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Mall Customer Segmentation Data

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
import numpy as np
```

Read to data into pandas dataframe

```
mall_data = pd.read_csv('Mall_Customers.csv')
mall_data
```

```
     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
..          ...     ...  ...                 ...                    .
..
195         196  Female   35                 120
79
196         197  Female   45                 126
28
197         198    Male   32                 126
74
198         199    Male   32                 137
18
199         200    Male   30                 137
83

[200 rows x 5 columns]
```

We can get basic info on the dataframe such as the columns, datatypes & non-null count

```
mall_data.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   Gender                  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
```

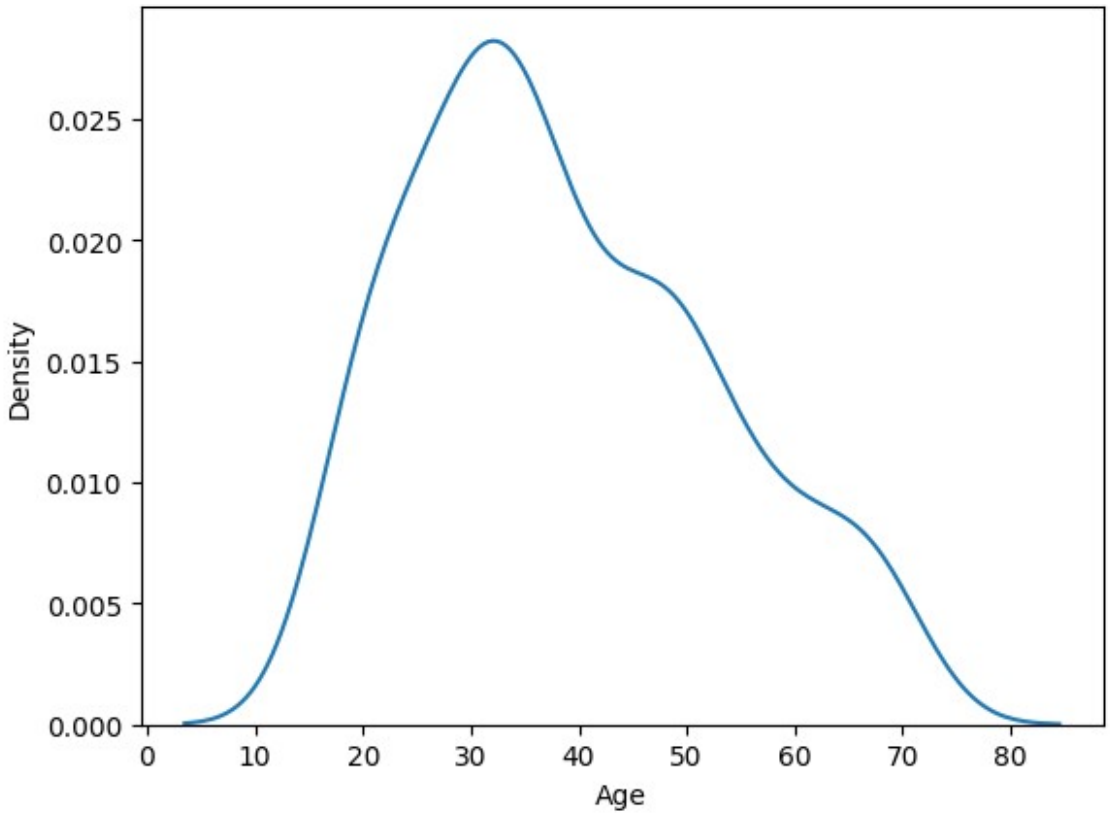
```
mall_data.describe()
```

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

Using sns plots to find relationship between various columns of dataframe

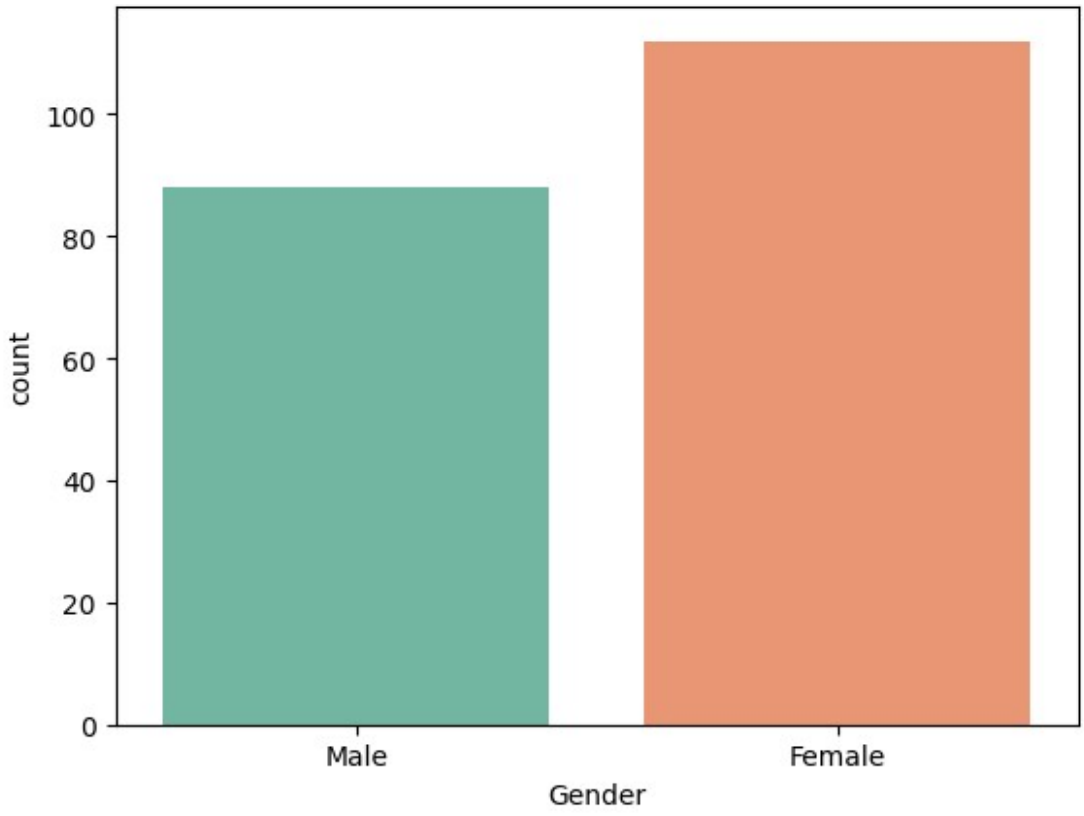
```
sns.kdeplot(data=mall_data, x='Age')
# Most customers lie around the age group of 30-40
```

```
<Axes: xlabel='Age', ylabel='Density'>
```



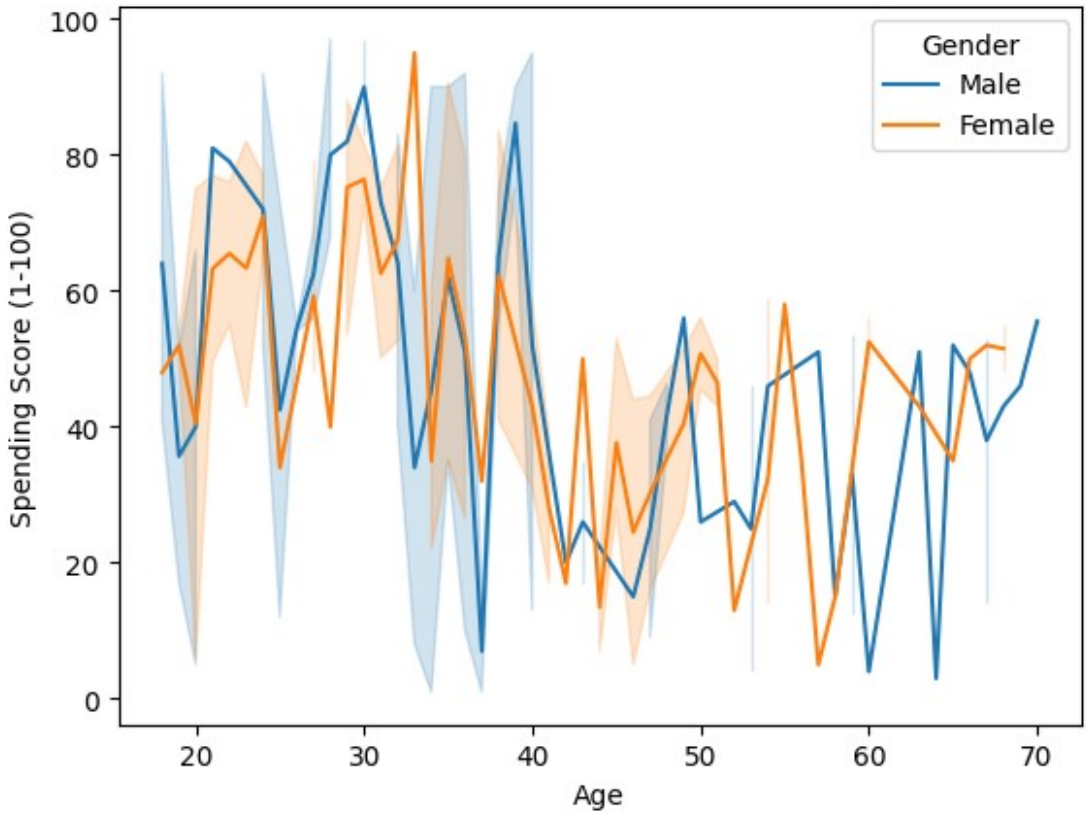

```
sns.countplot(data=mall_data, x='Gender', palette='Set2')
# More no. of female customers
```

```
C:\Users\vraj patel\AppData\Local\Temp\
ipykernel_17252\2370068275.py:1: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.countplot(data=mall_data, x='Gender', palette='Set2')

<Axes: xlabel='Gender', ylabel='count'>
```




```
sns.lineplot(data=mall_data, x='Age', y='Spending Score (1-100)',
hue='Gender')
# We can see women have more spending score on avg than men
```

```
<Axes: xlabel='Age', ylabel='Spending Score (1-100)'>
```




```
X = mall_data[['Age', 'Annual Income (k$)', 'Spending Score (1-100)']]
X
```

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

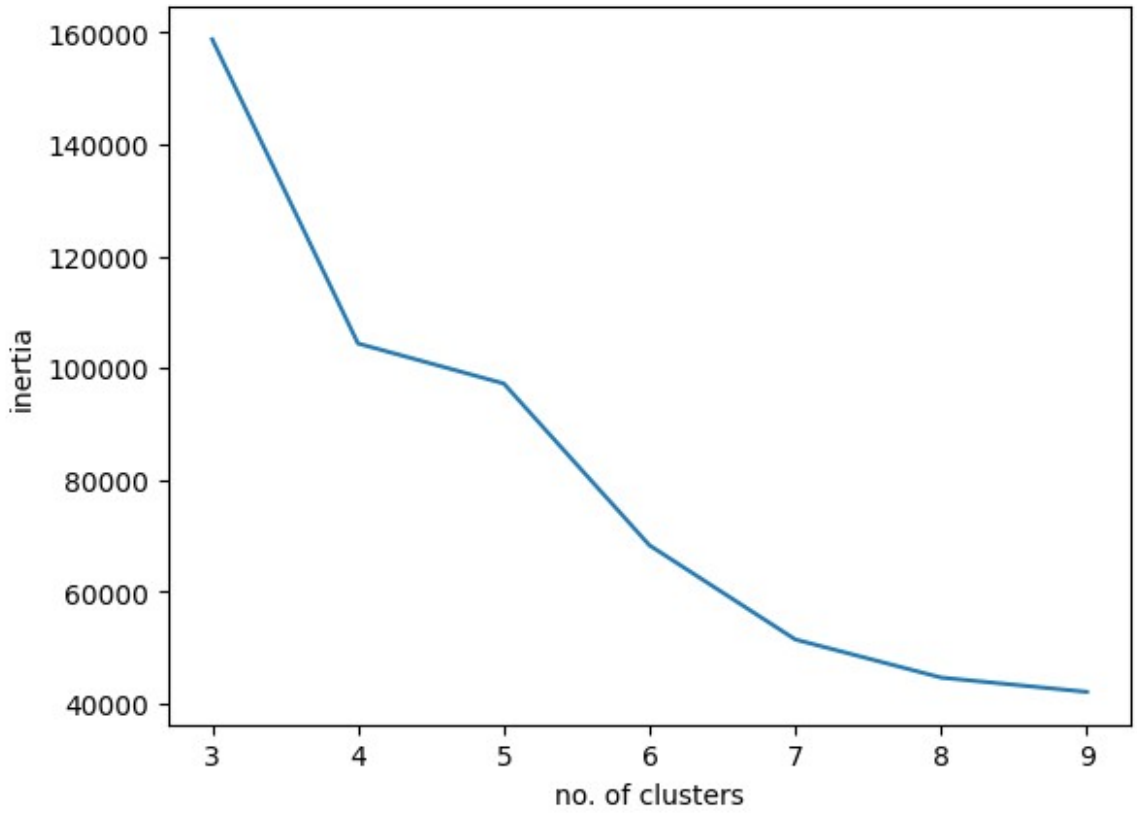
[200 rows x 3 columns]

Using K-means Clustering to group the customers

```
inertia = []
for i in range(3,10):
    kmeans = KMeans(n_clusters= i, init='k-means++', random_state=42,
max_iter=200)
```

```
    kmeans.fit(X)
    inertia.append(kmeans.inertia_)

plt.plot(range(3, 10), inertia)
plt.xlabel('no. of clusters')
plt.ylabel('inertia')
# We can see the elbow occurs at no. of clusters = 6
```

```
Text(0, 0.5, 'inertia')
```




```
# Fit k-means clustering algorithm to the dataset
kmeans_model = KMeans(n_clusters=6, init='k-means++', random_state=42,
max_iter=200)
kmeans_model.fit(X)
```

```
KMeans(max_iter=200, n_clusters=6, random_state=42)
```

```
# We can get the computed cluster centroids
centroids = kmeans_model.cluster_centers_

y_kmeans = kmeans_model.fit_predict(X)
y_kmeans
```

```
array([5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5,
2,
```

```
       5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5, 2, 5,
2,
       5, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
2,
       0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 4, 3, 4, 0, 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, 4, 3, 4, 3, 4, 3, 4, 3,
4,
       3, 4, 3, 4, 3, 1, 3, 1, 3, 1, 3, 1, 3, 1, 3, 1, 3, 1, 3, 1, 3,
1,
       3, 1])
```

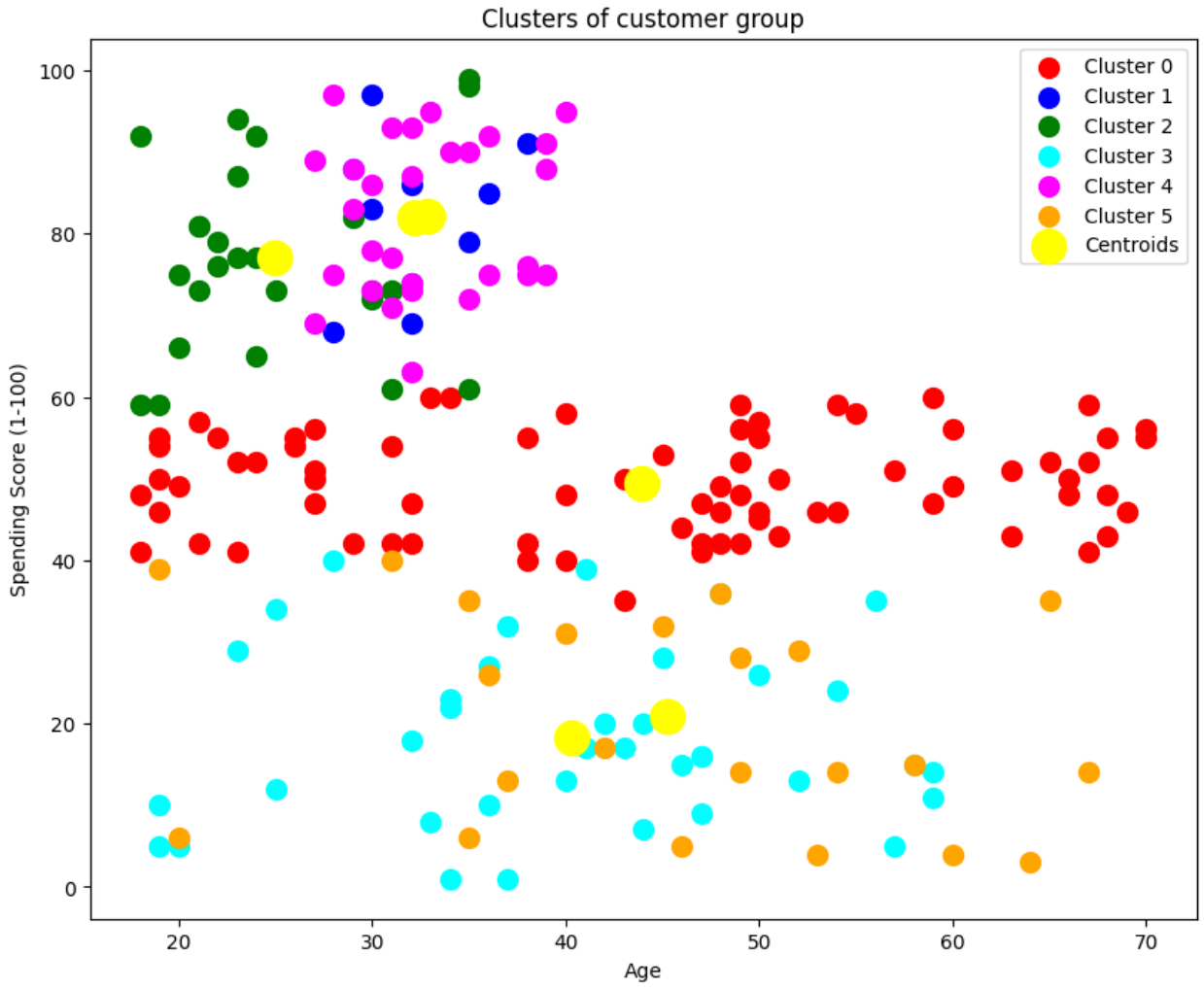
Visualizing all clusters

```
np.squeeze(np.argwhere(y_kmeans == i))
```

```
array([], dtype=int64)
```

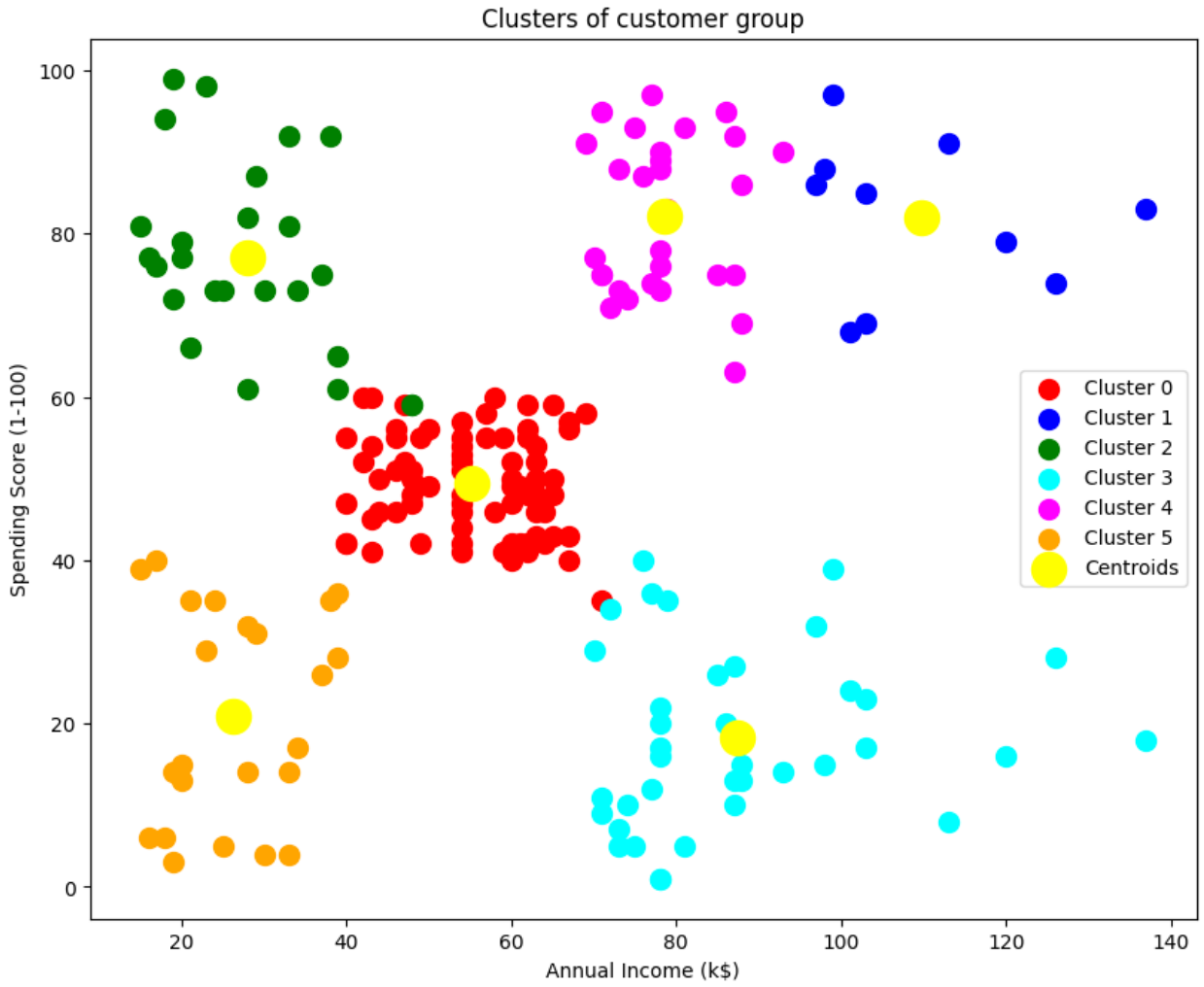
```
clusters = [0, 1, 2, 3, 4, 5]
colors = ['red', 'blue', 'green', 'cyan', 'magenta', 'orange']

plt.figure(figsize=(10, 8))
# Clusters for Age and Spending Score
for i in range(6):
  plt.scatter(X.iloc[np.squeeze(np.argwhere(y_kmeans == i)), 0],
X.iloc[np.squeeze(np.argwhere(y_kmeans == i)), 2], s = 100, c =
colors[i], label = f'Cluster {i}')

plt.scatter(centroids[:, 0], centroids[:, 2], s = 300, c = 'yellow',
label = 'Centroids')
plt.title('Clusters of customer group')
plt.xlabel('Age')
plt.ylabel('Spending Score (1-100)')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x20265e7cd70>
```




```
plt.figure(figsize=(10, 8))
# Clusters for Annual Income and Spending Score
for i in range(6):
  plt.scatter(X.iloc[np.squeeze(np.argwhere(y_kmeans == i)), 1],
X.iloc[np.squeeze(np.argwhere(y_kmeans == i)), 2], s = 100, c =
colors[i], label = f'Cluster {i}')

plt.scatter(centroids[:, 1], centroids[:, 2], s = 300, c = 'yellow',
label = 'Centroids')
plt.title('Clusters of customer group')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x20265f8ffe0>
```

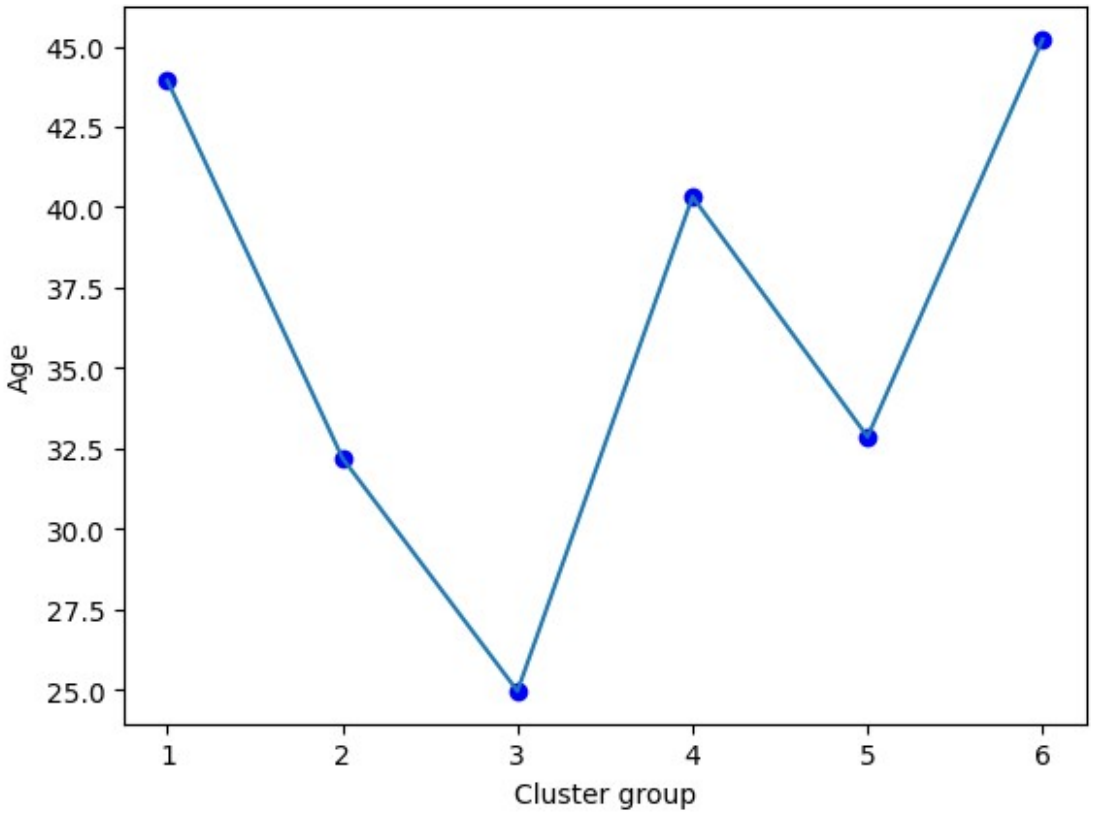


Analysis on Customer groups

```
x_data_c1 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 0)), :]
x_data_c2 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 1)), :]
x_data_c3 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 2)), :]
x_data_c4 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 3)), :]
x_data_c5 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 4)), :]
x_data_c6 = X.iloc[np.squeeze(np.argwhere(y_kmeans == 5)), :]
cluster_grps = [x_data_c1, x_data_c2, x_data_c3, x_data_c4, x_data_c5,
x_data_c6]

age_means = [np.mean(clust_i['Age']) for clust_i in cluster_grps]
annual_inc_means = [np.mean(clust_i['Annual Income (k$)']) for clust_i
in cluster_grps]
spending_scr_means = [np.mean(clust_i['Spending Score (1-100)']) for
clust_i in cluster_grps]
```

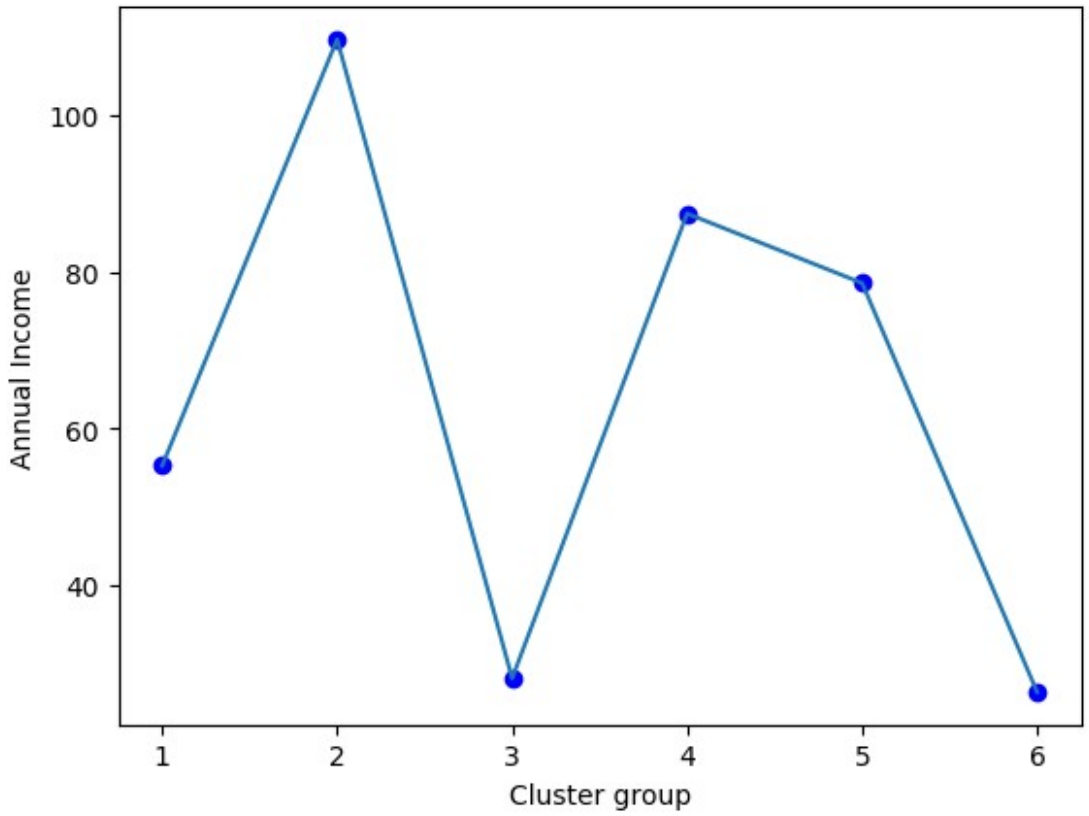
Avg. Age distribution among 6 cluster groups

```
plt.plot(range(1, 7), age_means, 'bo')
plt.plot(range(1, 7), age_means, '-')
plt.xlabel('Cluster group')
plt.ylabel('Age')
# Cluster group 3 is the YOUNGEST and group 1 is the OLDEST

Text(0, 0.5, 'Age')
```



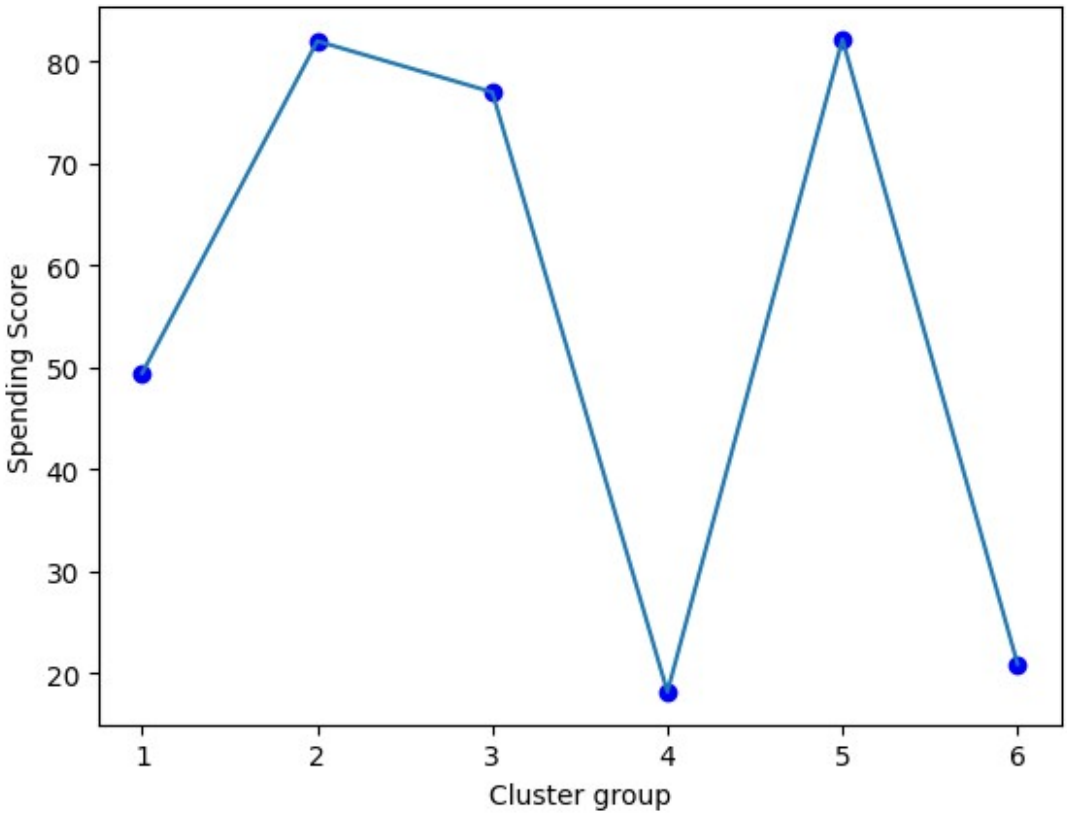
Avg. Annual Income distribution among 6 cluster groups

```
plt.plot(range(1, 7), annual_inc_means, 'bo')
plt.plot(range(1, 7), annual_inc_means, '-')
plt.xlabel('Cluster group')
plt.ylabel('Annual Income')
# Groups 3 & 6 have the lowest Annual income with Groups 2 & 5 ranking
the highest

Text(0, 0.5, 'Annual Income')
```



Avg. Spending Score distribution among 6 cluster groups

```
plt.plot(range(1, 7), spending_scr_means, 'bo')
plt.plot(range(1, 7), spending_scr_means, '-')
plt.xlabel('Cluster group')
plt.ylabel('Spending Score')
# Group 5 & 3 have the highest spending score with 2 & 6 ranking
lowest

Text(0, 0.5, 'Spending Score')
```


Spending Score
80
70
60
50
40
30
20
1
2
3
4
5
6
Cluster group