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Assignment 3.3

Import the required libraries

```
[51]: import matplotlib.pyplot as plt
import numpy as np
from sklearn import datasets
from sklearn.cluster import KMeans
from sklearn.decomposition import PCA
from sklearn.metrics import adjusted_rand_score
```

Load the Iris datasets

```
[10]: # Load the Iris dataset
iris_data = datasets.load_iris()
x = iris_data.data
y = iris_data.target
```

Use Elbow method to find optimal number of clusters

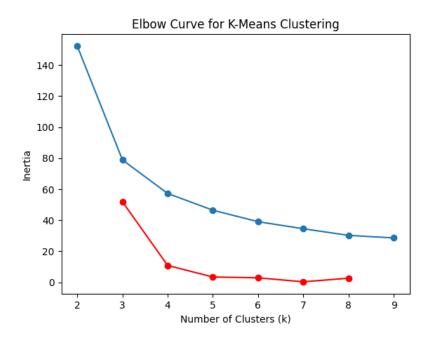
```
[33]: # Using Elbow method to determine the optimal number of clusters
k_values = []
inertia_scores = []

for k in range(2, 10):
    model = KMeans(n_clusters=k)
    model.fit(x)
    inertia_scores.append(model.inertia_)
    k_values.append(k)

module_of_second_derivative = np.abs(np.diff(np.diff(inertia_scores)))

# Plotting the Elbow curve
plt.plot(k_values, inertia_scores)
plt.scatter(k_values, inertia_scores)
plt.scatter(k_values, inertia_scores)
plt.plot(k_values[1:-1], module_of_second_derivative, color='red')
plt.scatter(k_values[1:-1], module_of_second_derivative, color='red')
plt.slabel("Mumber of Clusters (k)")
plt.ylabel("Inertia")
plt.title("Elbow Curve for K-Means Clustering")
```

C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning wainings.wan.langs.wan.local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning warnings.warn(C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning warnings.warn(C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n init` explicitly to suppress the warning C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning warnings.warn(C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning warnings.warn(C:\Users\LENOVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning worlings.won/my C:\Users\LENDVO\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\cluster_kmeans.py:870: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning warnings.warn(

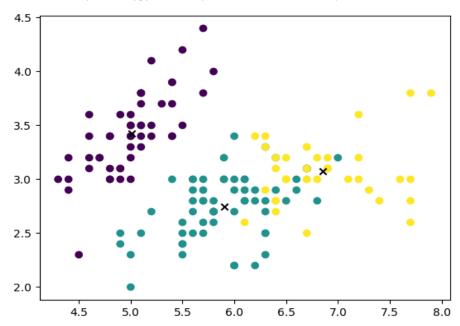


And from plot it is observed the sharp curves appear at k=3

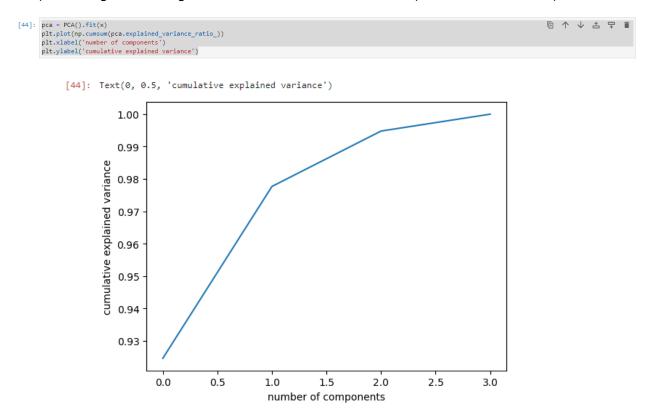
Now, Applying KMean on original dataset

```
[72]: #performing K-mean cluster on original dataset
model = KNeans(n_clusters=3 ,n_init=1,max_iter=100)
model.fit(x)
y_pred= model.predict(x)
centroids = model.cluster_centers_
plt.scatter(x[:,0], x[:,1], c= y_pred)
plt.scatter(centroids[:,0], centroids[:,1], marker = 'x', color = 'black')
plt.show
```

[72]: <function matplotlib.pyplot.show(close=None, block=None)>



For performing PCA on original dataset, we have to choose the optimal number of components



We can see that more than 99% of the variance is contained in the first 2 components

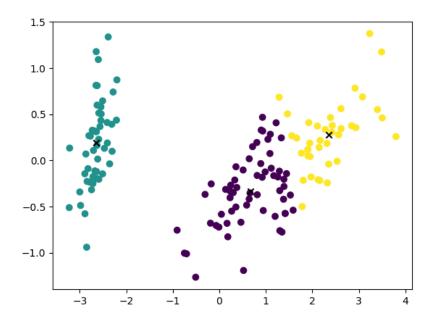
Applying PCA on Original dataset with two number of components

Applying KMean on reduced dataset

Apply KMean on reduced dataset

```
[64]: model_pca = KMeans(n_clusters=3, n_init =1, max_iter=100)

model_pca.fit(x_reduced)
y_red_pca = model_pca.predict(x_reduced)
centroid_pca = model_pca.cluster_centers_
plt.scatter(x_red[;,0], x_red[;,1], c= y_pred_pca)
plt.scatter(centroid_pca[:,0],centroid_pca[:,1], marker='x',color = 'black')
plt.show()
```



Now comparing both plot before and after PCA using Adjusted_rand_score

```
[74]: adj_rand_score = adjusted_rand_score(y_pred, y_pred_pca)
print(f"Adjusted Rand Score: {adj_rand_score: .4f}")

Adjusted Rand Score: 0.9803
```

The adjusted Rand score of 0.9803 indicates a high level of agreement between the cluster assignments obtained from K-means clustering on the original dataset and the PCA-reduced dataset