

Assignment 4


Customer Segmentation Analysis

Clustering the data and performing classification algorithms

▼ Import Libraries

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

```
from google.colab import drive
drive.mount('/content/drive')
```

 Mounted at /content/drive

▼ 2. Load the dataset into the tool

```
data = pd.read_csv('/content/drive/MyDrive/Mall_Customers.csv')
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 × 5 columns

```
data.shape
```

(200, 5)

```
data = data.drop(columns=["CustomerID"],axis=1)
```

```
data.head()
```

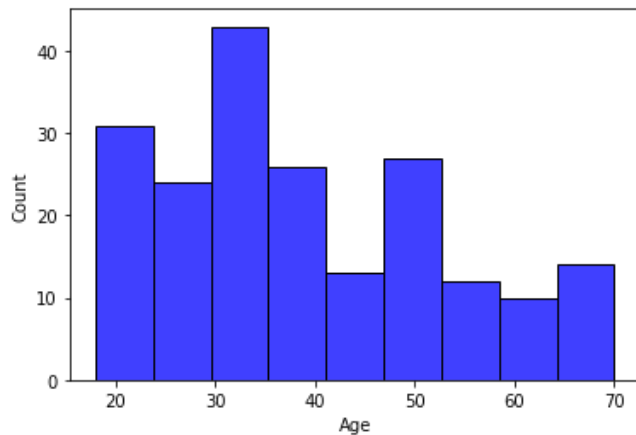
	Gender	Age	Annual Income (k\$)	Spending Score (1-100)
0	Male	19	15	39
1	Male	21	15	81
2	Female	20	16	6
3	Female	23	16	77
4	Female	31	17	40

3. Perform Below Visualizations

▼ • Univariate Analysis

```
sns.histplot(x=data.Age,color='Blue')
```

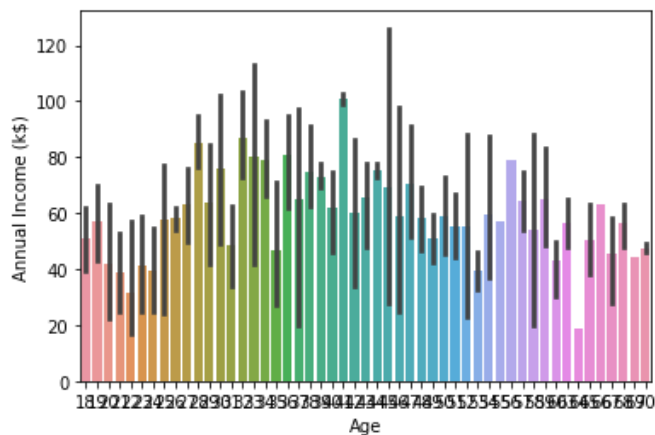
<matplotlib.axes._subplots.AxesSubplot at 0x7f3000396490>



▼ • Bi-Variate Analysis

```
sns.barplot(x=data.Age,y=data['Annual Income (k$)'])
```

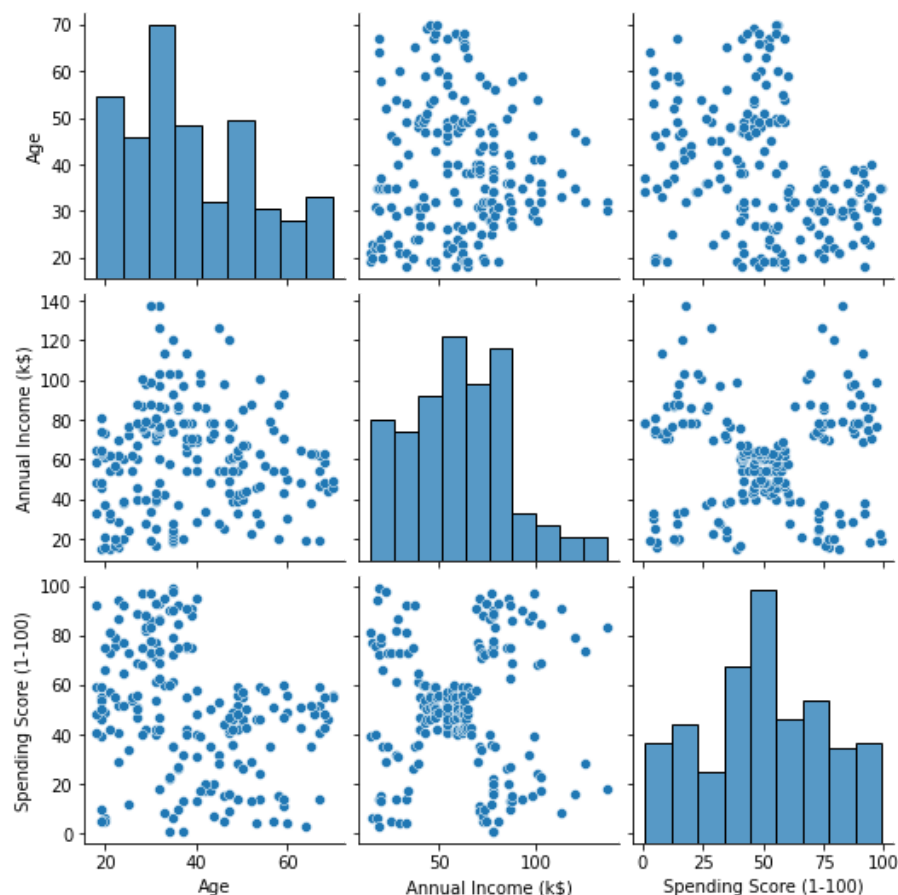
<matplotlib.axes._subplots.AxesSubplot at 0x7f30002a7ed0>



▼ • Multi-Variate Analysis

```
sns.pairplot(data)
```

<seaborn.axisgrid.PairGrid at 0x7f2fffd54fd0>



▼ 4. Perform descriptive statistics on the dataset

```
data.describe()
```

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

▼ 5. Check for Missing values and deal with them

```
data.isnull().any()
```

```
Gender      False
Age         False
```

```
Annual Income (k$)      False
Spending Score (1-100)  False
dtype: bool
```

```
data.isnull().sum()
```

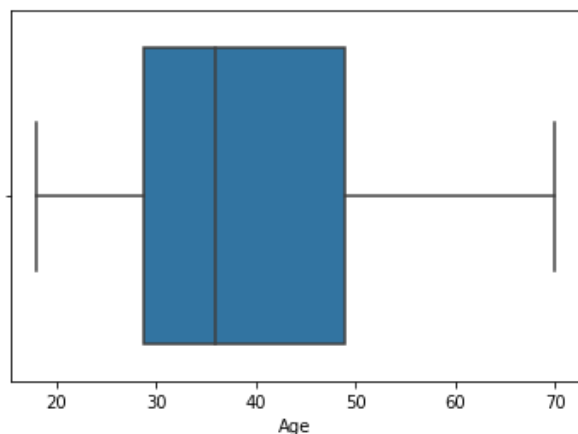
```
Gender      0
Age         0
Annual Income (k$)  0
Spending Score (1-100)  0
dtype: int64
```

There is no missing values so we go for next step

▼ 6. Find the outliers and replace them outliers

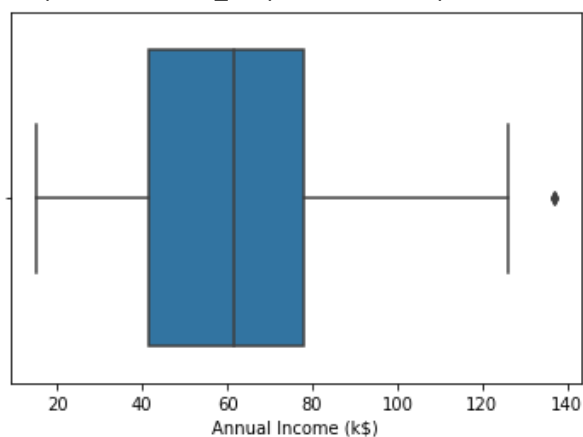
```
sns.boxplot(data.Age)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: P
FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f2fffc77750>
```



```
sns.boxplot(data['Annual Income (k$)'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: P
FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f2fffb5fd0>
```



```
data['Annual Income (k$)'].median()
```

61.5

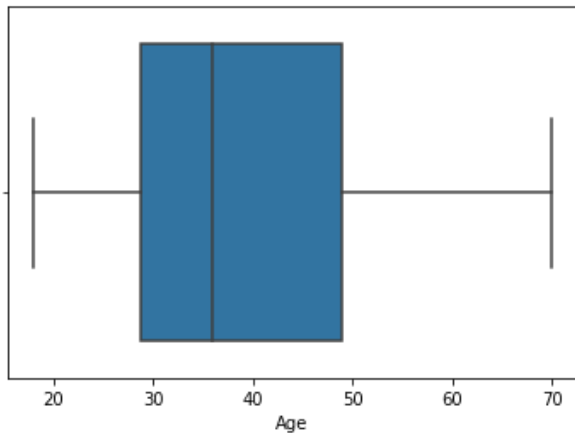
```
q1=data['Annual Income (k$)'].quantile(0.25)
q3=data['Annual Income (k$)'].quantile(0.75)

IQR=q3-q1

upper_limit= q3 + 1.5*IQR
lower_limit= q1 - 1.5*IQR

data['Annual Income (k$)']= np.where(data['Annual Income (k$)']>upper_limit,61,data['Annual Income (k$)'])
sns.boxplot(x=data.Age,showfliers=False)
```

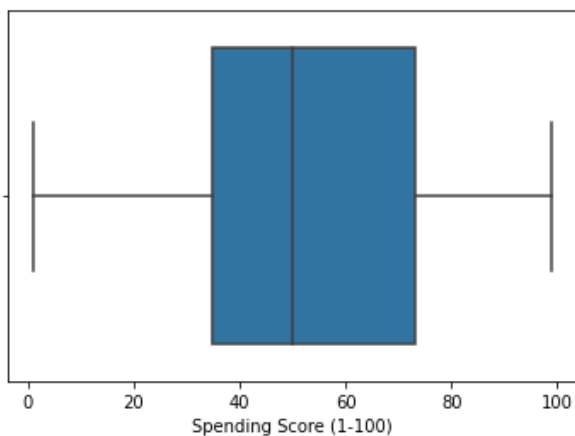
<matplotlib.axes._subplots.AxesSubplot at 0x7f2ffd05f550>



```
sns.boxplot(data['Spending Score (1-100)'])
```

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: P
FutureWarning

<matplotlib.axes._subplots.AxesSubplot at 0x7f2ffb612650>



< >

7. Check for Categorical columns and perform encoding

• Label encoding

```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()

data.Gender=le.fit_transform(data.Gender)
```

```
data.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

▼ 8. Scaling the data

```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
data_scaled = scaler.fit_transform(data)
data_scaled[0:5]
```

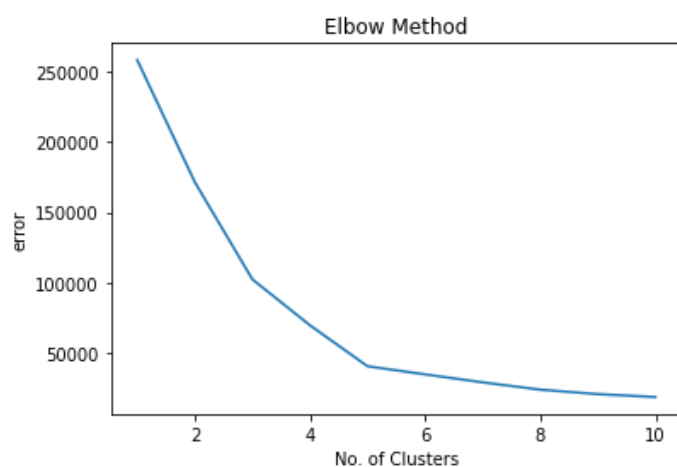
```
array([[1.          , 0.01923077, 0.          , 0.3877551 ],
       [1.          , 0.05769231, 0.          , 0.81632653],
       [0.          , 0.03846154, 0.00900901, 0.05102041],
       [0.          , 0.09615385, 0.00900901, 0.7755102 ],
       [0.          , 0.25          , 0.01801802, 0.39795918]])
```

▼ 9. Perform any of the clustering algorithms

```
target = data[['Annual Income (k$)', 'Spending Score (1-100)']].iloc[:, :].values
from sklearn.cluster import KMeans
```

```
error = []
for i in range(1, 11):
    km = KMeans(n_clusters = i, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
    km.fit(target)
    error.append(km.inertia_)
```

```
plt.plot(range(1, 11), error)
plt.title('Elbow Method')
plt.xlabel('No. of Clusters')
plt.ylabel('error')
plt.show()
```



```
k_means = KMeans(n_clusters = 5, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
```

```
KMeans(n_clusters=5, random_state=0)
```

y_means

[illegible]

▼ 10. Add the cluster data with the primary dataset

```
data['Outcome'] = pd.Series(y_means)
```

```
data.head()
```

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

11. Split the data into dependent and independent variables

- ▼ (i) Independent variable

```
x=data.drop(columns=['Outcome'],axis = 1)
x.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

▼ (ii) **Dependent variable**

```
y = data.Outcome
y.head()
```

```
0    3
1    4
2    3
3    4
4    3
Name: Outcome, dtype: int32
```

▼ 12. Split the data into training and testing

```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y, test_size=0.2, random_state=42)
```

```
x_train.shape
```

```
(160, 4)
```

```
x_test.shape
```

```
(40, 4)
```

```
y_train.shape
```

```
(160,)
```

```
y_test.shape
```

```
(40,)
```

▼ 13. Build the Model

```
from sklearn.ensemble import RandomForestClassifier
model = RandomForestClassifier(n_estimators=10,criterion='entropy')
```

```
model.fit(x_train,y_train)
```

```
RandomForestClassifier(criterion='entropy', n_estimators=10)
```

```
y_predict = model.predict(x_test)
```

```
y_predict_train = model.predict(x_train)
```

▼ 14. Train the Model

```
from sklearn.metrics import accuracy_score,confusion_matrix,classification_report
```

```
print('Training accuracy: ',accuracy_score(y_train,y_predict_train))
```

```
Training accuracy:  1.0
```


▼ 15. Test the Model

```
print('Testing accuracy: ',accuracy_score(y_test,y_predict))

Testing accuracy:  0.975
```

▼ 16. Measure the performance using Metrics

```
pd.crosstab(y_test,y_predict)
```

col_0	0	1	2	3	4
Outcome					
0	12	0	0	0	0
1	0	17	0	0	0
2	0	0	5	0	0
3	0	0	0	3	0
4	0	1	0	0	2

```
print(classification_report(y_test,y_predict))
```

	precision	recall	f1-score	support
0	1.00	1.00	1.00	12
1	0.94	1.00	0.97	17
2	1.00	1.00	1.00	5
3	1.00	1.00	1.00	3
4	1.00	0.67	0.80	3
accuracy			0.97	40
macro avg	0.99	0.93	0.95	40
weighted avg	0.98	0.97	0.97	40