week9

September 25, 2024

[7]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[8]:

```
data = pd.read_csv('C:/Users/HP/Downloads/Mall_Customers.csv')
print(data.shape)
```

```
(200, 5)
```

[9]:

```
 data = data.drop('CustomerID',axis=1)
data
```

[9]:

```
      Genre  Age  Annual Income (k$)  Spending Score (1-100)
0      Male   19                  15                      39
1      Male   21                  15                      81
2    Female   20                  16                       6
3    Female   23                  16                      77
4    Female   31                  17                      40
..      …    …                 …                     …
195  Female   35                 120                      79
196  Female   45                 126                      28
197    Male   32                 126                      74
198    Male   32                 137                      18
199    Male   30                 137                      83

[200 rows x 4 columns]
```

[10]:

```
data.head()
```

[10]:

```
    Genre  Age  Annual Income (k$)  Spending Score (1-100)
0    Male   19                  15                      39
1    Male   21                  15                      81
2  Female   20                  16                       6
```

```
3   Female   23                 16                       77
4   Female   31                 17                       40
```

```
[11]: data.describe()
```

```
[11]:              Age  Annual Income (k$)  Spending Score (1-100)
      count  200.000000          200.000000              200.000000
      mean    38.850000           60.560000               50.200000
      std     13.969007           26.264721               25.823522
      min     18.000000           15.000000                1.000000
      25%     28.750000           41.500000               34.750000
      50%     36.000000           61.500000               50.000000
      75%     49.000000           78.000000               73.000000
      max     70.000000          137.000000               99.000000
```

```
[12]: from sklearn.preprocessing import LabelEncoder
      label_encoder = LabelEncoder()
      #data['Genre']= label_encoder.fit_transform(data['Gnere'])
      data
```

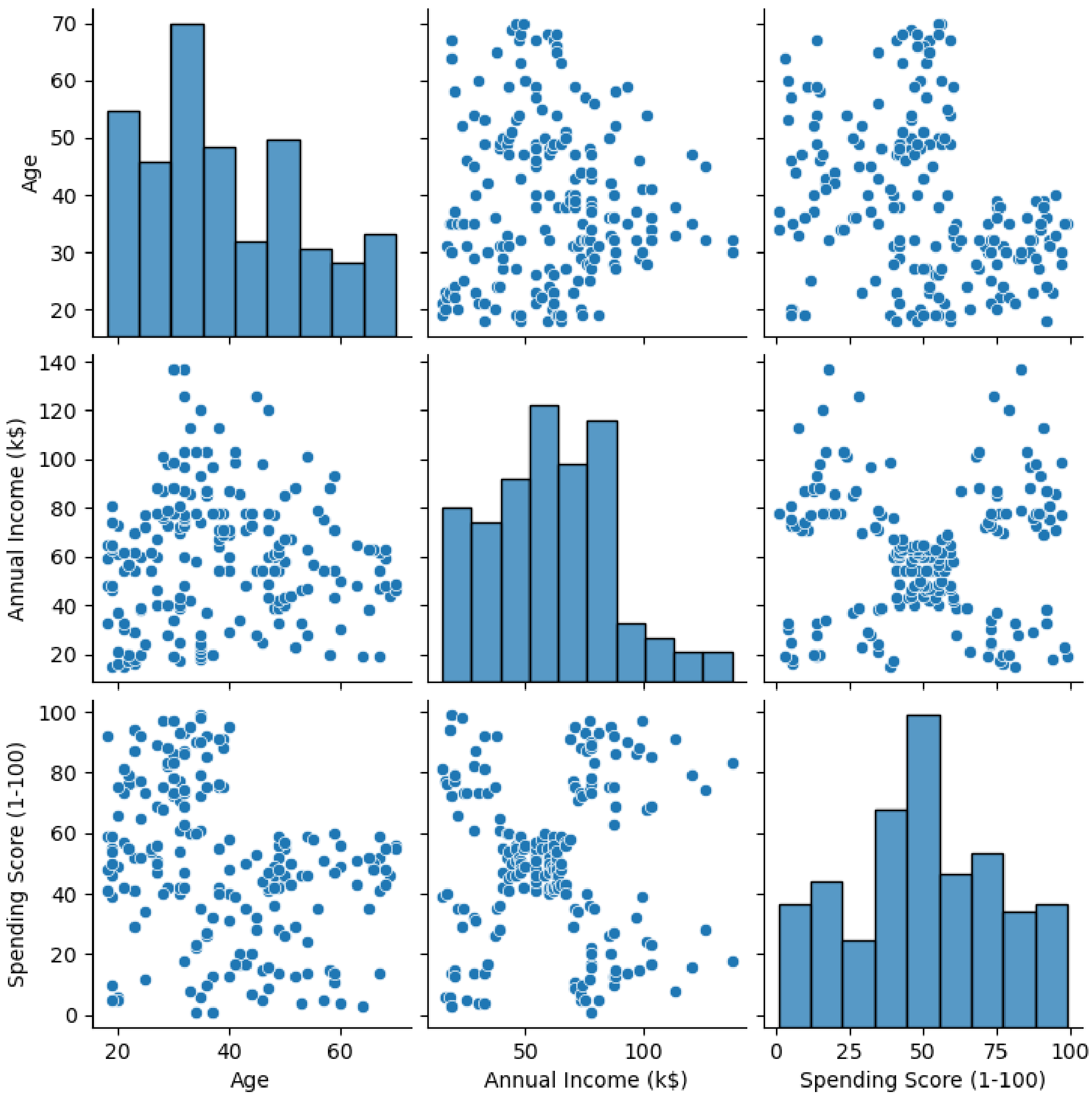
```
[12]:       Genre  Age  Annual Income (k$)  Spending Score (1-100)
      0      Male   19                  15                      39
      1      Male   21                  15                      81
      2    Female   20                  16                       6
      3    Female   23                  16                      77
      4    Female   31                  17                      40
      ..      …   …                 …                     …
      195  Female   35                 120                      79
      196  Female   45                 126                      28
      197    Male   32                 126                      74
      198    Male   32                 137                      18
      199    Male   30                 137                      83

      [200 rows x 4 columns]
```

```
[13]: sns.pairplot(data)
```

```
C:\Users\HP\anaconda3\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning:
The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

```
[13]: <seaborn.axisgrid.PairGrid at 0x260f4823510>
```



[14]:
```
x = data.iloc[:, 2:4].values
print(x.shape)
x
```

```
(200, 2)
```

[14]:
```
array([[ 15,  39],
       [ 15,  81],
       [ 16,   6],
       [ 16,  77],
       [ 17,  40],
       [ 17,  76],
       [ 18,   6],
       [ 18,  94],
       [ 19,   3],
       [ 19,  72],
       [ 19,  14],
       [ 19,  99],
       [ 20,  15],
       [ 20,  77],
       [ 20,  13],
       [ 20,  79],
       [ 21,  35],
       [ 21,  66],
       [ 23,  29],
       [ 23,  98],
       [ 24,  35],
       [ 24,  73],
       [ 25,   5],
       [ 25,  73],
       [ 28,  14],
       [ 28,  82],
       [ 28,  32],
       [ 28,  61],
       [ 29,  31],
       [ 29,  87],
       [ 30,   4],
       [ 30,  73],
       [ 33,   4],
       [ 33,  92],
       [ 33,  14],
       [ 33,  81],
       [ 34,  17],
       [ 34,  73],
       [ 37,  26],
       [ 37,  75],
       [ 38,  35],
       [ 38,  92],
       [ 39,  36],
       [ 39,  61],
       [ 39,  28],
       [ 39,  65],
       [ 40,  55],
       [ 40,  47],
       [ 40,  42],
       [ 40,  42],
       [ 42,  52],
       [ 42,  60],
       [ 43,  54],
       [ 43,  60],
       [ 43,  45],
       [ 43,  41],
       [ 44,  50],
       [ 44,  46],
       [ 46,  51],
       [ 46,  46],
       [ 46,  56],
       [ 46,  55],
       [ 47,  52],
       [ 47,  59],
       [ 48,  51],
       [ 48,  59],
       [ 48,  50],
       [ 48,  48],
       [ 48,  59],
       [ 48,  47],
       [ 49,  55],
       [ 49,  42],
       [ 50,  49],
       [ 50,  56],
       [ 54,  47],
       [ 54,  54],
       [ 54,  53],
       [ 54,  48],
       [ 54,  52],
       [ 54,  42],
       [ 54,  51],
       [ 54,  55],
       [ 54,  41],
       [ 54,  44],
       [ 54,  57],
       [ 54,  46],
       [ 57,  58],
       [ 57,  55],
       [ 58,  60],
       [ 58,  46],
       [ 59,  55],
       [ 59,  41],
       [ 60,  49],
       [ 60,  40],
       [ 60,  42],
       [ 60,  52],
       [ 60,  47],
       [ 60,  50],
       [ 61,  42],
       [ 61,  49],
       [ 62,  41],
       [ 62,  48],
       [ 62,  59],
       [ 62,  55],
       [ 62,  56],
       [ 62,  42],
       [ 63,  50],
       [ 63,  46],
       [ 63,  43],
       [ 63,  48],
       [ 63,  52],
       [ 63,  54],
       [ 64,  42],
       [ 64,  46],
       [ 65,  48],
       [ 65,  50],
       [ 65,  43],
       [ 65,  59],
       [ 67,  43],
       [ 67,  57],
       [ 67,  56],
       [ 67,  40],
       [ 69,  58],
       [ 69,  91],
       [ 70,  29],
       [ 70,  77],
       [ 71,  35],
       [ 71,  95],
       [ 71,  11],
       [ 71,  75],
       [ 71,   9],
       [ 71,  75],
       [ 72,  34],
       [ 72,  71],
       [ 73,   5],
       [ 73,  88],
       [ 73,   7],
       [ 73,  73],
       [ 74,  10],
       [ 74,  72],
       [ 75,   5],
       [ 75,  93],
       [ 76,  40],
       [ 76,  87],
       [ 77,  12],
       [ 77,  97],
       [ 77,  36],
       [ 77,  74],
       [ 78,  22],
       [ 78,  90],
       [ 78,  17],
       [ 78,  88],
       [ 78,  20],
       [ 78,  76],
       [ 78,  16],
       [ 78,  89],
       [ 78,   1],
       [ 78,  78],
       [ 78,   1],
       [ 78,  73],
       [ 79,  35],
       [ 79,  83],
       [ 81,   5],
       [ 81,  93],
       [ 85,  26],
       [ 85,  75],
       [ 86,  20],
       [ 86,  95],
       [ 87,  27],
       [ 87,  63],
       [ 87,  13],
       [ 87,  75],
       [ 87,  10],
       [ 87,  92],
       [ 88,  13],
       [ 88,  86],
       [ 88,  15],
       [ 88,  69],
       [ 93,  14],
       [ 93,  90],
       [ 97,  32],
       [ 97,  86],
       [ 98,  15],
       [ 98,  88],
       [ 99,  39],
       [ 99,  97],
       [101,  24],
       [101,  68],
       [103,  17],
       [103,  85],
       [103,  23],
       [103,  69],
       [113,   8],
       [113,  91],
       [120,  16],
       [120,  79],
       [126,  28],
       [126,  74],
       [137,  18],
       [137,  83]], dtype=int64)
```

[15]:

```
from sklearn.cluster import KMeans
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter = 300, n_init␣
 ↪= 10, random_state = 0)
    kmeans.fit(x)
    wcss.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss)
plt.title('The Elbow Method')
plt.xlabel('No. of Clusters')
plt.ylabel('wcss')
plt.show()
```

```
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
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C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
```

