

Mall Customer Segmentation

Date : 31.January.2024

By : Yasein Shikhada

```
[1]: # import libraries
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import AgglomerativeClustering
from sklearn import preprocessing
from scipy.cluster.hierarchy import dendrogram, linkage
```

```
[2]: # load dataset
df = pd.read_csv('Mall_Customers.csv')
```

```
[3]: df.head()
```

```
[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

```
[4]: df.isnull().sum()
```

```
[4]: CustomerID          0
Genre                  0
Age                    0
Annual Income (k$)     0
Spending Score (1-100) 0
dtype: int64
```

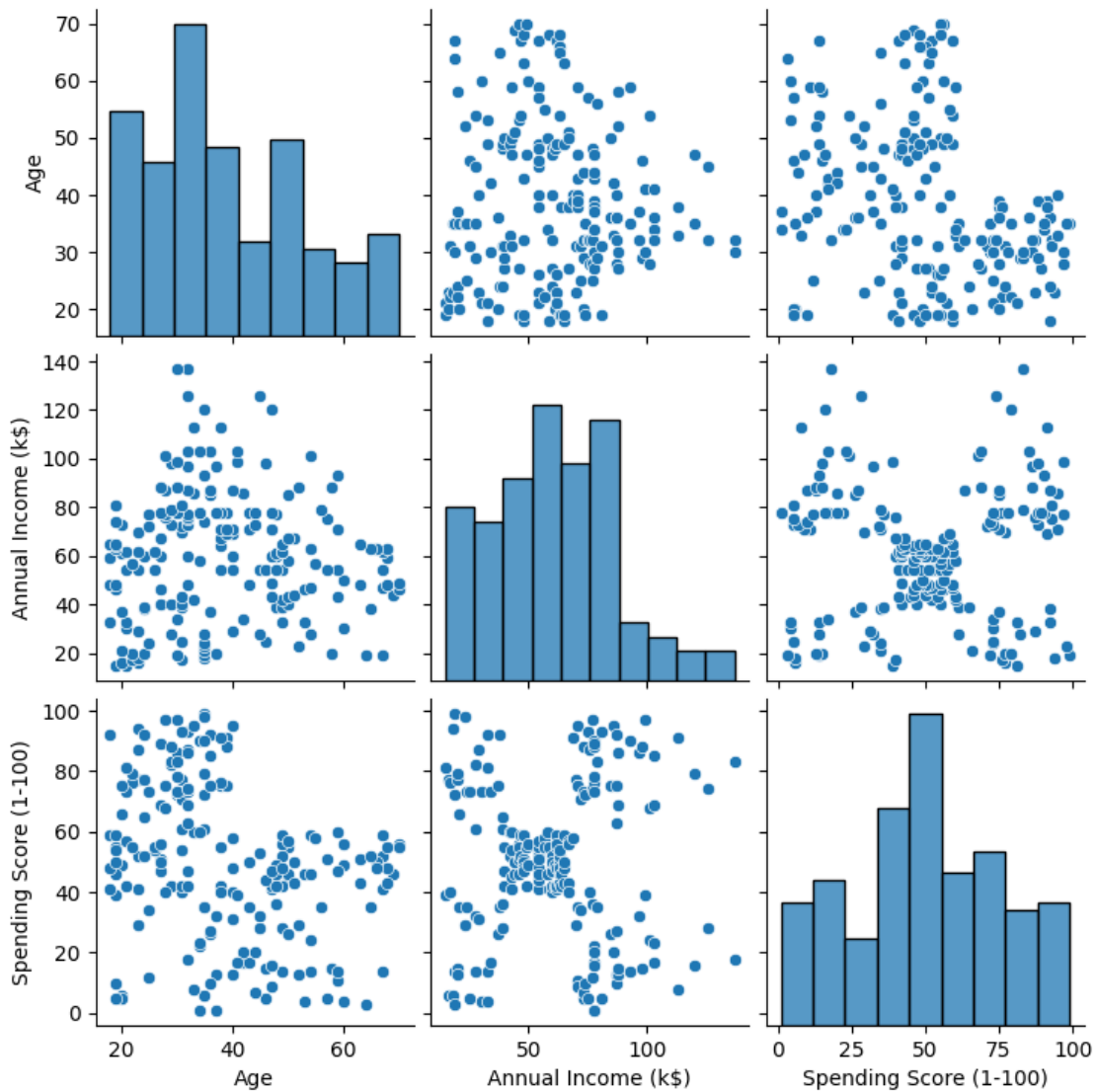
```
[5]: df.describe()
```

