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

```
import os
os.getcwd()
```

```
     '/content'
```

```
from sklearn.metrics import ConfusionMatrixDisplay,accuracy_score,classification_report
from sklearn.model_selection import train_test_split,cross_val_score
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
```

```
df=pd.read_csv('/content/archive mall.zip')
```

```
df.head()
```

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

```
df.shape
```

```
     (200, 5)
```

```
x=df.iloc[:,3:]
```

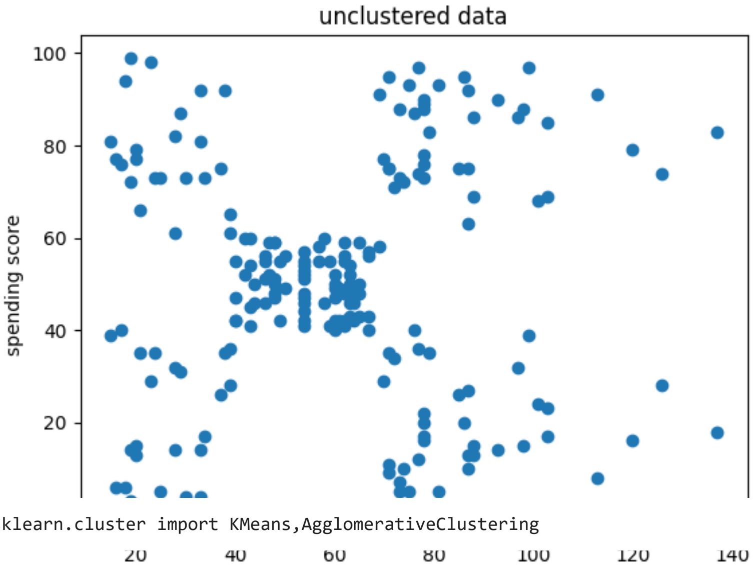
```
x
```

	Annual Income (k$)	Spending Score (1-100)
0	15	39
1	15	81
2	16	6
3	16	77
4	17	40
...	...	...
195	120	79
196	126	28
197	126	74
198	137	18
199	137	83

200 rows × 2 columns

```
plt.title('unclustered data')
plt.xlabel('annual income')
plt.ylabel('spending score')
plt.scatter(x['Annual Income (k$)'],x['Spending Score (1-100)'])
```

```
<matplotlib.collections.PathCollection at 0x7a45ad1ed960>
```



```
from sklearn.cluster import KMeans,AgglomerativeClustering
```

```
sse=[]
```

```
for k in range(1,16):
  km=KMeans(n_clusters=k)
  km.fit_predict(x)
  sse.append(km.inertia_)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from
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/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from
  warnings.warn(
```
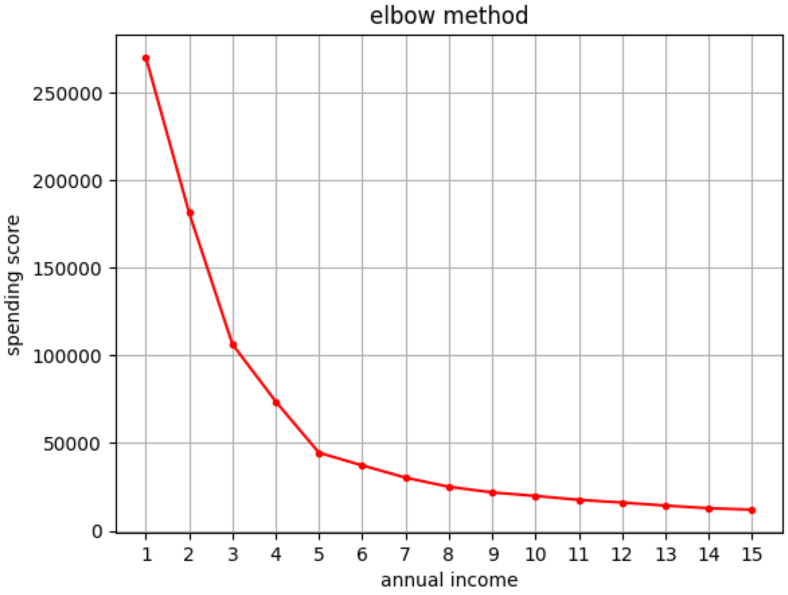

```
sse
```

```
[269981.28,
 181363.59595959593,
 106348.37306211122,
 73679.78903948836,
 44448.4554479337,
 37233.814510710006,
 30241.34361793658,
 25043.970949607214,
 21818.114588452176,
 19829.031646581996,
 17602.19046838677,
 16049.714149902382,
 14314.980233818465,
 12816.898555873555,
 11995.506623278681]
```

```
plt.title('elbow method')
plt.xlabel('annual income')
plt.ylabel('spending score')
plt.grid()
plt.xticks(range(1,16))
plt.plot(range(1,16),sse,marker='.',color='r')
```

```
[<matplotlib.lines.Line2D at 0x7a45acba4f40>]
```



```
silh=[]
```

```
from sklearn.metrics.cluster import silhouette_score
for k in range(2,16):
  km=KMeans(n_clusters=k)
  labels=km.fit_predict(x)
  score=silhouette_score(x,labels)
  silh.append(score)
```

```
y: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 suppr

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```
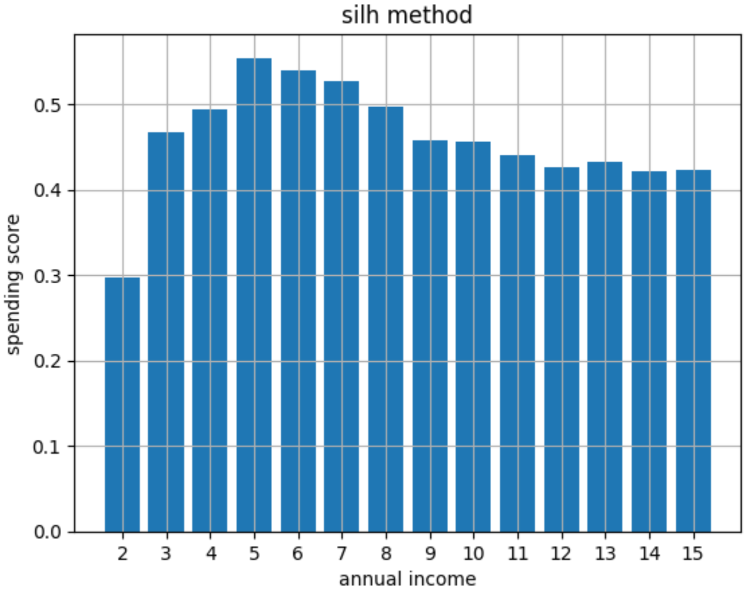

```
silh
```

```
[0.2968969162503008,
 0.46761358158775435,
 0.4931963109249047,
 0.553931997444648,
 0.53976103063432,
 0.5270287298101395,
 0.4976260414857619,
 0.45819645551960536,
 0.45575852895571267,
 0.4395970285642804,
 0.4263917088390977,
 0.43211339472104393,
 0.42200427744178964,
 0.4235485715125881]
```

```
plt.title('silh method')
plt.xlabel('annual income')
plt.ylabel('spending score')
plt.grid()
plt.xticks(range(2,16))
plt.bar(range(2,16),silh)
```

```
<BarContainer object of 14 artists>
```



```
km=KMeans(n_clusters=5)
```

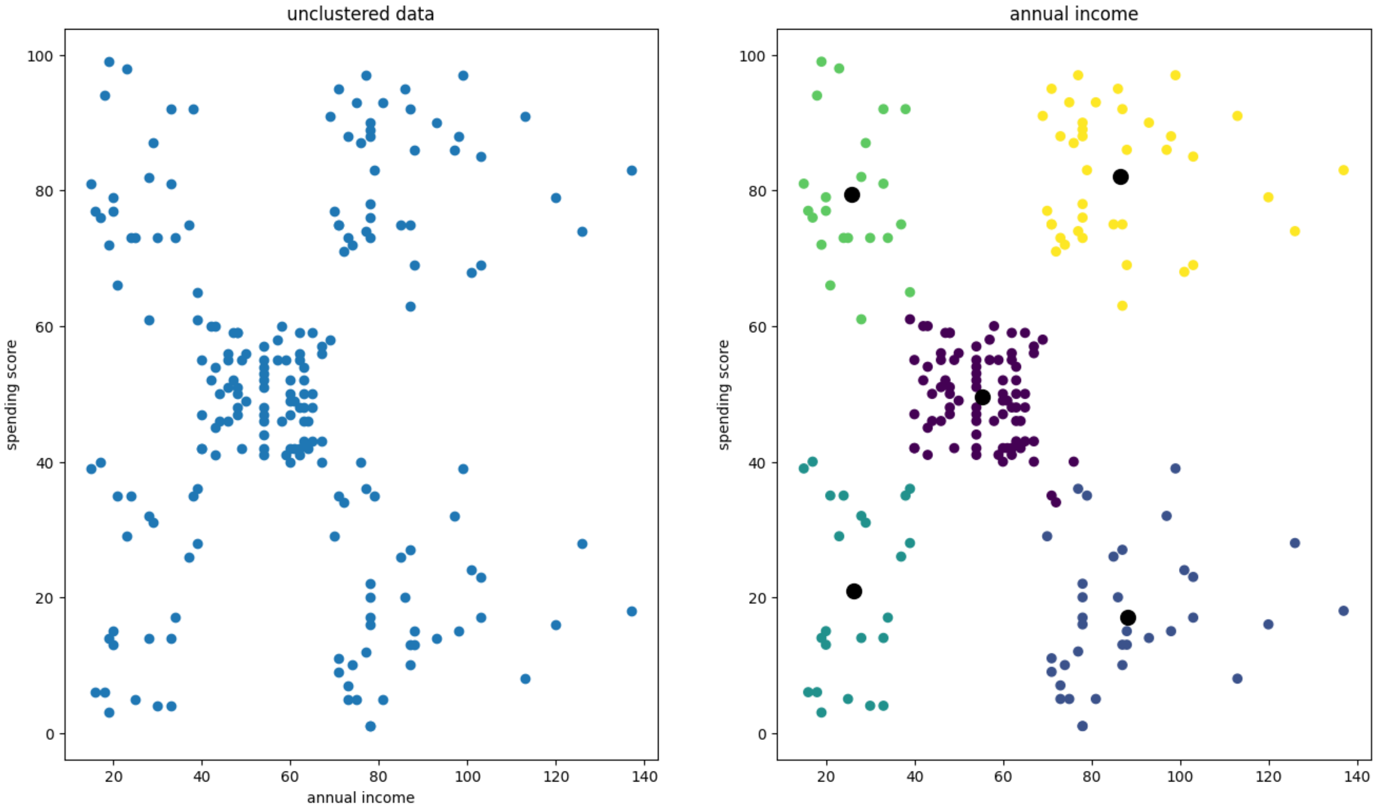
```
labels=km.fit_predict(x)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change from
  warnings.warn(
```

```
cent=km.cluster_centers_
```

```
plt.figure(figsize=(16,9))
plt.subplot(1,2,1)
plt.title('unclustered data')
plt.xlabel('annual income')
plt.ylabel('spending score')
plt.scatter(x['Annual Income (k$)'],x['Spending Score (1-100)'])

plt.subplot(1,2,2)
plt.title('clustered data')
plt.title('annual income')
plt.ylabel('spending score')
plt.scatter(x['Annual Income (k$)'],x['Spending Score (1-100)'],c=labels)
plt.scatter(cent[:,0],cent[:,1],s=100,color='k')
```

```
<matplotlib.collections.PathCollection at 0x7a45ac886140>
```

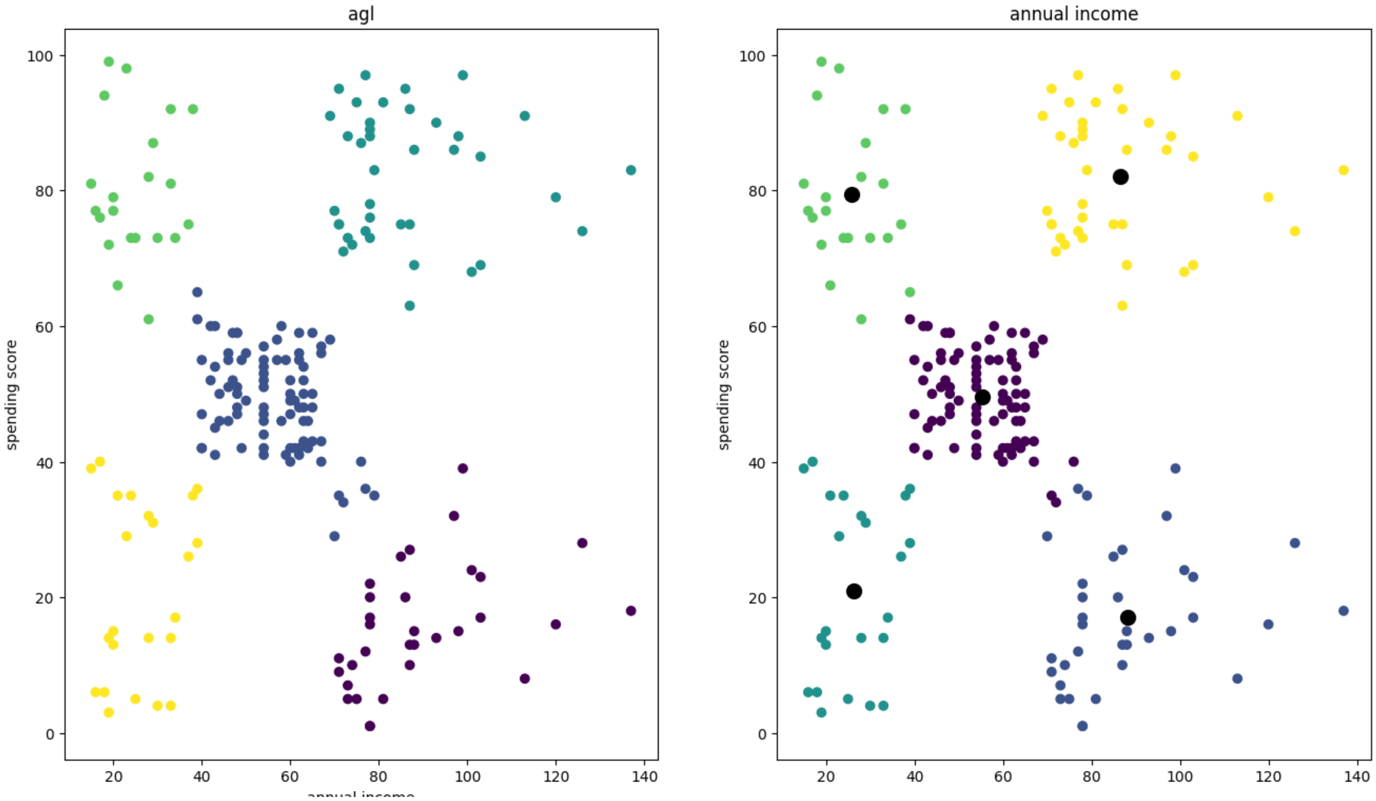


```
agl=AgglomerativeClustering(n_clusters=5)
```

```
alabels=agl.fit_predict(x)
```

```
plt.figure(figsize=(16,9))
plt.subplot(1,2,1)
plt.title('agl')
plt.xlabel('annual income')
plt.ylabel('spending score')
plt.scatter(x['Annual Income (k$)'],x['Spending Score (1-100)'],c=alabels)

plt.subplot(1,2,2)
plt.title('k means')
plt.title('annual income')
plt.ylabel('spending score')
plt.scatter(x['Annual Income (k$)'],x['Spending Score (1-100)'],c=labels)
plt.scatter(cent[:,0],cent[:,1],s=100,color='k')
```

```
<matplotlib.collections.PathCollection at 0x7a45a99c84c0>
```


agl
annual income
spending score
spending score
annual income
0
20
40
60
80
100
20
40
60
80
100
120
140