```
  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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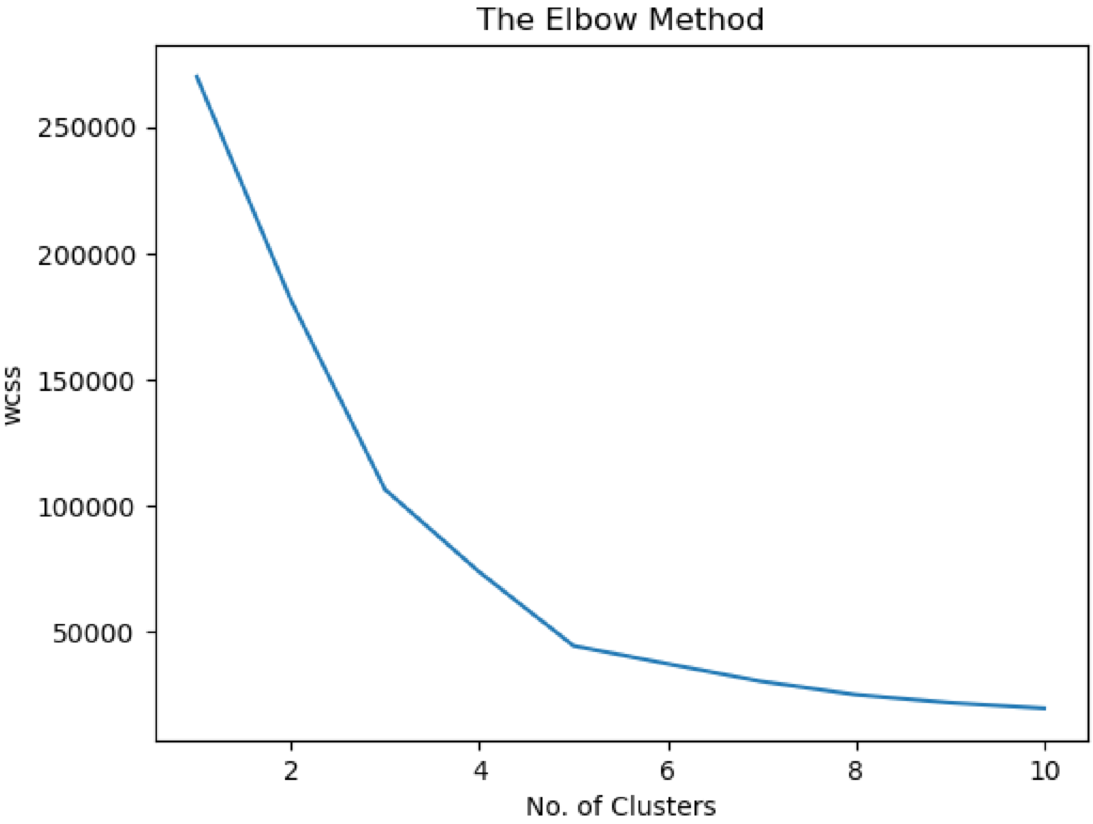
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```



```
[16]: km1 = KMeans(n_clusters = 5, init = 'k-means++', max_iter = 300, n_init = 10,␣
        ↪random_state = 0)
      y_means = km1.fit_predict(x)
```

```
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

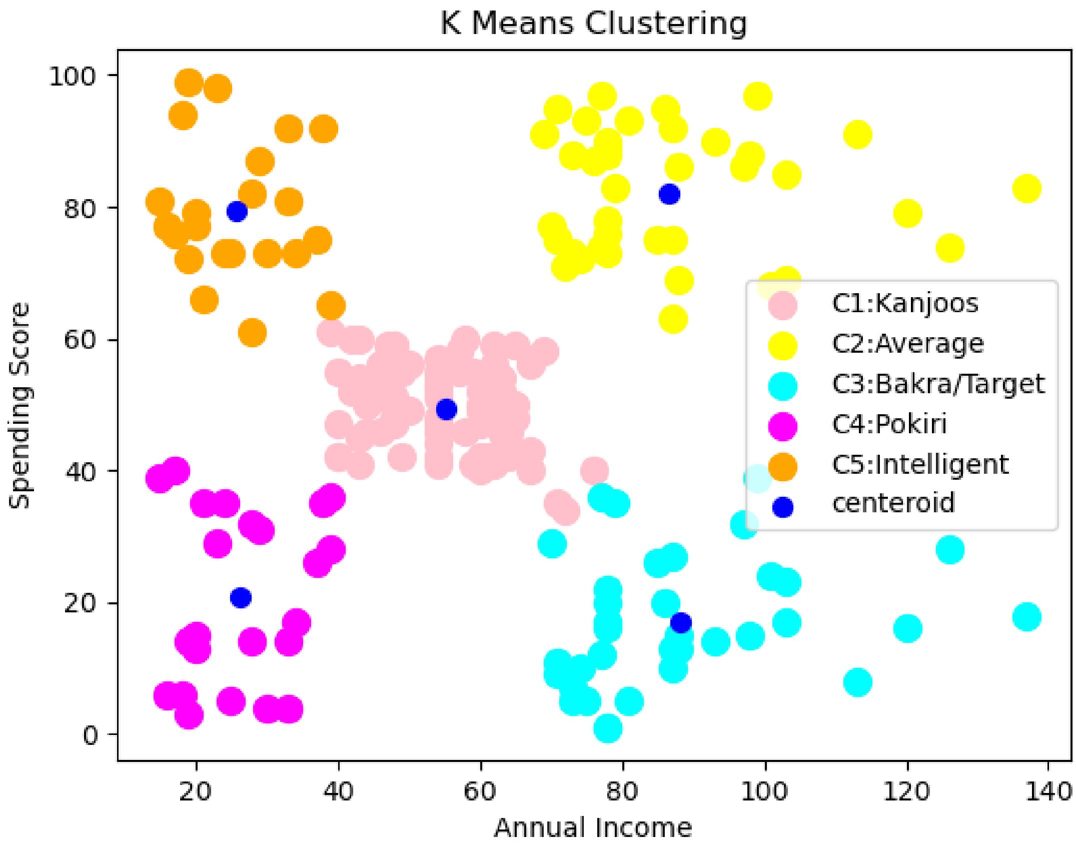
```
[17]: y_means
```

```
[17]: array([3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4,
             3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 0,
             3, 4, 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, 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, 2, 1, 0, 1, 2, 1, 2, 1,
             0, 1, 2, 1, 2, 1, 2, 1, 2, 1, 0, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
             2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
             2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1,
             2, 1])
```

```
[18]: km1.cluster_centers_
```

```
[18]: array([[55.2962963 , 49.51851852],
             [86.53846154, 82.12820513],
             [88.2       , 17.11428571],
             [26.30434783, 20.91304348],
             [25.72727273, 79.36363636]])
```

```
[19]: plt.scatter(x[y_means == 0, 0], x[y_means == 0, 1], s = 100, c = 'pink', label␣
        ↪= 'C1:Kanjoos')
      plt.scatter(x[y_means == 1, 0], x[y_means == 1, 1], s = 100, c = 'yellow',␣
        ↪label = 'C2:Average')
      plt.scatter(x[y_means == 2, 0], x[y_means == 2, 1], s = 100, c = 'cyan', label␣
        ↪= 'C3:Bakra/Target')
      plt.scatter(x[y_means == 3, 0], x[y_means == 3, 1], s = 100, c = 'magenta',␣
        ↪label = 'C4:Pokiri')
      plt.scatter(x[y_means == 4, 0], x[y_means == 4, 1], s = 100, c = 'orange',␣
        ↪label = 'C5:Intelligent')
      plt.scatter(km1.cluster_centers_[:,0], km1.cluster_centers_[:, 1], s = 50, c =␣
        ↪'blue' , label = 'centeroid')
      plt.title('K Means Clustering')
      plt.xlabel('Annual Income')
      plt.ylabel('Spending Score')
      plt.legend()
plt.show()
```



[20]:
```
x[y_means == 1, 0]
```

[20]:
```
array([ 69,  70,  71,  71,  71,  72,  73,  73,  74,  75,  76,  77,  77,
        78,  78,  78,  78,  78,  78,  79,  81,  85,  86,  87,  87,  87,
        88,  88,  93,  97,  98,  99, 101, 103, 103, 113, 120, 126, 137],
      dtype=int64)
```

[21]:
```
km1.inertia_
```

[21]:
```
44448.4554479337
```

[22]:
```
km1.cluster_centers_
```

[22]:
```
array([[55.2962963 , 49.51851852],
       [86.53846154, 82.12820513],
       [88.2       , 17.11428571],
       [26.30434783, 20.91304348],
       [25.72727273, 79.36363636]])
```

[23]:
```
x = data.iloc[:, [1, 3]].values
x.shape
```

[23]:
```
(200, 2)
```

[24]:
```
data.columns
```

[24]:
```
Index(['Genre', 'Age', 'Annual Income (k$)', 'Spending Score (1-100)'],
dtype='object')
```

[26]:
```
from sklearn.cluster import KMeans
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter = 300, n_init␣
 ↪= 10, random_state = 0)
    kmeans.fit(x)
    wcss.append(kmeans.inertia_)
plt.rcParams['figure.figsize'] = (7, 5)
plt.plot(range(1, 11), wcss)
plt.title('K-Means Clustering(The Elbow Method)', fontsize = 20)
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```

```
