 else 'red', km.labels_))
plt.scatter(X[:,0], X[:,1], c=colors, marker="o")
plt.title('Two clusters of data')
plt.show()
```


Two clusters of data
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.10
0.15
0.20
0.25
0.30

[ ]: