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COURSE TITLE : PRACTICAL MACHINE LEARNING LAB

LAB11. Shopping Customer Segmentation using Clustering

In [1]:
```
import pandas as pan
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
mall=pan.read_csv('Mall_Customers.csv')
```

In [3]:
```
mall.head()
```

Out[3]:

	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

In [4]:
```
mall.shape
```

Out[4]:
```
(200, 5)
```

In [5]:
```
mall['Genre'].unique()
```

Out[5]:
```
array(['Male', 'Female'], dtype=object)
```

In [6]:
```
mall.columns
```

Out[6]:
```
Index(['CustomerID', 'Genre', 'Age', 'Annual Income (k$)',
       'Spending Score (1-100)'],
      dtype='object')
```

In [7]:
```
mall.dtypes
```
Out[7]:
```
CustomerID                 int64
Genre                     object
Age                        int64
Annual Income (k$)         int64
Spending Score (1-100)     int64
dtype: object
```
In [8]:
```
mall.info()
```
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype 
---  ------                  --------------  ----- 
 0   CustomerID              200 non-null    int64 
 1   Genre                   200 non-null    object
 2   Age                     200 non-null    int64 
 3   Annual Income (k$)      200 non-null    int64 
 4   Spending Score (1-100)  200 non-null    int64 
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```
In [9]:
```
mall['Genre'].value_counts()
```
Out[9]:
```
Female    112
Male       88
Name: Genre, dtype: int64
```
Step-2

In [10]:
```
from sklearn.preprocessing import LabelEncoder
```
In [11]:
```
lb=LabelEncoder()
mall['Genre']=lb.fit_transform(mall['Genre'])
```
Step-3

In [12]:
```python
mall.describe()
```

Out[12]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000	200.000000
mean	100.500000	0.440000	38.850000	60.560000	50.200000
std	57.879185	0.497633	13.969007	26.264721	25.823522
min	1.000000	0.000000	18.000000	15.000000	1.000000
25%	50.750000	0.000000	28.750000	41.500000	34.750000
50%	100.500000	0.000000	36.000000	61.500000	50.000000
75%	150.250000	1.000000	49.000000	78.000000	73.000000
max	200.000000	1.000000	70.000000	137.000000	99.000000

Step-4

In [13]:
```python
mall.skew()
```

Out[13]:
```
CustomerID                0.000000
Genre                     0.243578
Age                       0.485569
Annual Income (k$)        0.321843
Spending Score (1-100)   -0.047220
dtype: float64
```