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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```
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C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
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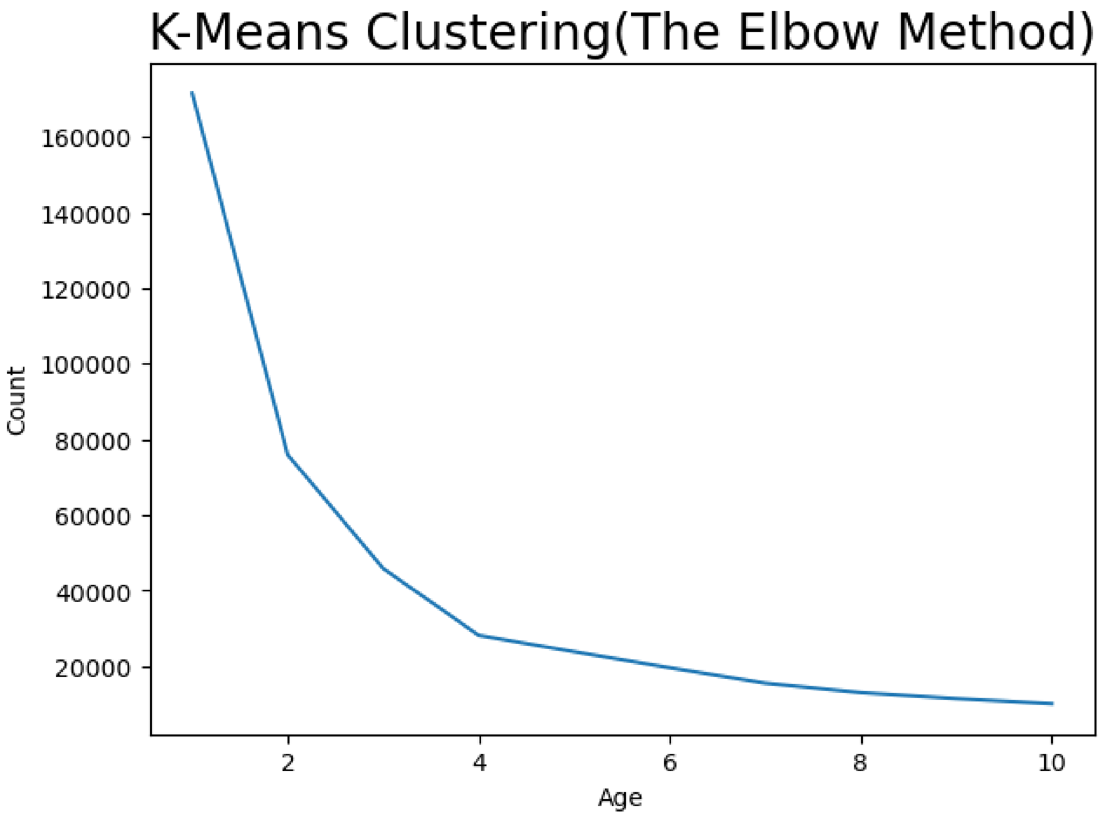
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

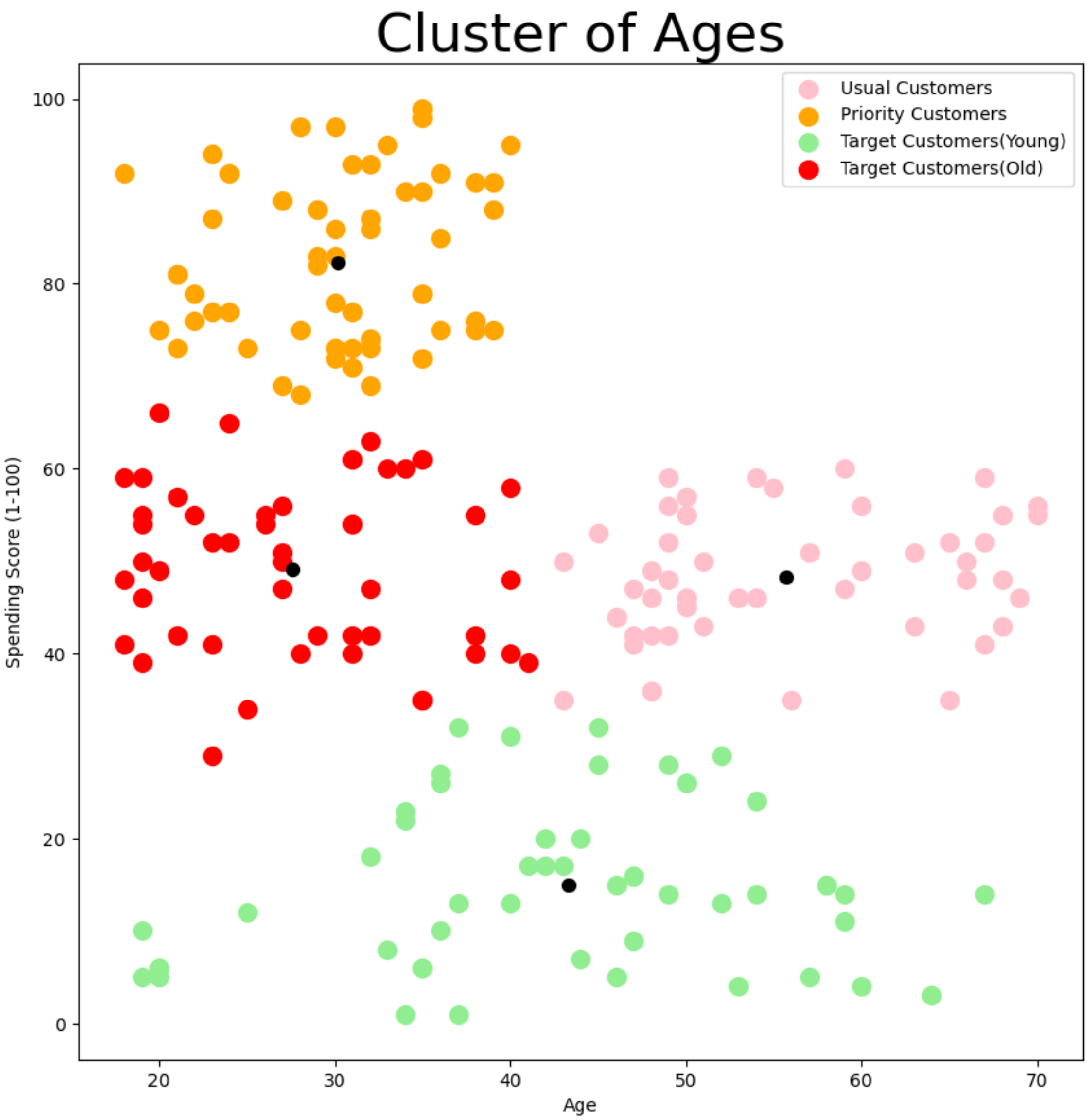


[25]:

```
km2 = KMeans(n_clusters = 4, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
ymeans = km2.fit_predict(x)
plt.rcParams['figure.figsize'] = (10, 10)
plt.title('Cluster of Ages', fontsize = 30)
plt.scatter(x[ymeans == 0, 0], x[ymeans == 0, 1], s = 100, c = 'pink', label = 'Usual Customers' )
plt.scatter(x[ymeans == 1, 0], x[ymeans == 1, 1], s = 100, c = 'orange', label = 'Priority Customers')
plt.scatter(x[ymeans == 2, 0], x[ymeans == 2, 1], s = 100, c = 'lightgreen', label = 'Target Customers(Young)')
plt.scatter(x[ymeans == 3, 0], x[ymeans == 3, 1], s = 100, c = 'red', label = 'Target Customers(Old)')
plt.scatter(km2.cluster_centers_[:, 0], km2.cluster_centers_[:, 1], s = 50, c = 'black')
plt.xlabel('Age')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```

```
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1436:
```

```
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when
there are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```



[26]:

```python
x = data.iloc[:, [0, 3]].values
x.shape
```

[26]:

```
(200, 2)
```

[ ]: