Chapter 15 - Exercise 1: Iris (4 features)

Cho dữ liệu iris.xls

1. Chuẩn hóa dữ liệu X chứa 4 thuộc tính
2. Tìm số cụm phù hợp k?
3. Áp dụng thuật toán GMM để giải bài toán phân cụm với số cụm k
4. Cho X_test = np.array([[4.7, 3.2, 1.5, 0.4], [4.8, 3.5, 4.5,1.6], [6.1, 3.5, 5.7,2]]), cho biết phần tử này thuộc cụm nào?
5. Vẽ hình, xem kết quả

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.mixture import GaussianMixture
```

In [2]:
```
data = pd.read_excel('iris.xls')
```

In [3]:
```
data.info()
```

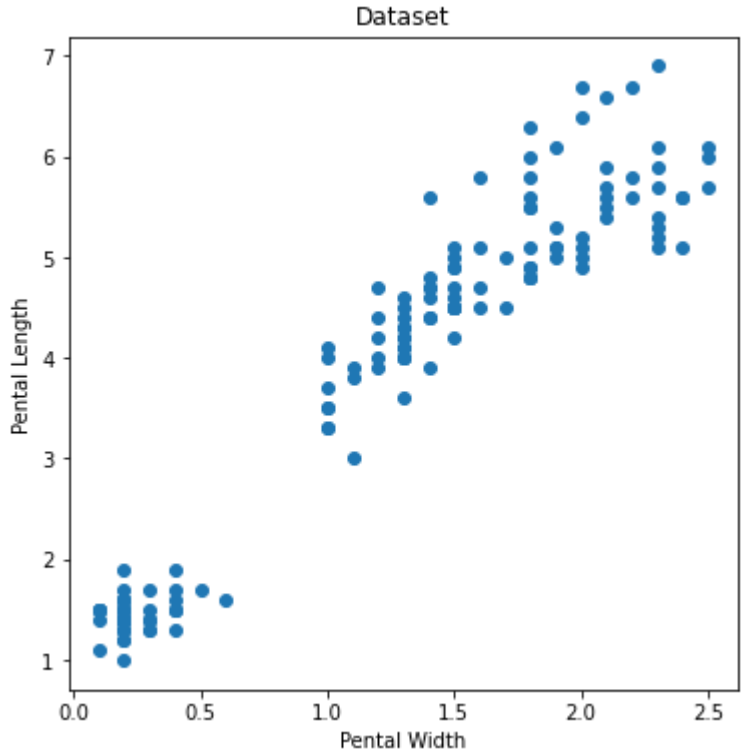
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
sepallength    150 non-null float64
sepalwidth     150 non-null float64
petallength    150 non-null float64
petalwidth     150 non-null float64
iris           150 non-null object
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

In [4]:
```
data.head()
```

Out[4]:

	sepallength	sepalwidth	petallength	petalwidth	iris
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

In [5]:
```
plt.figure(figsize=(6,6))
plt.scatter(data.petalwidth, data.petallength)
plt.title('Dataset')
plt.ylabel("Pental Length")
plt.xlabel("Pental Width")
plt.show()
```



In [6]:
```
X_train = data.drop('iris', axis = 1)
```

In [7]:
```
from sklearn import metrics
list_sil = [] # chua danh sach cac gia tri sil
K = range(2,8) # chua danh sach cac k
for k in K:
    gmm = GaussianMixture(n_components=k) # 2, 3, 4...
    gmm.fit(X_train)
    labels = gmm.predict(X_train)
    # k = 2 => 0, 1
    # k = 3 => 0, 1, 2
    sil = metrics.silhouette_score(X_train, labels, metric='euclidean')
    list_sil.append(sil)
```

In [8]:
```
# Plot
plt.plot(K, list_sil, 'bx-')
plt.xlabel('k')
plt.ylabel('sil_score')
plt.title('The silhouette_score & k')
plt.show()
```

In [9]:
```
# Select k = 2
gmm = GaussianMixture(n_components=2)
gmm.fit(X_train)
```

Out[9]:
```
GaussianMixture(covariance_type='full', init_params='kmeans', max_iter=100,
                means_init=None, n_components=2, n_init=1, precisions_init=Non
e,
                random_state=None, reg_covar=1e-06, tol=0.001, verbose=0,
                verbose_interval=10, warm_start=False, weights_init=None)
```

Sau khi model đã hội tụ, weights, means, và covariances cần phải được giải quyết. In các thông số này:

In [10]:
```
print(gmm.weights_)
```

```
[0.66667166 0.33332834]
```

In [11]:
```
print(gmm.means_)
```

```
[[6.2619868  2.87199575 4.90597298 1.67598968]
 [5.00600757 3.41801668 1.46400244 0.24399917]]
```

In [12]:
```
print(gmm.covariances_)
```

```
[[[0.43497698 0.12094258 0.44887221 0.16550493]
  [0.12094258 0.10961862 0.14138226 0.07923325]
  [0.44887221 0.14138226 0.67485733 0.28587905]
  [0.16550493 0.07923325 0.28587905 0.17863786]]

 [[0.12176299 0.09828504 0.015815   0.01033657]
  [0.09828504 0.14226051 0.01144544 0.0112091 ]
  [0.015815   0.01144544 0.02950504 0.00558422]
  [0.01033657 0.0112091  0.00558422 0.01126512]]]
```

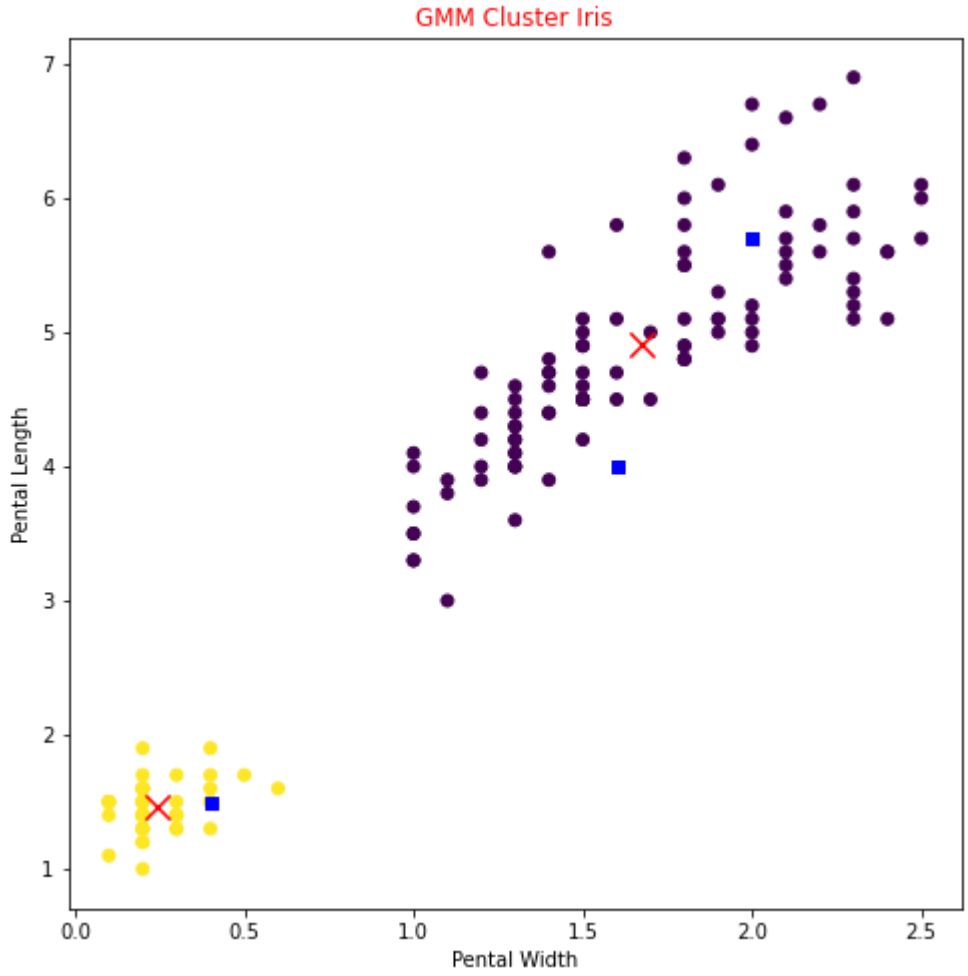
In [13]:
```
types = gmm.predict(X_train)
```

In [14]:
```
X_now = np.array([[4.7, 3.2, 1.5, 0.4], [4.8, 3.5, 4.0,1.6], [6.1, 3.5, 5.7,2]])
y_now = gmm.predict(X_now)
y_now
```

Out[14]:
```
array([1, 0, 0], dtype=int64)
```

In [15]:
```
# plot mixture of Gaussians
plt.figure(figsize=(8,8))

plt.scatter(X_train['petalwidth'], X_train['petallength'], c=types)
plt.scatter(X_now[:,3], X_now[:,2], marker="s", c='b')
plt.scatter(gmm.means_[:,3], gmm.means_[:,2], color="red", marker='x', s=150)
plt.xlabel("Pental Width")
plt.ylabel("Pental Length")
plt.title("GMM Cluster Iris", color="red")
plt.show()
```



In [16]:
```
# Có nhận xét gì cho kết quả này?
```