K-Means Clustering

Importing the libraries

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

Importing the dataset

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

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True)
```

```
# Reading the data file into a DATAFRAME and checking the shape
dataset=pd.read_csv("/content/drive/My Drive/Colab Notebooks/Mall_Customers.csv")
print(dataset.shape)
dataset
```

```
(200, 5)
```

	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
...	...	...	...	...	...
195	196	Female	35	120	79
196	197	Female	45	126	28
199	200	Male	30	137	83

```
# calling head() method
# storing in new variable
data_top = dataset.head()
```

```
# iterating the columns
for row in data_top.index:
    print(row, end = " ")
```

```
0 1 2 3 4
```

Getting column names in Pandas dataframe

Now let’s try to get the columns name from the dataset.

Method #1: Simply iterating over columns

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Method #2: Using columns with dataframe object

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Method #3: column.values method returns an array of indexes.

```
list(dataset.columns.values)
```

```
['CustomerID', 'Genre', 'Age', 'Annual Income (k$)', 'Spending Score (1-100)']
```

Method #4: Using tolist() method with values with given the list of columns.

```
list(dataset.columns.values.tolist())
```

```
['CustomerID', 'Genre', 'Age', 'Annual Income (k$)', 'Spending Score (1-100)']
```

Method #5: Using sorted() method

Sorted() method will return the list of columns sorted in alphabetical order.

```
# using sorted() method
sorted(dataset)
```

```
['Age', 'Annual Income (k$)', 'CustomerID', 'Genre', 'Spending Score (1-100)']
```

Select rows and columns using labels

```
dataset.loc[:,"Age"]
```

```
0      19
1      21
2      20
3      23
4      31
       ..
195    35
196    45
197    32
198    32
199    30
Name: Age, Length: 200, dtype: int64
```

```
dataset["Age"]
```

```
0      19
1      21
2      20
3      23
4      31
       ..
195    35
196    45
197    32
198    32
199    30
Name: Age, Length: 200, dtype: int64
```

```
dataset.Age
```

```
0      19
```

```
1      21
2      20
3      23
4      31
       ..
195    35
196    45
197    32
198    32
199    30
Name: Age, Length: 200, dtype: int64
```

Double-click (or enter) to edit

To select multiple columns.

Double-click (or enter) to edit

```
dataset.loc[:, ["Age", "Genre"]]
```

	Age	Genre
0	19	Male
1	21	Male
2	20	Female
3	23	Female

```
dataset[["Age", "Genre"]]
```

	Age	Genre
0	19	Male
1	21	Male
2	20	Female
3	23	Female
4	31	Female
...	...	...
195	35	Female
196	45	Female
197	32	Male
198	32	Male
199	30	Male

200 rows × 2 columns

Select a row by its label.

```
dataset.loc[0]
```

```
CustomerID                   1
Genre                     Male
Age                         19
Annual Income (k$)          15
Spending Score (1-100)      39
Name: 0, dtype: object
```

Select multiple rows by label.

```
dataset.loc[[0,1]]
```

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81

Accessing values by row and column label.

```
dataset.loc[0,"Age"]
```

```
19
```

Accessing values from multiple columns of same row.

```
dataset.loc[1,["Age", "Genre"]]
```

```
Age        21
Genre    Male
Name: 1, dtype: object
```

Select by Index Position

we can select data from a Pandas DataFrame by its location.

Note, Pandas indexing starts from zero.

Select a row by index location.

```
dataset.iloc[0]
```

```
CustomerID                   1
Genre                     Male
Age                         19
Annual Income (k$)          15
Spending Score (1-100)      39
Name: 0, dtype: object
```

Select a column by index location.

```
dataset.iloc[:, 3]
```

```
0       15
1       15
2       16
3       16
4       17
      ...
```

```
195    120
196    126
197    126
198    137
199    137
Name: Annual Income (k$), Length: 200, dtype: int64
```

#Select data at the specified row and column location.

```
dataset.iloc[0,3]
```

```
15
```

Select list of rows and columns.

```
dataset.iloc[[1,2],[0, 1]]
```

	CustomerID	Genre
1	2	Male
2	3	Female

Slicing Rows and Columns by position

To slice a Pandas dataframe by position use the iloc attribute.

Remember index starts from 0 to (number of rows/columns - 1).

To slice rows by index position.

```
dataset.iloc[0:2,:]
```

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81

To slice columns by index position.

```
dataset.iloc[:,1:3]
```

	Genre	Age
0	Male	19
1	Male	21
2	Female	20
3	Female	23
4	Female	31
...	...	...
195	Female	35
196	Female	45
197	Male	32
198	Male	32
199	Male	30

200 rows × 2 columns

To slice row and columns by index position.

```
dataset.iloc[1:2,1:3]
```

	Genre	Age
1	Male	21

```
dataset.iloc[:2,:2]
```

	CustomerID	Genre
0	1	Male
1	2	Male

Subsetting by boolean conditions

we can use boolean conditions to obtain a subset of the data from the DataFrame.

Select rows based on column value

To select all rows whose column contain the specified value(s).

```
dataset[dataset.CustomerID == 9]
```

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
8	9	Male	64	19	3

```
dataset.loc[dataset.Age == 64]
```

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
8	9	Male	64	19	3

Double-click (or enter) to edit

```
X = dataset.iloc[:, [3, 4]].values
```

Using the elbow method to find the optimal number of clusters

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Training the K-Means model on the dataset

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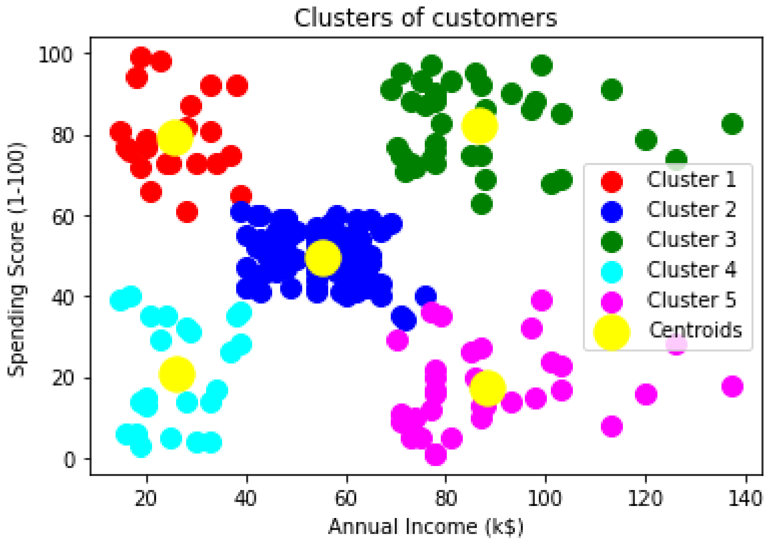
Visualising the clusters

```
plt.scatter(X[y_kmeans == 0, 0], X[y_kmeans == 0, 1], s = 100, c = 'red', label = 'Cluster 1')
plt.scatter(X[y_kmeans == 1, 0], X[y_kmeans == 1, 1], s = 100, c = 'blue', label = 'Cluster 2')
plt.scatter(X[y_kmeans == 2, 0], X[y_kmeans == 2, 1], s = 100, c = 'green', label = 'Cluster 3')
plt.scatter(X[y_kmeans == 3, 0], X[y_kmeans == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4')
plt.scatter(X[y_kmeans == 4, 0], X[y_kmeans == 4, 1], s = 100, c = 'magenta', label = 'Cluster 5')
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = 'yellow', label = 'Centroids')
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```



Python Implementation of the K-Means Clustering Algorithm

Here’s how to use Python to implement the K-Means Clustering Algorithm. These are the steps you need to take:

1.Data pre-processing

2.Finding the optimal number of clusters using the elbow method

3.Training the K-Means algorithm on the training data set

4.Visualizing the clusters

1. Data Pre-Processing. Import the libraries, datasets, and extract the independent variables.

```
# importing libraries

import numpy as nm

import matplotlib.pyplot as mtp

import pandas as pd

# Importing the dataset
```

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

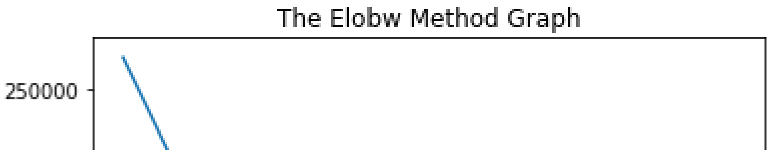
```
dataset=pd.read_csv("/content/drive/My Drive/Colab Notebooks/Mall_Customers.csv")
```

```
x = dataset.iloc[:, [3, 4]].values
```

2. Find the optimal number of clusters using the elbow method. Here’s the code you use:

```
#finding optimal number of clusters using the elbow method
```

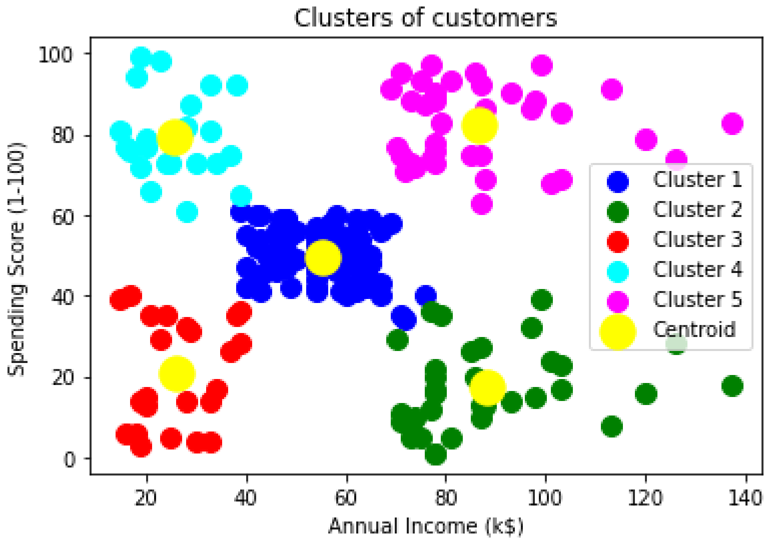
```
from sklearn.cluster import KMeans

wcss_list= []  #Initializing the list for the values of WCSS

#Using for loop for iterations from 1 to 10.

for i in range(1, 11):

    kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)

    kmeans.fit(x)

    wcss_list.append(kmeans.inertia_)

mtp.plot(range(1, 11), wcss_list)

mtp.title('The Elobw Method Graph')

mtp.xlabel('Number of clusters(k)')

mtp.ylabel('wcss_list')

mtp.show()
```



3. Train the K-means algorithm on the training dataset.

Use the same two lines of code used in the previous section. However, instead of using i, use 5, because there are 5 clusters that need to be formed. Here’s the code:

```
#training the K-means model on a dataset

kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)

y_predict= kmeans.fit_predict(x)

#4. Visualize the Clusters. Since this model has five clusters, we need to visualize each one.

#visulaizing the clusters

mtp.scatter(x[y_predict == 0, 0], x[y_predict == 0, 1], s = 100, c = 'blue', label = 'Cluster 1') #for first cluster

mtp.scatter(x[y_predict == 1, 0], x[y_predict == 1, 1], s = 100, c = 'green', label = 'Cluster 2') #for second cluster

mtp.scatter(x[y_predict== 2, 0], x[y_predict == 2, 1], s = 100, c = 'red', label = 'Cluster 3') #for third cluster

mtp.scatter(x[y_predict == 3, 0], x[y_predict == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4') #for fourth cluster

mtp.scatter(x[y_predict == 4, 0], x[y_predict == 4, 1], s = 100, c = 'magenta', label = 'Cluster 5') #for fifth cluster

mtp.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = 'yellow', label = 'Centroid')

mtp.title('Clusters of customers')

mtp.xlabel('Annual Income (k$)')
mtp.ylabel('Spending Score (1-100)')

mtp.legend()

mtp.show()
```



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