```
[5]:
```

	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

```
[6]: sns.pairplot(df[['Age', 'Annual Income (k$)', 'Spending Score (1-100)']])
plt.show()
```



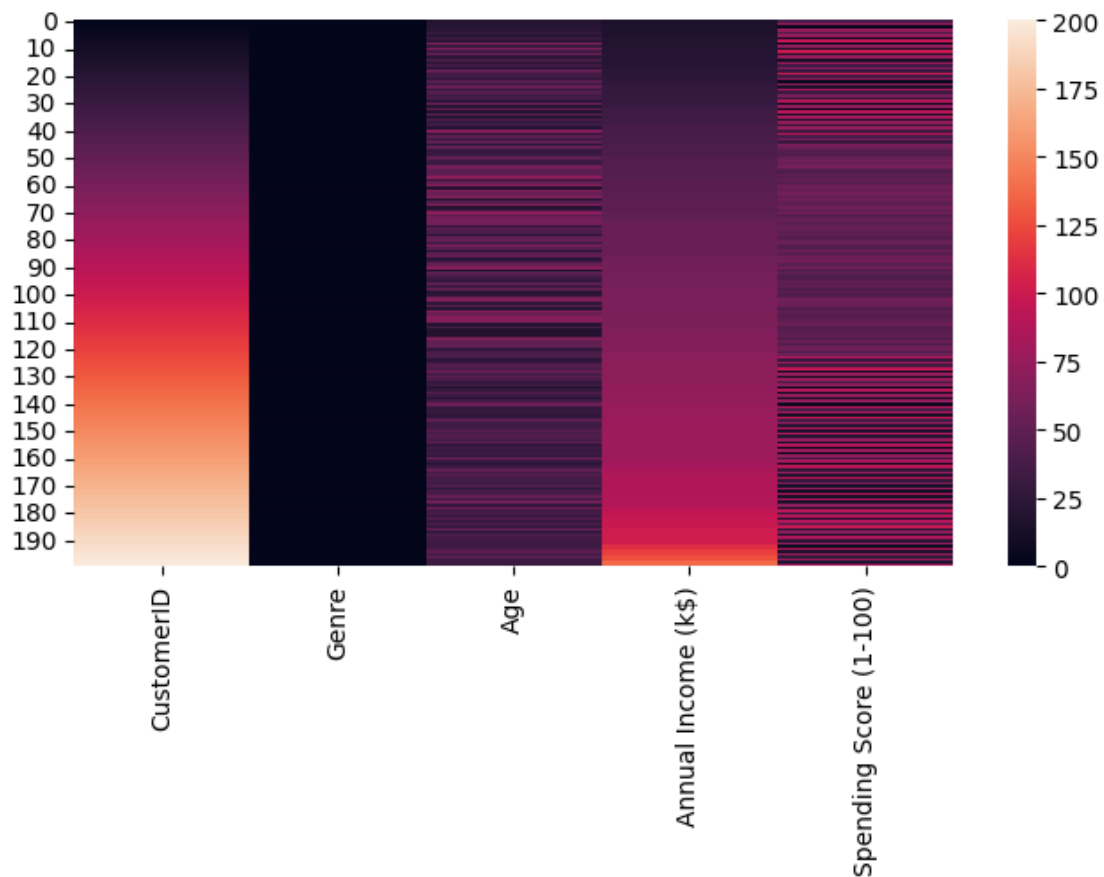
```
[7]: label_encoder = preprocessing.LabelEncoder()

df['Genre'] = label_encoder.fit_transform(df['Genre'])
df.head()
```

```
[7]:
```

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

```
[8]: plt.figure(1, figsize = (8 ,4))
sns.heatmap(df)
plt.show()
```



Feature Selection:

```
[9]: X = df[['Annual Income (k$)', 'Spending Score (1-100)']]
```

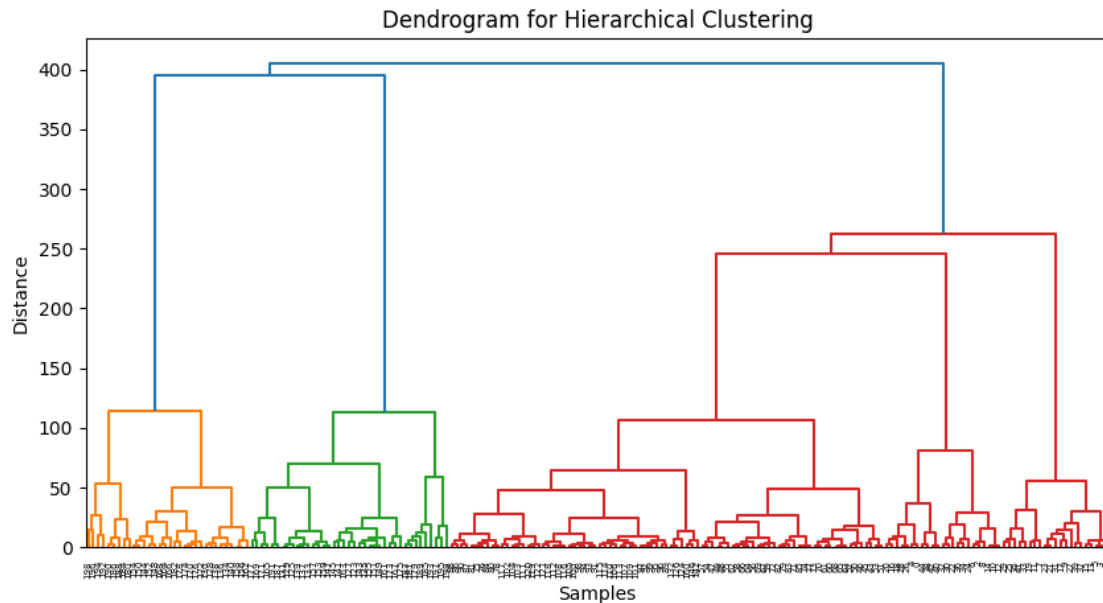
Hierarchical Clustering

using the 'ward' linkage method, creating the linkage matrix.

```
[10]: linked = linkage(X, method='ward')
```

Dendrogram for Hierarchical Clustering

```
[11]: plt.figure(figsize=(10, 5))
      dendrogram(linked, orientation='top', distance_sort='descending',
      ↪ show_leaf_counts=True)
      plt.title('Dendrogram for Hierarchical Clustering')
      plt.xlabel('Samples')
      plt.ylabel('Distance')
      plt.show()
```



Agglomerative Clustering Model Training

Training the model with 5 clusters using Euclidean distance and ‘ward’ linkage.

```
[12]: hc = AgglomerativeClustering(n_clusters=5, affinity='euclidean', linkage='ward')
      y_pred = hc.fit_predict(X)
```

```

/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_agglomerative.py:983:
FutureWarning: Attribute `affinity` was deprecated in version 1.2 and will be
removed in 1.4. Use `metric` instead
    warnings.warn(

```

```
[13]: df['Cluster'] = y_pred
      y_pred
```

```
[13]: array([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, 1,
            4, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
```

```

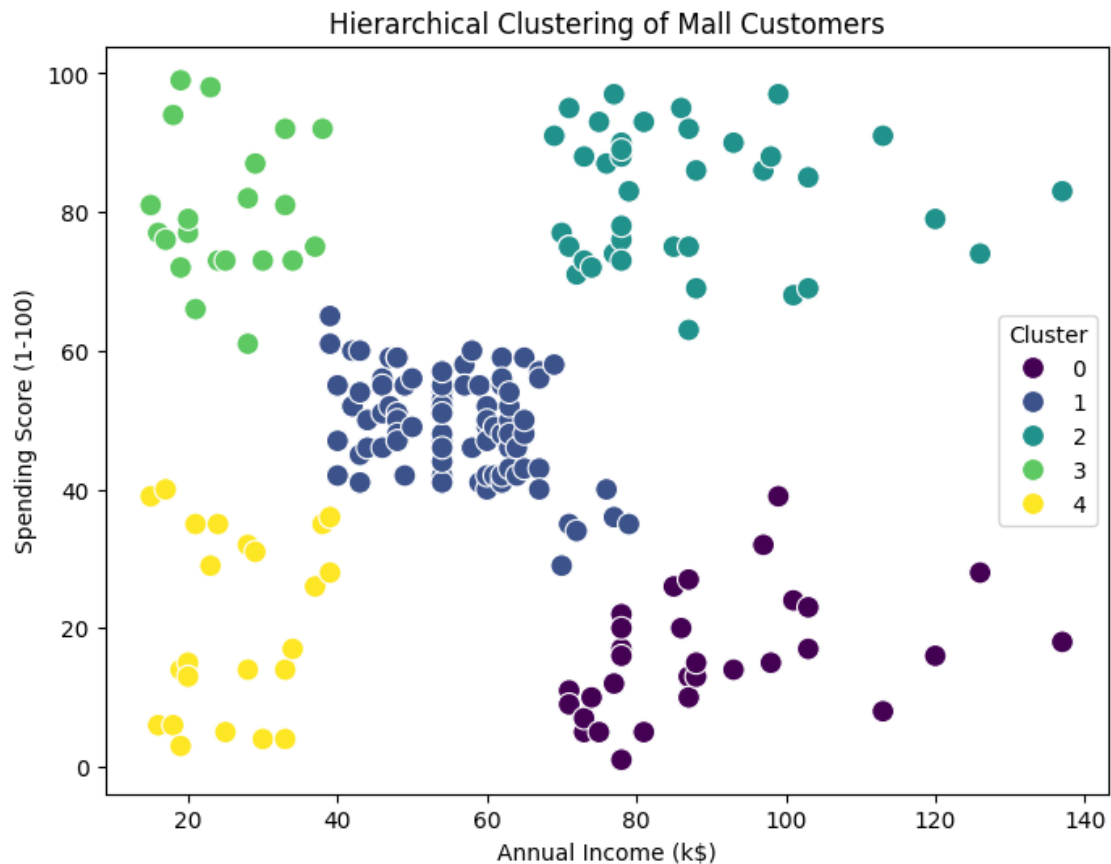
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 1, 2, 0, 2, 0, 2,
1, 2, 0, 2, 0, 2, 0, 2, 0, 2, 1, 2, 0, 2, 1, 2, 0, 2, 0, 2, 0, 2,
0, 2, 0, 2, 0, 2, 1, 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])

```

```

[14]: plt.figure(figsize=(8, 6))
sns.scatterplot(x='Annual Income (k$)', y='Spending Score (1-100)', data=df,
               hue='Cluster', palette='viridis', s=100)
plt.title('Hierarchical Clustering of Mall Customers')
plt.show()

```



```

[15]: from sklearn import metrics

silhouette = metrics.silhouette_score(X, y_pred)
print(f"Silhouette Score: {silhouette}")

```

Silhouette Score: 0.5529945955148897

Plotting in 3D using Plotly

```
[16]: import plotly.graph_objs as go
import plotly.offline as py

sample = go.Scatter3d(
    x=df['Annual Income (k$)'], y=df['Spending Score (1-100)'], z=df['Age'],
    mode='markers',
    marker=dict(color=df['Cluster'], size=10, line=dict(color=df['Cluster'],
    width=12), opacity=0.8
)
data_plotly = [sample]
layout = go.Layout(title='Clusters using Agglomerative Clustering',
    scene=dict(
        xaxis=dict(title='Annual Income (k$)'),
        yaxis=dict(title='Spending Score (1-100)'),
        zaxis=dict(title='Age')
    )
)
fig = go.Figure(data=data_plotly, layout=layout)
py.iplot(fig)
```

Our plot visualizes how customers are grouped based on these attributes after clustering.

By using Agglomerative Clustering on our mall_customer information, we grouped them based on how much they earn, spend, and their age.

So, This customer segmentation helps us discover better ways to sell products/services and grow our business.