In [14]:
```python
import numpy as num

num.log(mall)
```

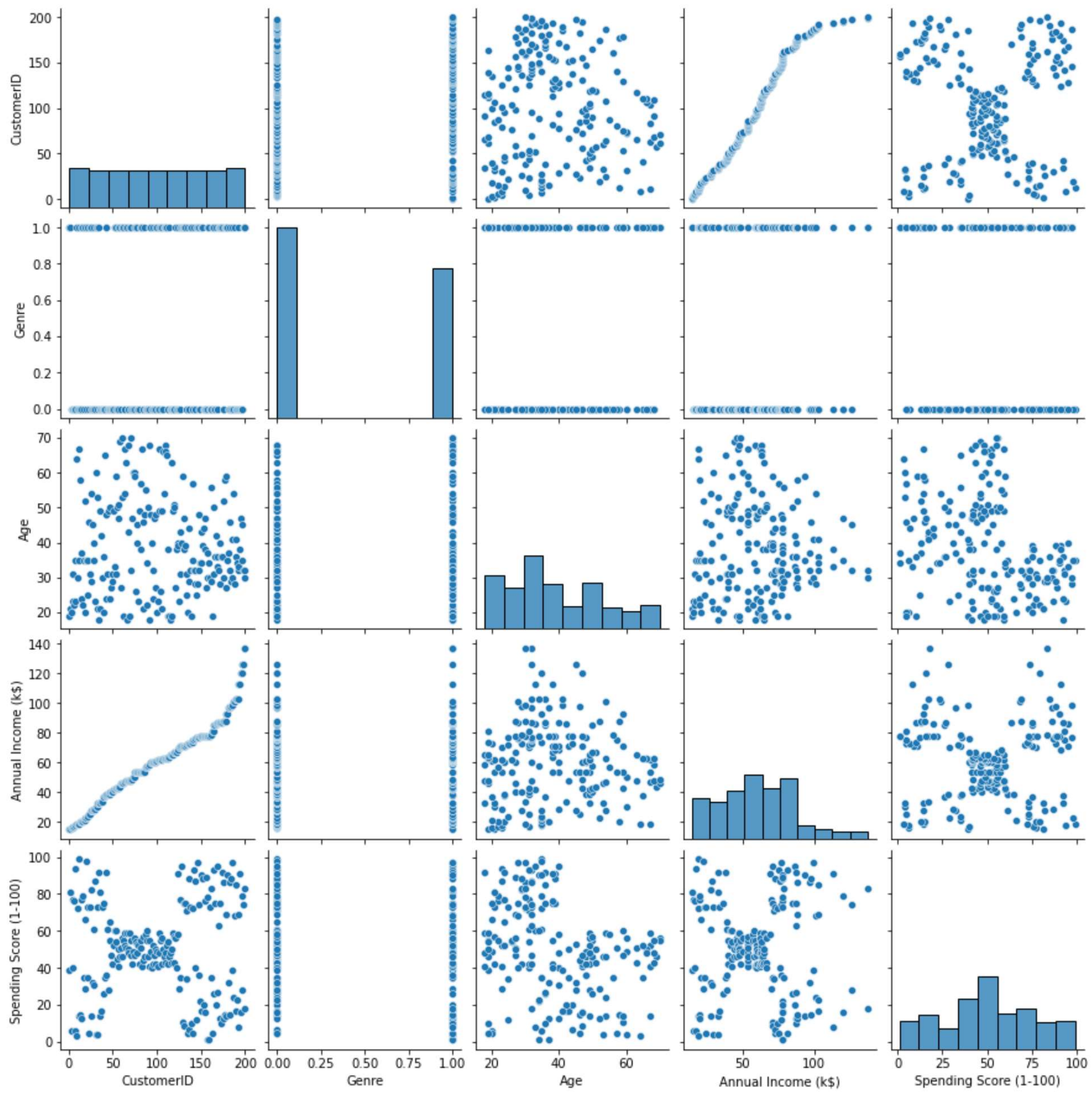
0	0.000000	0.0	2.944439	2.708050	3.663562
1	0.693147	0.0	3.044522	2.708050	4.394449
2	1.098612	-inf	2.995732	2.772589	1.791759
3	1.386294	-inf	3.135494	2.772589	4.343805
4	1.609438	-inf	3.433987	2.833213	3.688879
...	...	...	...	...	...
195	5.278115	-inf	3.555348	4.787492	4.369448
196	5.283204	-inf	3.806662	4.836282	3.332205
197	5.288267	0.0	3.465736	4.836282	4.304065
198	5.293305	0.0	3.465736	4.919981	2.890372
199	5.298317	0.0	3.401197	4.919981	4.418841

200 rows × 5 columns

Step-5

In [15]:
```
sns.pairplot(data=mall)
```

Out[15]:
```
<seaborn.axisgrid.PairGrid at 0x149b51cfac0>
```



Step-6

In [16]:
```
from sklearn.cluster import KMeans
```

In [17]:
```
kmeans= KMeans(n_clusters=4)
kmeans.fit(mall)
```

Out[17]:
```
KMeans(n_clusters=4)
```

```
In [18]: print(kmeans.labels_)
```

```
[3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0
 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2
 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0]
```

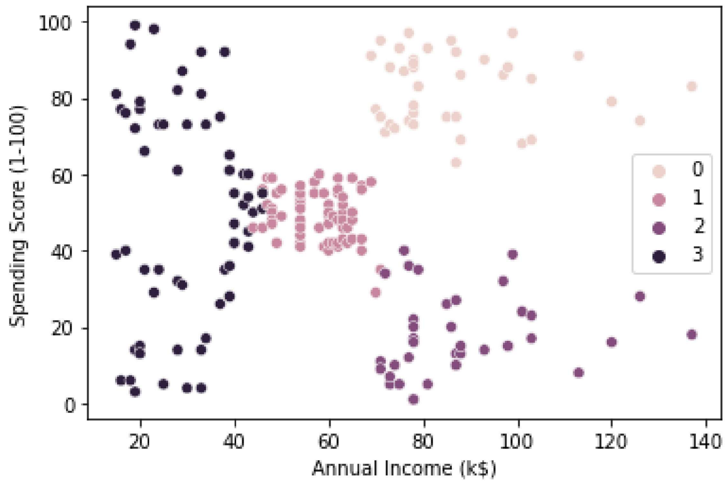
```
In [19]: kmeans.cluster_centers_
```

```
Out[19]: array([[162.        ,   0.46153846,  32.69230769,  86.53846154,
          82.12820513],
        [ 92.48484848,   0.43939394,  43.87878788,  57.72727273,
          49.25757576],
        [164.        ,   0.52777778,  40.80555556,  87.91666667,
          17.88888889],
        [ 30.06779661,   0.37288136,  36.10169492,  29.86440678,
          49.86440678]])
```

Step-7

```
In [20]: sns.scatterplot(data=mall,x="Annual Income (k$)",y="Spending Score (1-100)",hue=kmeans
```

```
Out[20]: <AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-100)'>
```



step-8

```
In [21]: kmeans2=KMeans(n_clusters=5,init='k-means++')
         kmeans2.fit(mall)
         pred=kmeans.predict(mall)
```

```
In [22]: frame=pan.DataFrame(mall)
         frame['Cluster']=pred
```

In [23]:
```
frame
```

Out[23]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)	Cluster
0	1	1	19	15	39	3
1	2	1	21	15	81	3
2	3	0	20	16	6	3
3	4	0	23	16	77	3
4	5	0	31	17	40	3
...	...	...	...	...	...	...
195	196	0	35	120	79	0
196	197	0	45	126	28	2
197	198	1	32	126	74	0
198	199	1	32	137	18	2
199	200	1	30	137	83	0

200 rows × 6 columns

In [24]:
```
c=frame.groupby(['Cluster'])
```

In [25]:
```
C0 = frame[frame['Cluster'] == 0]
C1 = frame[frame['Cluster'] == 1]
C2 = frame[frame['Cluster'] == 2]
C3 = frame[frame['Cluster'] == 3]
C4 = frame[frame['Cluster'] == 4]
```

In [26]:
```
import statistics as ss
r=[C0,C1,C2,C3,C4]
for i in r:
    print('Average Age : ',i['Age'].mean())
    print('Average Annual Income : ',i['Annual Income (k$)'].mean())
    print('Deviation of the mean for annual Income : ',ss.stdev(i['Annual Income (k$)']
    print('No. of Customers ie shape :' ,i.shape)
    print('From those Customers We have',i.Genre.value_counts()[1],'male and',i.Genre.
    print("-----------------------------------------------------------------------------
```

```
Average Age :  32.69230769230769
Average Annual Income :  86.53846153846153
Deviation of the mean for annual Income :  16.312484972924967
No. of Customers ie shape : (39, 6)
From those Customers We have 18 male and 21 female
-----------------------------------------------------------------------------------
---------------------------------
Average Age :  43.878787878787875
Average Annual Income :  57.72727272727273
Deviation of the mean for annual Income :  6.929414348758718
No. of Customers ie shape : (66, 6)
From those Customers We have 29 male and 37 female
-----------------------------------------------------------------------------------
---------------------------------
Average Age :  40.80555555555556
Average Annual Income :  87.91666666666667
Deviation of the mean for annual Income :  16.231142904922006
No. of Customers ie shape : (36, 6)
From those Customers We have 19 male and 17 female
```

Step-9

In [29]:
```
SSE=[]
for clust in range(1,20):
    km=KMeans(n_clusters=clust,init='k-means++')
    km=km.fit(mall)
    SSE.append(km.inertia_)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1036: UserWarnin
g: KMeans is known to have a memory leak on Windows with MKL, when there are less chu
nks than available threads. You can avoid it by setting the environment variable OMP_
NUM_THREADS=1.
  warnings.warn(
```

In [30]:
```
plt.plot(km,km.inertia_)
plt.xlabel('Number of Clusters')
plt.ylabel('Inertia Value')
plt.title('Inertia Value vs Number of Clusters')
plt.show()
```

...

Step-10

In [31]:
```python
from sklearn.decomposition import PCA
```

In [32]:
```python
pca = PCA(n_components = 2)
pca.fit(mall)
pca = pca.transform(mall)
pca = pan.DataFrame(pca,columns=['PC1','PC2'])
pca.head()
```

Out[32]:

	PC1	PC2
0	-109.393522	5.478230
1	-108.210784	-34.927209
2	-107.387369	37.837242
3	-106.016046	-30.558340
4	-104.990159	7.296131

In [33]:
```python
pca_fit=kmeans.fit(pca)
```

```
C:\Users\user\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1036: UserWarnin
g: KMeans is known to have a memory leak on Windows with MKL, when there are less chu
nks than available threads. You can avoid it by setting the environment variable OMP_
NUM_THREADS=1.
  warnings.warn(
```

In [34]:
```python
pca_fit.cluster_centers_
```

Out[34]:
```
array([[3.45323770e-14, 2.73558953e-15]])
```

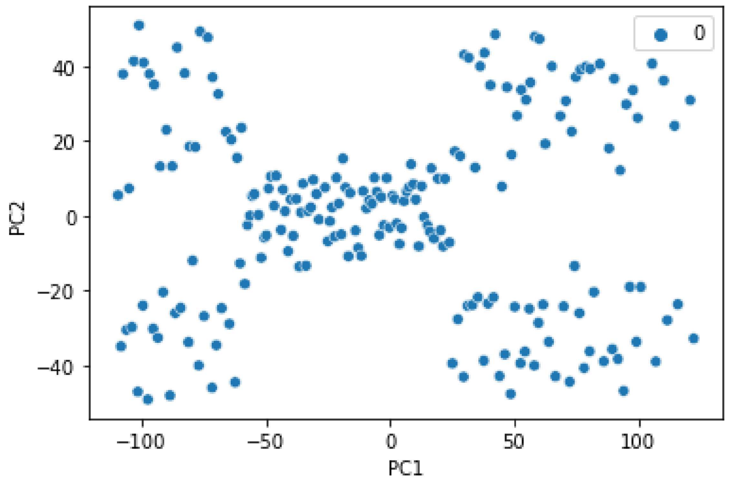
In [35]:
```python
pca_fit.labels_
```

Out[35]:
```
array([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, 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,
       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])
```

Step-11

```
In [36]: sns.scatterplot(data=pca,x="PC1",y='PC2',hue=pca_fit.labels_)
```

```
Out[36]: <AxesSubplot:xlabel='PC1', ylabel='PC2'>
```



Step-12

```
In [37]: from sklearn.cluster import MeanShift
```

```
In [38]: ms = MeanShift()
         ms_fit=ms.fit(pca)
         ms_fit.labels_
```

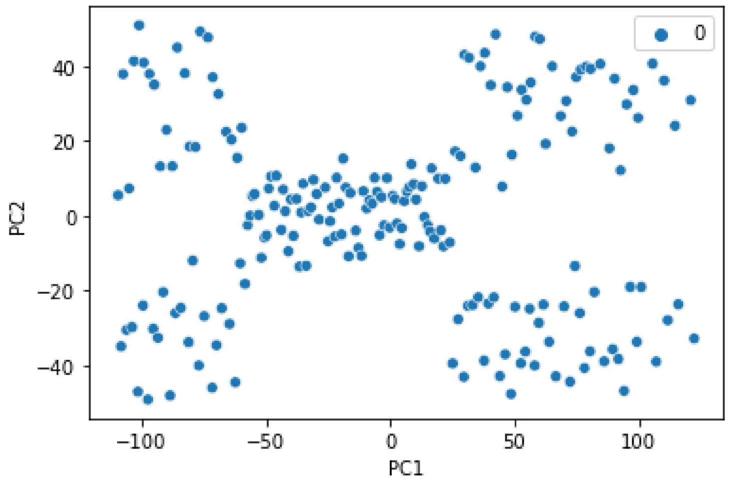
```
Out[38]: array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 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,
                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], dtype=int64)
```

```
In [39]: print(ms_fit)
```

```
MeanShift()
```

```
In [40]: sns.scatterplot(data=pca,x="PC1",y='PC2',hue=ms_fit.labels_)
```

```
Out[40]: <AxesSubplot:xlabel='PC1', ylabel='PC2'>
```



Step-13

```
In [41]: from sklearn.cluster import AgglomerativeClustering as agc
```

```
In [42]: agg=agc(n_clusters=5)
         agg.fit(mall)
```

```
Out[42]: AgglomerativeClustering(n_clusters=5)
```

```
In [43]: plt.figure(figsize=(10,7))
         sns.clustermap(mall.linkage(agg,method='Warm'))
```

...

Step-14

```
In [44]: mall.columns
```

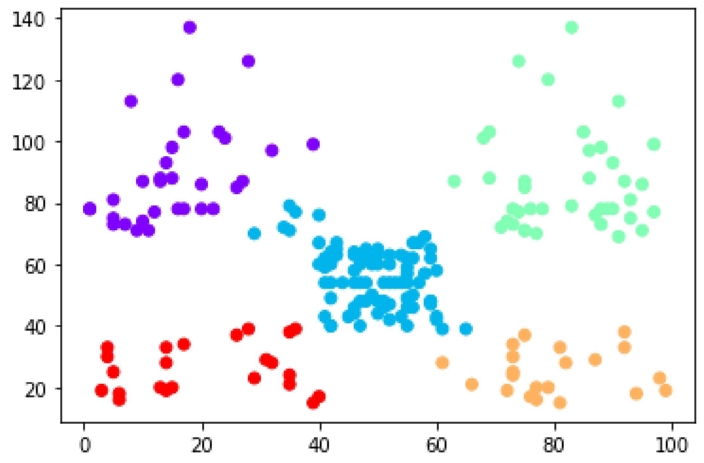
```
Out[44]: Index(['CustomerID', 'Genre', 'Age', 'Annual Income (k$)',
                'Spending Score (1-100)', 'Cluster'],
               dtype='object')
```

```
In [45]: X=mall[["Annual Income (k$)",'Spending Score (1-100)']].values
         agg_clust=agc(n_clusters=5)
         agg_clust.fit(X)
```

```
Out[45]: AgglomerativeClustering(n_clusters=5)
```

```
In [46]: plt.scatter(x=X[:,1],y=X[:,0],c=agg_clust.labels_,cmap='rainbow')
```

```
Out[46]: <matplotlib.collections.PathCollection at 0x149c13a4460>
```



```
In [ ]:
```