

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

```
data=pd.read_csv("/content/Mall_Customers.csv")
data.head()
```

	CustomerID	Gender	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=pd.DataFrame(data)
df.describe()
```

	CustomerID	Age	Annual Income (k\$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	
mean	100.500000	38.850000	60.560000	
std	57.879185	13.969007	26.264721	
min	1.000000	18.000000	15.000000	
25%	50.750000	28.750000	41.500000	
50%	100.500000	36.000000	61.500000	
75%	150.250000	49.000000	78.000000	
max	200.000000	70.000000	137.000000	

```
df=df.drop(["CustomerID"],axis=1)
df.isnull()
```

	Gender	Age	Annual Income (k\$)	Spending Score (1-100)
0	False	False	False	False
1	False	False	False	False
2	False	False	False	False
3	False	False	False	False
4	False	False	False	False
...	...	...	...	...
195	False	False	False	False
196	False	False	False	False
197	False	False	False	False
198	False	False	False	False

```
199    False  False                False                False
```

```
[200 rows x 4 columns]
```

```
df.isna().sum()
```

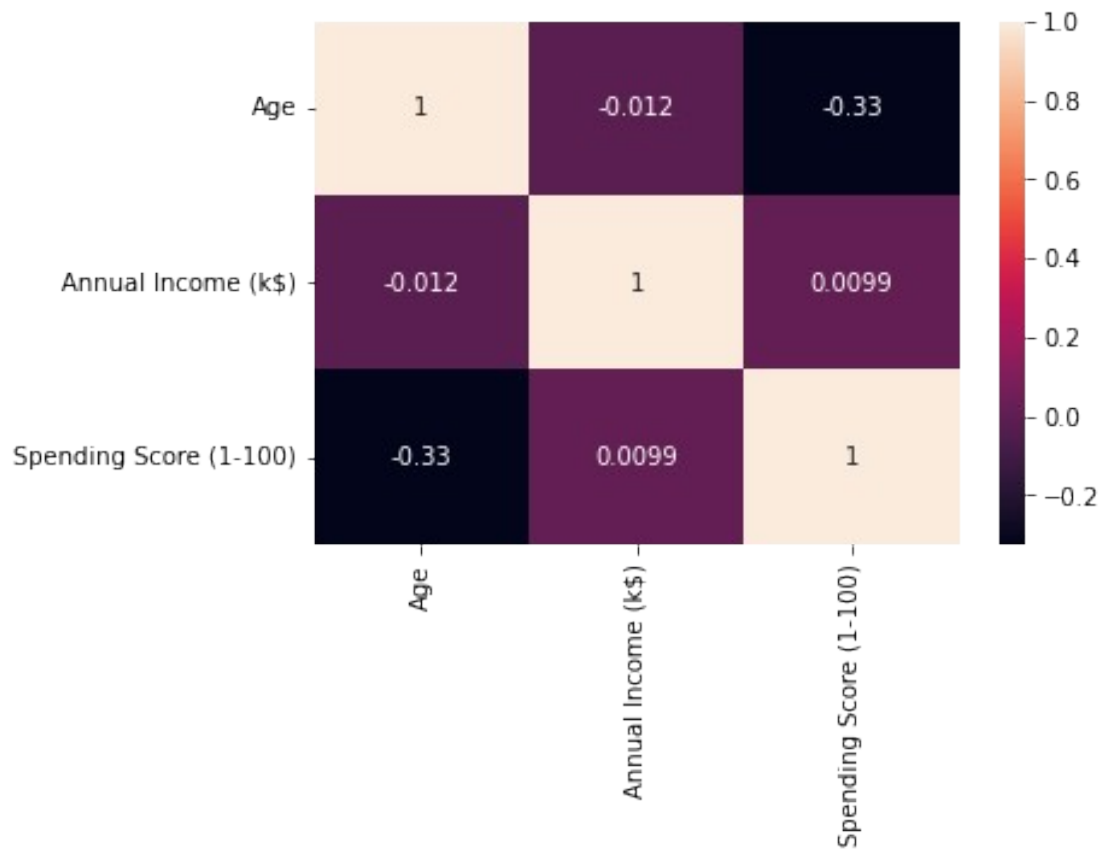
```
Gender                0
Age                  0
Annual Income (k$)    0
Spending Score (1-100) 0
dtype: int64
```

```
df.corr()
```

	Age	Annual Income (k\$)	Spending Score (1-100)
Age	1.000000	-0.012398	0.327227
Annual Income (k\$)	-0.012398	1.000000	0.009903
Spending Score (1-100)	-0.327227	0.009903	1.000000

```
sns.heatmap(df.corr(),annot=True)
```

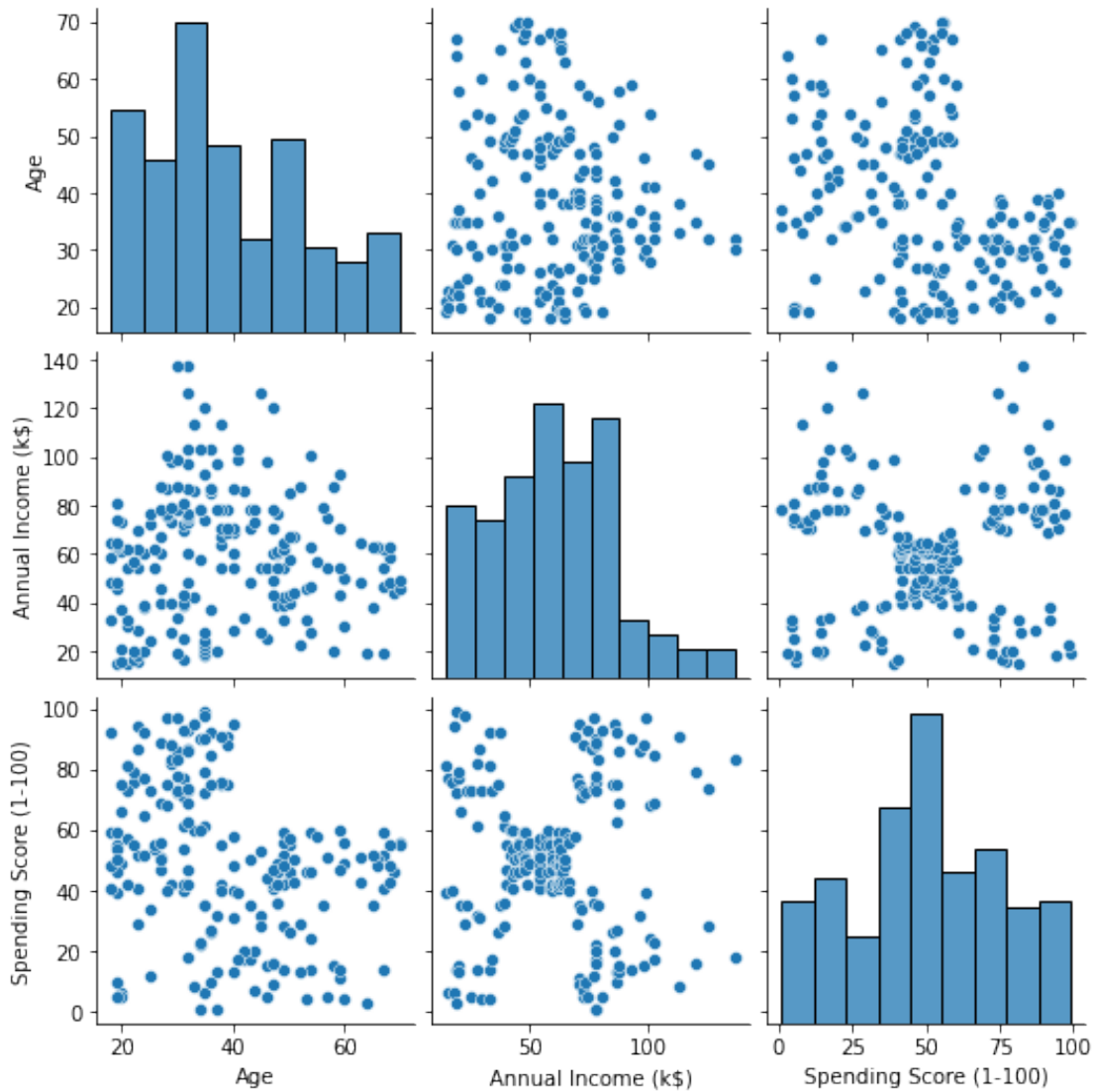
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fbed436c590>
```



*#Mivariate Analysis*

`sns.pairplot(df)`

`<seaborn.axisgrid.PairGrid at 0x7fbed1a3a790>`



*#Univariate Analysis of Continous Variables*

```
l=list(df.columns)
```

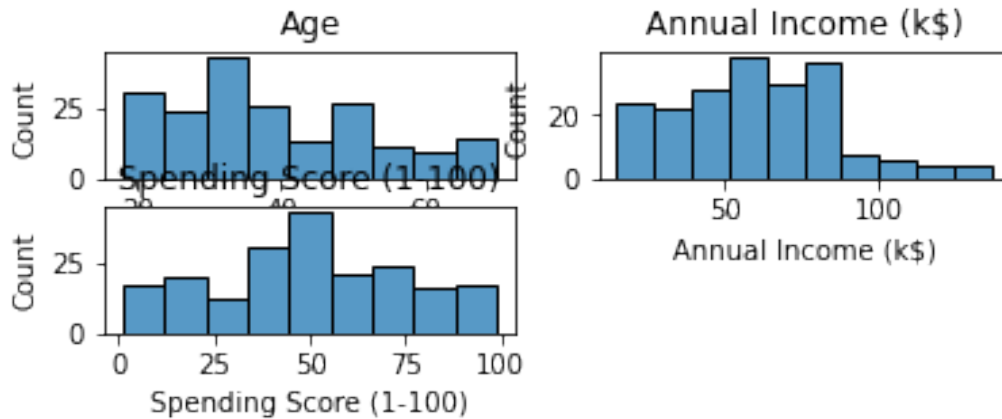
```
l1=l[1:]
```

```
for i in range(len(l1)):
```

```
    plt.subplot(4,2,i+1)
```

```
    sns.histplot(df[l1[i]])
```

```
    plt.title(f'{l1[i]}')
```



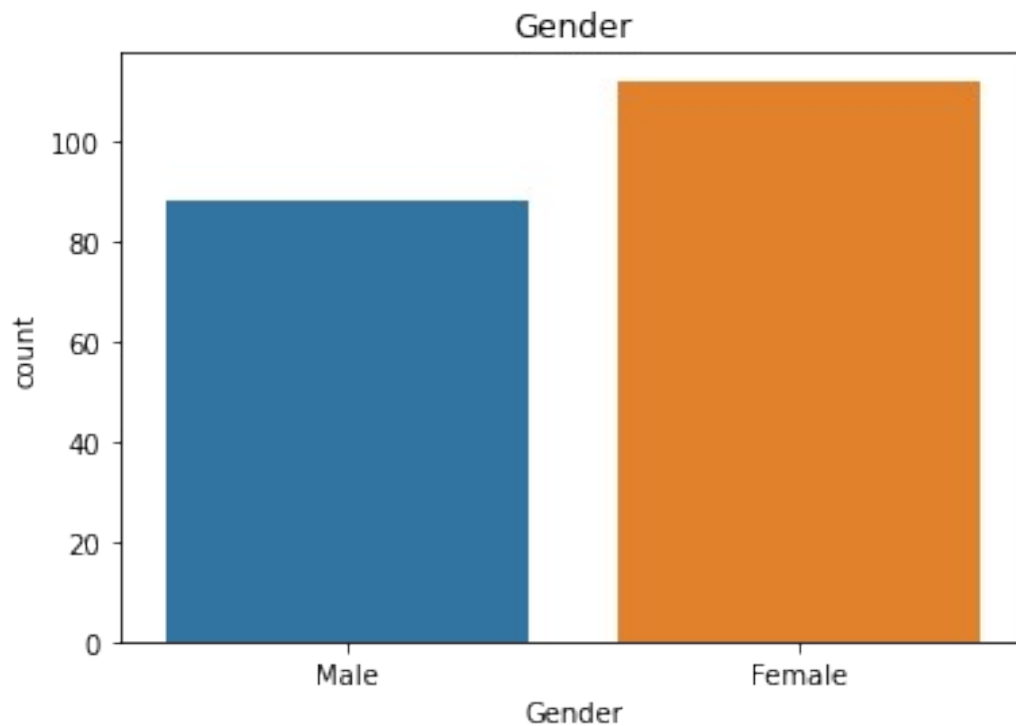
### #Univariate Analysis of Categorical Values

```
sns.countplot(df['Gender'])
plt.title('Gender')
```

/usr/local/lib/python3.7/dist-packages/seaborn/\_decorators.py:43:  
FutureWarning: Pass the following variable as a keyword arg: x. From  
version 0.12, the only valid positional argument will be `data`, and  
passing other arguments without an explicit keyword will result in an  
error or misinterpretation.

FutureWarning

Text(0.5, 1.0, 'Gender')



### *#Bivariate Analysis of Continuous Variables*

```
df[list(df.columns[2:]).corr()
```

	Annual Income (k\$)	Spending Score (1-100)
Annual Income (k\$)	1.000000	0.009903
Spending Score (1-100)	0.009903	1.000000

### *#Label Encoding For Categorical Values*

```
from sklearn import preprocessing
label_encoder=preprocessing.LabelEncoder()
df['Gender']=label_encoder.fit_transform(df['Gender'])
df.head()
```

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

### *#Outliers Identification And Replacing Using Quantile-Based Flooring and Capping for Continuous Variables*

```
q1=df['Age'].quantile(0.10)
q2=df['Age'].quantile(0.90)
df['Age']=np.where(df['Age']<q1,q1,df['Age'])
df['Age']=np.where(df['Age']>q2,q2,df['Age'])
print(df['Age'].skew())
```

```
q1=df['Annual Income (k$)'].quantile(0.10)
q2=df['Annual Income (k$)'].quantile(0.90)
df['Annual Income (k$)']=np.where(df['Annual Income (k$)']<q1,q1,df['Annual Income (k$)'])
df['Annual Income (k$)']=np.where(df['Annual Income (k$)']>q2,q2,df['Annual Income (k$)'])
print(df['Annual Income (k$)'].skew())
```

```
q1=df['Spending Score (1-100)'].quantile(0.10)
q2=df['Spending Score (1-100)'].quantile(0.90)
df['Spending Score (1-100)']=np.where(df['Spending Score (1-100)']<q1,q1,df['Spending Score (1-100)'])
df['Spending Score (1-100)']=np.where(df['Spending Score (1-100)']>q2,q2,df['Spending Score (1-100)'])
print(df['Spending Score (1-100)'].skew())
```

```
0.281242452772514
-0.11114517936178386
-0.03744215109217243
```

```
df
```

	Gender	Age	Annual Income (k\$)	Spending Score (1-100)
0	1	21.0	23.9	39.0
1	1	21.0	23.9	81.0
2	0	21.0	23.9	13.0
3	0	23.0	23.9	77.0
4	0	31.0	23.9	40.0
...	...	...	...	...
195	0	35.0	93.4	79.0
196	0	45.0	93.4	28.0
197	1	32.0	93.4	74.0
198	1	32.0	93.4	18.0
199	1	30.0	93.4	83.0

[200 rows x 4 columns]

### #Scaling Variables

```
import pandas as pd
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
scaled=scaler.fit_transform(df)
print(scaled)
```

[	1.12815215	-1.39030724	-1.599128	-0.47229142]
[	1.12815215	-1.39030724	-1.599128	1.28936397]
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[	-0.88640526	-1.2301336	-1.599128	1.12158726]
[	-0.88640526	-0.58943902	-1.599128	-0.43034725]
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[	-0.88640526	-0.26909172	-1.599128	-1.56284 ]
[	-0.88640526	-1.2301336	-1.599128	1.54522344]
[	1.12815215	1.6610007	-1.599128	-1.56284 ]
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[	1.12815215	1.6610007	-1.599128	-1.52089582]
[	-0.88640526	-0.26909172	-1.599128	1.54522344]
[	-0.88640526	1.5729052	-1.599128	-1.47895164]
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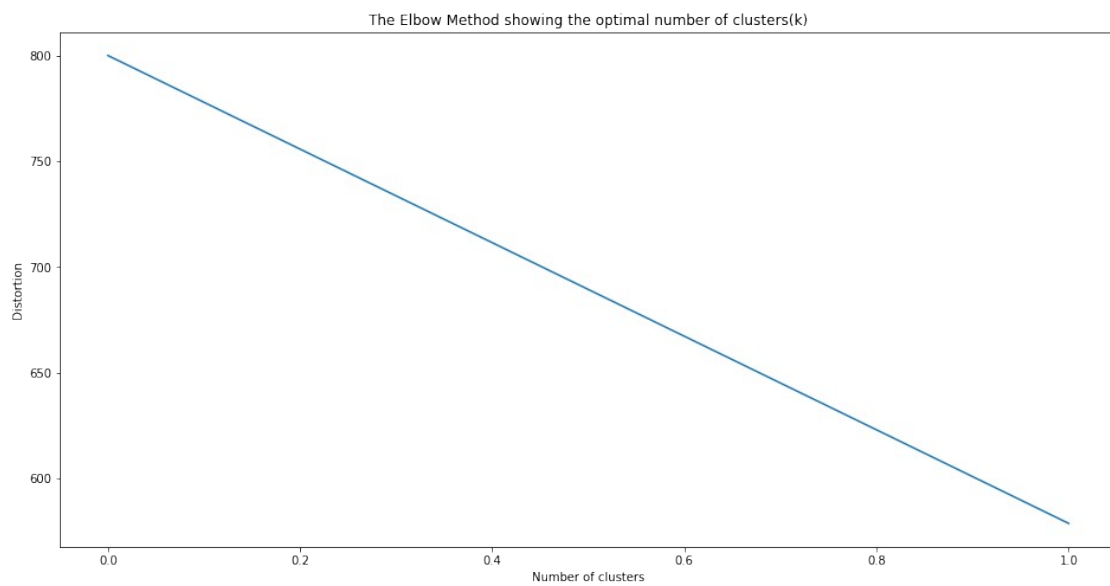
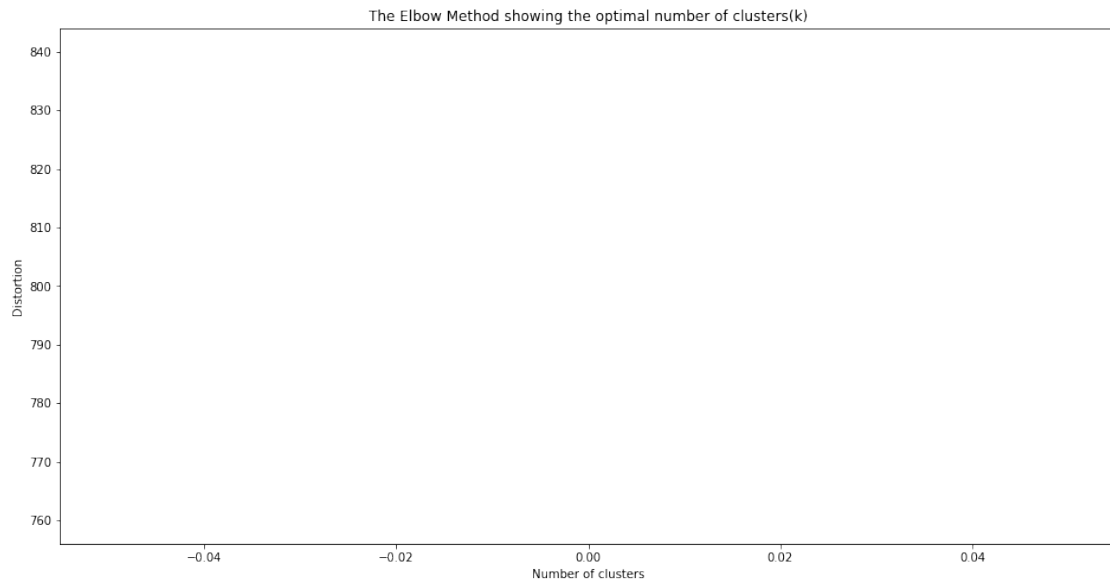
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[-0.88640526 -0.1890049  1.52803564  1.45714067]
[-0.88640526 -0.34917855  1.52803564 -1.14339824]
[-0.88640526 -0.50935219  1.52803564  0.78603386]
[ 1.12815215 -0.42926537  1.52803564 -1.56284    ]
[-0.88640526 -0.02883126  1.52803564  1.54522344]
[-0.88640526  0.69195015  1.52803564 -1.43700747]
[-0.88640526 -0.26909172  1.52803564  1.20547562]
[-0.88640526  0.5317765  1.52803564 -0.93367736]
[ 1.12815215 -0.50935219  1.52803564  0.99575474]
[ 1.12815215 -0.50935219  1.52803564 -1.35311912]
[ 1.12815215 -0.66952584  1.52803564  1.37325232]]
```

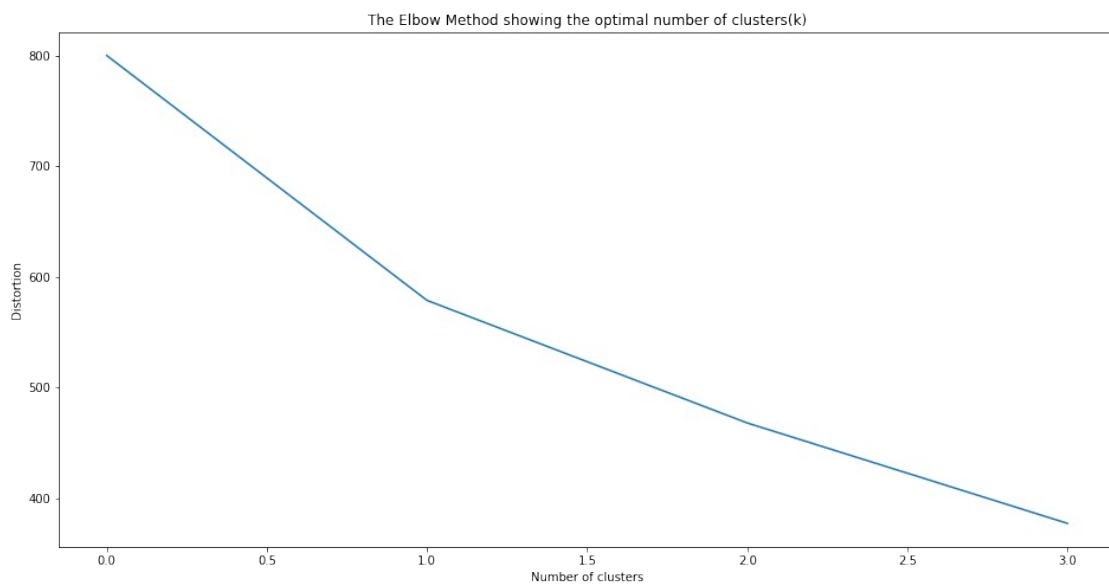
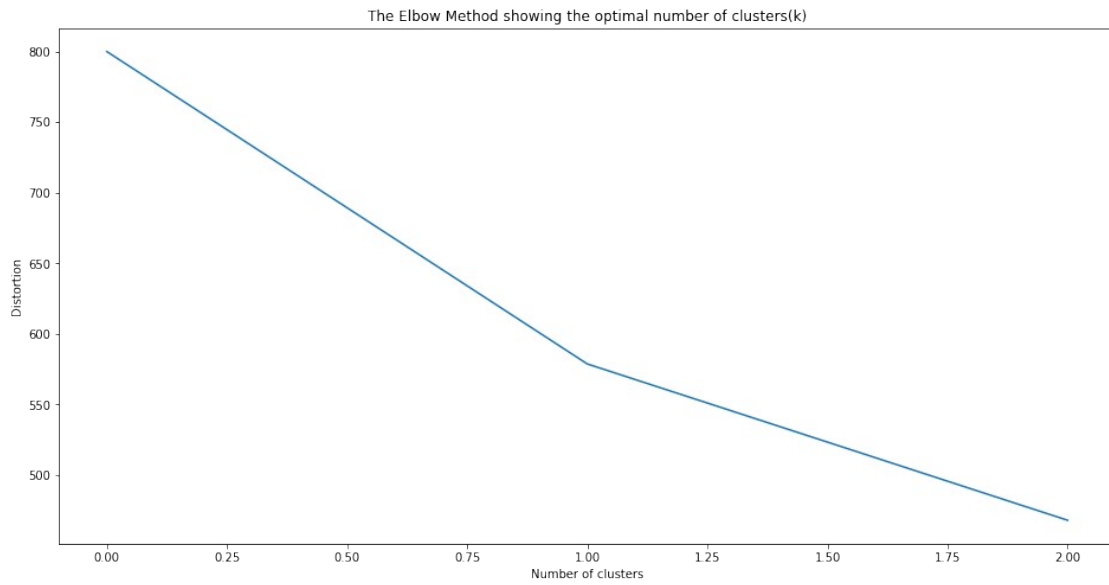
*#Elbow Method To Find Number Of Clusters*

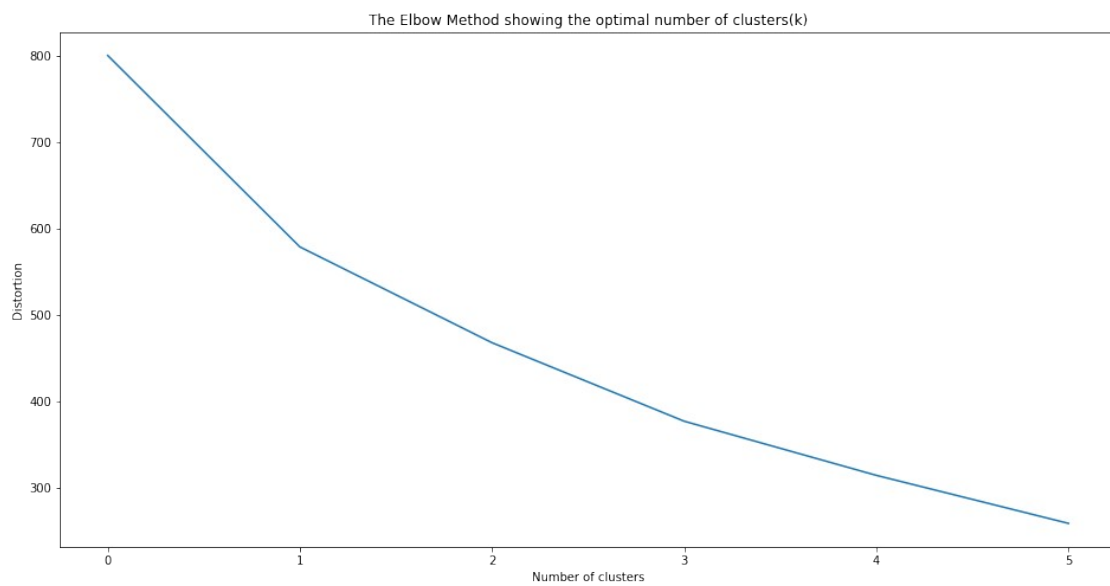
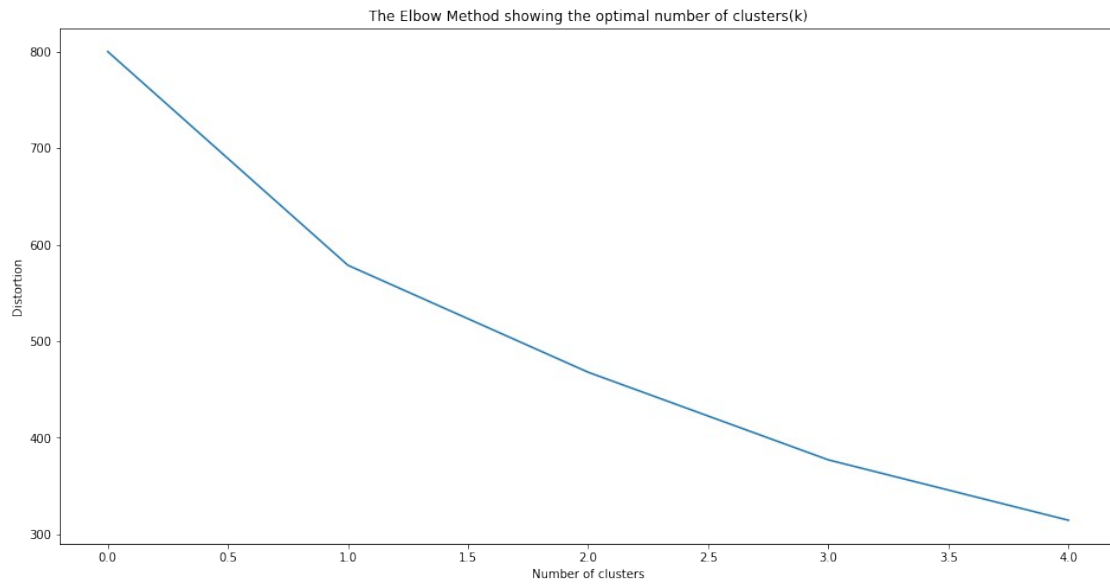
```
w=[]
K=range(1,10)
for k in K:
    kmeanModel=KMeans(n_clusters=k)
    kmeanModel.fit(scaled)
    w.append(kmeanModel.inertia_)

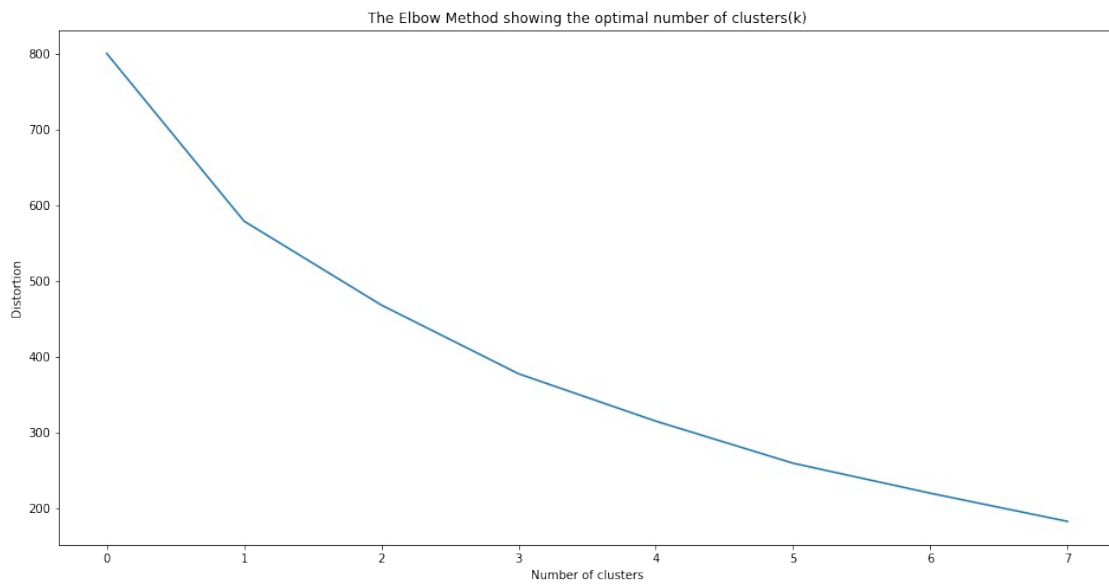
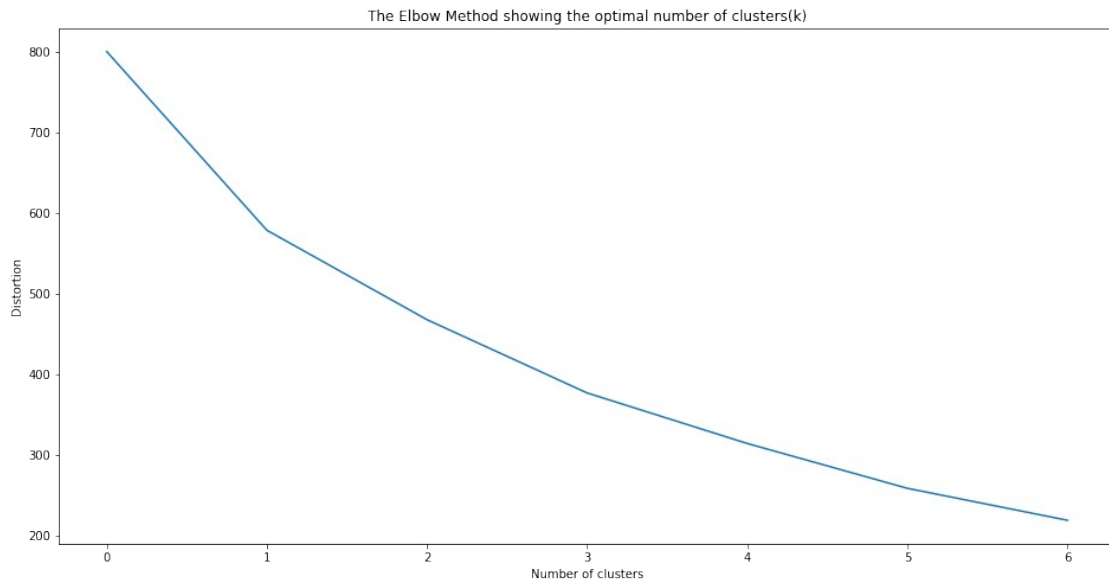
plt.figure(figsize=(16,8))
plt.plot(w)
plt.xlabel('Number of clusters')
plt.ylabel('Distortion')
plt.title('The Elbow Method showing the optimal number of
clusters(k)')

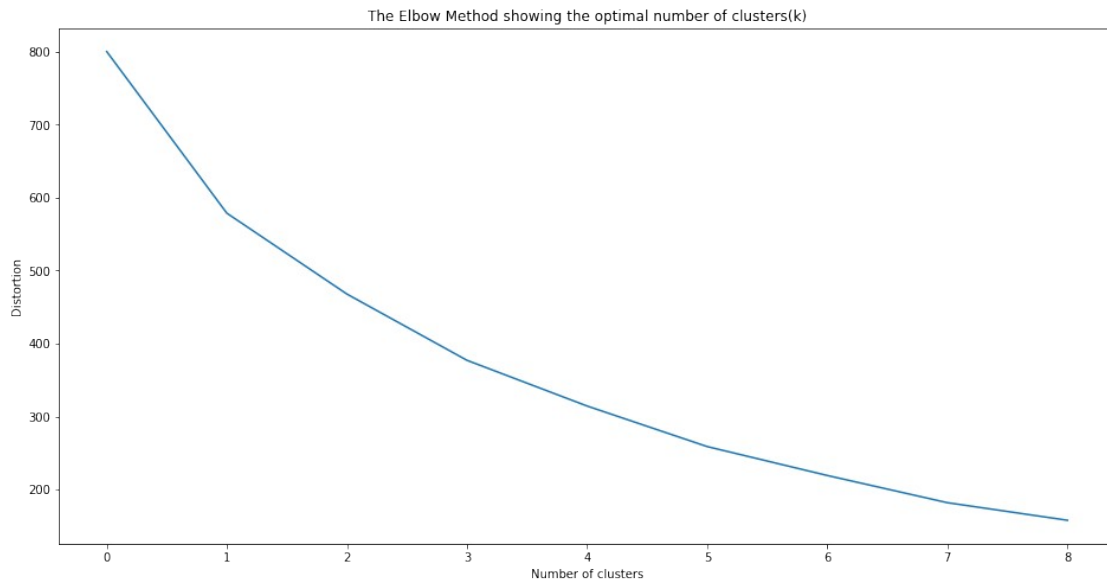
plt.show()
```











*#Training the model-support vector regression*

```
from sklearn.cluster import KMeans
kmean=KMeans(n_clusters=3)
kmean.fit(scaled)
y_pred=kmean.predict(scaled)
df['pred_cluster']=y_pred
df.head
```

```
<bound method NDFrame.head of      Gender  Age  Annual Income (k$)
Spending Score (1-100)  pred_cluster
0          1  21.0          23.9          39.0
1          1  21.0          23.9          81.0
1          0  21.0          23.9          13.0
2          0  23.0          23.9          77.0
3          0  31.0          23.9          40.0
4          0  31.0          23.9          40.0
0          0  31.0          23.9          40.0
..          ..  ..          ..          ..
...          ...          ...          ...
195         0  35.0          93.4          79.0
1          0  45.0          93.4          28.0
196         0  45.0          93.4          28.0
0          1  32.0          93.4          74.0
197         1  32.0          93.4          74.0
1          1  32.0          93.4          18.0
198         1  32.0          93.4          18.0
2          1  30.0          93.4          83.0
199         1  30.0          93.4          83.0
1          1  30.0          93.4          83.0
```



```
[200 rows x 5 columns]>
```

```
#Independent Variables
```

```
l2=list(df.columns)
df2=df[l2[:len(l2)-1]]
df2.head()
```

	Gender	Age	Annual Income (k\$)	Spending Score (1-100)
0	1	21.0	23.9	39.0
1	1	21.0	23.9	81.0
2	0	21.0	23.9	13.0
3	0	23.0	23.9	77.0
4	0	31.0	23.9	40.0

```
#Dependent Variables
```

```
df1=df['pred_cluster']
df1
```

```
0      1
1      1
2      0
3      1
4      0
```

```
..
195    1
196    0
197    1
198    2
199    1
```

```
Name: pred_cluster, Length: 200, dtype: int32
```

```
#Scaling Variables
```

```
import pandas as pd
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
scaled=scaler.fit_transform(df)
print(scaled)
```

```
[[ 1.12815215 -1.39030724 -1.599128 -0.47229142  0.10027894]
 [ 1.12815215 -1.39030724 -1.599128  1.28936397  0.10027894]
 [-0.88640526 -1.39030724 -1.599128 -1.56284    -1.2367736 ]
 [-0.88640526 -1.2301336  -1.599128  1.12158726  0.10027894]
 [-0.88640526 -0.58943902 -1.599128 -0.43034725 -1.2367736 ]
 [-0.88640526 -1.31022042 -1.599128  1.07964309  0.10027894]
 [-0.88640526 -0.26909172 -1.599128 -1.56284    -1.2367736 ]
 [-0.88640526 -1.2301336  -1.599128  1.54522344  0.10027894]
 [ 1.12815215  1.6610007  -1.599128 -1.56284    1.43733148]
 [-0.88640526 -0.66952584 -1.599128  0.91186639  0.10027894]
 [ 1.12815215  1.6610007  -1.599128 -1.52089582  1.43733148]
 [-0.88640526 -0.26909172 -1.599128  1.54522344  0.10027894]
```

[ -0.88640526	1.5729052	-1.599128	-1.47895164	-1.2367736 ]
[ -0.88640526	-1.15004677	-1.599128	1.12158726	0.10027894]
[ 1.12815215	-0.10891808	-1.599128	-1.56284	1.43733148]
[ 1.12815215	-1.31022042	-1.599128	1.20547562	0.10027894]
[ -0.88640526	-0.26909172	-1.599128	-0.64006812	-1.2367736 ]
[ 1.12815215	-1.39030724	-1.599128	0.66020133	0.10027894]
[ 1.12815215	1.09238426	-1.599128	-0.89173318	1.43733148]
[ -0.88640526	-0.26909172	-1.599128	1.54522344	0.10027894]
[ 1.12815215	-0.26909172	-1.59462848	-0.64006812	1.43733148]
[ 1.12815215	-1.06995995	-1.59462848	0.95381056	0.10027894]
[ -0.88640526	0.61186333	-1.54963332	-1.56284	-1.2367736 ]
[ 1.12815215	-0.58943902	-1.54963332	0.95381056	0.10027894]
[ -0.88640526	1.25255791	-1.41464784	-1.52089582	-1.2367736 ]
[ 1.12815215	-0.74961266	-1.41464784	1.33130814	0.10027894]
[ -0.88640526	0.5317765	-1.41464784	-0.76590065	-1.2367736 ]
[ 1.12815215	-0.26909172	-1.41464784	0.45048045	0.10027894]
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[ -0.88640526	-1.2301336	-1.36965268	1.54102902	0.10027894]
[ 1.12815215	1.6610007	-1.32465752	-1.56284	1.43733148]
[ -0.88640526	-1.39030724	-1.32465752	0.95381056	0.10027894]
[ 1.12815215	1.17247108	-1.18967204	-1.56284	1.43733148]
[ 1.12815215	-1.39030724	-1.18967204	1.54522344	0.10027894]
[ -0.88640526	0.85212379	-1.18967204	-1.52089582	-1.2367736 ]
[ -0.88640526	-1.39030724	-1.18967204	1.28936397	0.10027894]
[ -0.88640526	0.29151603	-1.14467688	-1.39506329	-1.2367736 ]
[ -0.88640526	-0.66952584	-1.14467688	0.95381056	0.10027894]
[ -0.88640526	-0.1890049	-1.0096914	-1.01756571	-1.2367736 ]
[ -0.88640526	-1.39030724	-1.0096914	1.03769891	0.10027894]
[ -0.88640526	1.6610007	-0.96469624	-0.64006812	-1.2367736 ]
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[ -0.88640526	-0.58943902	-0.91970108	0.45048045	0.10027894]
[ -0.88640526	0.85212379	-0.91970108	-0.93367736	-1.2367736 ]
[ -0.88640526	-1.15004677	-0.91970108	0.61825715	0.10027894]
[ -0.88640526	0.93221062	-0.87470592	0.19881539	-1.2367736 ]
[ -0.88640526	-0.90978631	-0.87470592	-0.13673801	0.10027894]
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[ -0.88640526	-0.58943902	-0.87470592	-0.34645889	-1.2367736 ]
[ -0.88640526	0.85212379	-0.78471559	0.07298287	-1.2367736 ]
[ 1.12815215	-0.42926537	-0.78471559	0.40853627	0.10027894]
[ -0.88640526	-0.58943902	-0.73972043	0.15687122	0.10027894]
[ 1.12815215	1.65299202	-0.73972043	0.40853627	1.43733148]
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[ 1.12815215	0.69195015	-0.73972043	-0.38840307	1.43733148]
[ -0.88640526	1.01229744	-0.69472527	-0.01090549	-1.2367736 ]
[ 1.12815215	1.6610007	-0.69472527	-0.17868219	1.43733148]
[ -0.88640526	-0.90978631	-0.60473495	0.03103869	0.10027894]
[ 1.12815215	1.17247108	-0.60473495	-0.17868219	1.43733148]
[ 1.12815215	1.6610007	-0.60473495	0.24075957	1.43733148]
[ 1.12815215	-1.39030724	-0.60473495	0.19881539	0.10027894]

[ -0.88640526	1.6610007	-0.55973979	0.07298287	-1.2367736 ]
[ -0.88640526	1.25255791	-0.55973979	0.3665921	-1.2367736 ]
[ 1.12815215	1.6610007	-0.51474463	0.03103869	1.43733148]
[ 1.12815215	-1.39030724	-0.51474463	0.3665921	0.10027894]
[ -0.88640526	0.37160286	-0.51474463	-0.01090549	-1.2367736 ]
[ -0.88640526	1.6610007	-0.51474463	-0.09479384	-1.2367736 ]
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[ -0.88640526	-0.90978631	0.02519729	-0.01090549	0.10027894]
[ 1.12815215	0.77203697	0.07019245	-0.34645889	1.43733148]
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[ 1.12815215	1.6610007	0.11518761	0.3665921	1.43733148]
[ 1.12815215	-0.98987313	0.11518761	0.19881539	0.10027894]
[ 1.12815215	0.85212379	0.11518761	0.24075957	1.43733148]
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[ -0.88640526	-1.39030724	0.25017309	-0.01090549	0.10027894]
[ -0.88640526	1.6610007	0.25017309	-0.30451472	-1.2367736 ]
[ -0.88640526	0.85212379	0.25017309	0.3665921	-1.2367736 ]
[ -0.88640526	1.01229744	0.34016341	-0.30451472	-1.2367736 ]
[ -0.88640526	0.93221062	0.34016341	0.28270375	-1.2367736 ]
[ 1.12815215	-0.90978631	0.34016341	0.24075957	0.10027894]
[ -0.88640526	-0.02883126	0.34016341	-0.43034725	-1.2367736 ]
[ -0.88640526	0.13134239	0.43015373	0.32464792	-1.2367736 ]
[ 1.12815215	0.05125557	0.43015373	1.54522344	0.10027894]
[ -0.88640526	-1.2301336	0.47514889	-0.89173318	-1.2367736 ]
[ -0.88640526	-0.58943902	0.47514889	1.12158726	0.10027894]
[ 1.12815215	0.37160286	0.52014405	-0.64006812	1.43733148]
[ 1.12815215	0.13134239	0.52014405	1.54522344	0.10027894]
[ 1.12815215	1.65299202	0.52014405	-1.56284	1.43733148]
[ 1.12815215	-0.02883126	0.52014405	1.03769891	0.10027894]
[ 1.12815215	0.69195015	0.52014405	-1.56284	1.43733148]
[ 1.12815215	0.05125557	0.52014405	1.03769891	0.10027894]
[ -0.88640526	-1.06995995	0.56513921	-0.6820123	-1.2367736 ]
[ -0.88640526	-0.58943902	0.56513921	0.86992221	0.10027894]
[ 1.12815215	-1.39030724	0.61013437	-1.56284	1.43733148]
[ -0.88640526	-0.74961266	0.61013437	1.54522344	0.10027894]
[ -0.88640526	0.45168968	0.61013437	-1.56284	-1.2367736 ]
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[ -0.88640526	-0.26909172	0.65512953	0.91186639	0.10027894]
[ -0.88640526	1.49281838	0.70012469	-1.56284	-1.2367736 ]
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[ -0.88640526	-0.82969948	0.74511985	-0.43034725	-1.2367736 ]
[ -0.88640526	-0.50935219	0.74511985	1.54102902	0.10027894]
[ 1.12815215	-1.06995995	0.79011501	-1.56284	1.43733148]
[ 1.12815215	-0.82969948	0.79011501	1.54522344	0.10027894]
[ 1.12815215	0.77203697	0.79011501	-0.59812395	1.43733148]
[ -0.88640526	-0.50935219	0.79011501	0.99575474	0.10027894]
[ -0.88640526	-0.34917855	0.83511017	-1.18534241	-1.2367736 ]
[ 1.12815215	-0.34917855	0.83511017	1.54522344	0.10027894]
[ 1.12815215	0.37160286	0.83511017	-1.39506329	1.43733148]
[ 1.12815215	0.05125557	0.83511017	1.54522344	0.10027894]
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[ -0.88640526	-0.02883126	0.83511017	1.07964309	0.10027894]
[ -0.88640526	0.69195015	0.83511017	-1.43700747	-1.2367736 ]
[ -0.88640526	-0.90978631	0.83511017	1.54522344	0.10027894]
[ 1.12815215	-0.10891808	0.83511017	-1.56284	1.43733148]
[ -0.88640526	-0.66952584	0.83511017	1.16353144	0.10027894]
[ 1.12815215	-0.34917855	0.83511017	-1.56284	1.43733148]
[ -0.88640526	-0.66952584	0.83511017	0.95381056	0.10027894]
[ -0.88640526	1.41273155	0.88010533	-0.64006812	-1.2367736 ]
[ -0.88640526	-0.74961266	0.88010533	1.37325232	0.10027894]

```
[ 1.12815215 -1.39030724  0.97009565 -1.56284      1.43733148]
[-0.88640526 -0.58943902  0.97009565  1.54522344  0.10027894]
[ 1.12815215  0.93221062  1.1500763  -1.01756571  1.43733148]
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[ 1.12815215  0.13134239  1.24006662 -1.56284      1.43733148]
[ 1.12815215 -0.82969948  1.24006662  1.03769891  0.10027894]
[ 1.12815215 -0.1890049  1.24006662 -1.56284      1.43733148]
[ 1.12815215 -0.1890049  1.24006662  1.54522344  0.10027894]
[-0.88640526  1.09238426  1.28506178 -1.56284      -1.2367736 ]
[-0.88640526 -0.66952584  1.28506178  1.49908485  0.10027894]
[ 1.12815215  1.5729052  1.28506178 -1.47895164  1.43733148]
[ 1.12815215 -0.90978631  1.28506178  0.78603386  0.10027894]
[ 1.12815215  1.65299202  1.51003758 -1.52089582  1.43733148]
[ 1.12815215 -0.26909172  1.51003758  1.54522344  0.10027894]
[-0.88640526 -0.10891808  1.52803564 -0.76590065 -1.2367736 ]
[-0.88640526 -0.50935219  1.52803564  1.49908485  0.10027894]
[ 1.12815215  0.61186333  1.52803564 -1.47895164  1.43733148]
[-0.88640526 -0.74961266  1.52803564  1.54522344  0.10027894]
[-0.88640526  0.21142921  1.52803564 -0.47229142 -1.2367736 ]
[ 1.12815215 -0.66952584  1.52803564  1.54522344  0.10027894]
[-0.88640526  1.25255791  1.52803564 -1.10145406 -1.2367736 ]
[ 1.12815215 -0.82969948  1.52803564  0.74408968  0.10027894]
[-0.88640526  0.21142921  1.52803564 -1.39506329 -1.2367736 ]
[-0.88640526 -0.1890049  1.52803564  1.45714067  0.10027894]
[-0.88640526 -0.34917855  1.52803564 -1.14339824 -1.2367736 ]
[-0.88640526 -0.50935219  1.52803564  0.78603386  0.10027894]
[ 1.12815215 -0.42926537  1.52803564 -1.56284      1.43733148]
[-0.88640526 -0.02883126  1.52803564  1.54522344  0.10027894]
[-0.88640526  0.69195015  1.52803564 -1.43700747 -1.2367736 ]
[-0.88640526 -0.26909172  1.52803564  1.20547562  0.10027894]
[-0.88640526  0.5317765  1.52803564 -0.93367736 -1.2367736 ]
[ 1.12815215 -0.50935219  1.52803564  0.99575474  0.10027894]
[ 1.12815215 -0.50935219  1.52803564 -1.35311912  1.43733148]
[ 1.12815215 -0.66952584  1.52803564  1.37325232  0.10027894]]
```

### #Splitting Dataset

```
import numpy as np
from sklearn.model_selection import train_test_split
y=df['pred_cluster'].to_numpy()
X_train,X_test,y_train,y_test=train_test_split(scaled,y,test_size=0.10
,random_state=42)
```

X\_train.shape

(180, 5)

X\_test.shape

```
(20, 5)
```

```
y_train.shape
```

```
(180,)
```

```
y_test.shape
```

```
(20,)
```

```
#Training the model
```

```
from sklearn.svm import SVR
```

```
regrassor=SVR(kernel='rbf')
```

```
regrassor.fit(X_train,y_train)
```

```
SVR()
```

```
#Testing the model
```

```
y_pred=regrassor.predict((X_test))
```

```
df3=pd.DataFrame({'Predicted value':y_pred,'Real Value':y_test})
```

```
df3
```

	Predicted value	Real Value
0	1.067228	1
1	0.965805	1
2	1.938242	2
3	2.032868	2
4	1.996615	2
5	0.950163	1
6	0.056714	0
7	1.994406	2
8	0.117154	0
9	1.000021	1
10	-0.008916	0
11	1.949340	2
12	0.904566	1
13	0.957596	1
14	0.154222	0
15	1.044386	1
16	-0.006081	0
17	-0.070443	0
18	2.050848	2
19	1.000664	1

```
#performance metrics
```

```
from sklearn.metrics import mean_squared_error
```

```
import math
```

```
print(mean_squared_error(y_test,y_pred))
```

```
print(math.sqrt(mean_squared_error(y_test,y_pred)))
```

```
0.0038471231954710695
```

```
0.06202518194629557
```