```
!pip install -q powerbiclient

import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from powerbiclient import QuickVisualize, get_dataset_config, Report
from powerbiclient.authentication import DeviceCodeLoginAuthentication
import matplotlib.pyplot as plt
```

```
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```

```
dataset_clients = pd.read_csv('/content/data_clients.csv')
```

1. Data Cleaning step

```
dataset_clients.head(10)
```

	id	age	annual_income	purchase_power_score
0	1	56	94740.0	90
1	2	69	136352.0	50
2	3	46	86617.0	62
3	4	32	114841.0	97
4	5	60	36896.0	51
5	6	25	145729.0	37
6	7	38	66175.0	96
7	8	56	27805.0	87
8	9	36	25237.0	78
9	10	40	135247.0	29

```
dataset_clients.shape
```

```
(501, 4)
```

```
missing_values_count = dataset_clients.isnull().sum()
missing_values_count
```

	0
id	0
age	0
annual_income	4
purchase_power_score	0

dtype: int64

```
total_cells= np.product(dataset_clients.shape)
total_missing = missing_values_count.sum()
total_missing
```

```
4
```

```
percent_missing = (total_missing/total_cells)*100
percent_missing
```

```
0.19960079840319359
```

```
duplicate_rows = dataset_clients[dataset_clients.duplicated()]

```

```
print("Duplicate Rows:")
print(duplicate_rows)

num_duplicates = len(duplicate_rows)
print(f"\nNumber of duplicate rows: {num_duplicates}")
```

```
Duplicate Rows:
    id  age  annual_income  purchase_power_score
10  10   40       135247.0                    29

Number of duplicate rows: 1
```

```
dataset_clients = dataset_clients.drop_duplicates()
```

```
duplicate_rows_after_removal = dataset_clients[dataset_clients.duplicated()]
num_duplicates_after_removal = len(duplicate_rows_after_removal)
print(f"\nNumber of duplicate rows after removal: {num_duplicates_after_removal}")
```

```

Number of duplicate rows after removal: 0
```

```
average_annual_income = dataset_clients['annual_income'].mean()
```

```
dataset_clients['annual_income'].fillna(average_annual_income, inplace=True)
```

```
<ipython-input-12-f0eac7d3c5ee>:1: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through cha
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col]


  dataset_clients['annual_income'].fillna(average_annual_income, inplace=True)
```

```
print(dataset_clients.isnull().sum())
```

```
id                      0
age                     0
annual_income           0
purchase_power_score    0
dtype: int64
```

```
#dataset_clients.head(12)
```

2. Exploratory Analysis

```
dataset_clients[['age','annual_income','purchase_power_score']].describe()
```

	age	annual_income	purchase_power_score
count	500.000000	500.000000	500.000000
mean	44.732000	81501.377016	48.512000
std	15.239707	36621.580957	29.556946
min	18.000000	20384.000000	0.000000
25%	32.000000	49328.500000	24.000000
50%	45.000000	79384.500000	48.500000
75%	57.000000	112942.000000	73.250000
max	70.000000	149695.000000	100.000000

3. Preprocessing step

```
standardize = StandardScaler()
```

```
standardize_dataset = standardize.fit_transform(dataset_clients[['age','annual_income','purchase_power_score']])
```

```
print(standardize_dataset)
```

```
[[ 0.74012478  0.3618599   1.40506904]
 [ 1.59401387  1.49926777  0.05039391]
 [ 0.08328703  0.13982865  0.45679645]
 ...
 [-0.31081563  0.32941485  0.18586143]
 [-1.23038848 -1.49133429  1.43893592]
 [-1.03333716 -0.97218626 -0.59307677]]
```

4. Machine Learning Model

```
k = 3
```

```
model_kmeans = KMeans (n_clusters = k)
```

```
model_kmeans.fit(standardize_dataset)
```

```
▾ KMeans
KMeans(n_clusters=3)
```

```
dataset_clients['cluster'] = model_kmeans.labels_
```

```
dataset_clients.head()
```

	id	age	annual_income	purchase_power_score	cluster
0	1	56	94740.0	90	1
1	2	69	136352.0	50	1
2	3	46	86617.0	62	1
3	4	32	114841.0	97	2
4	5	60	36896.0	51	0

```
#Sum of Squared Errors(SSE)
model_kmeans.inertia_
```

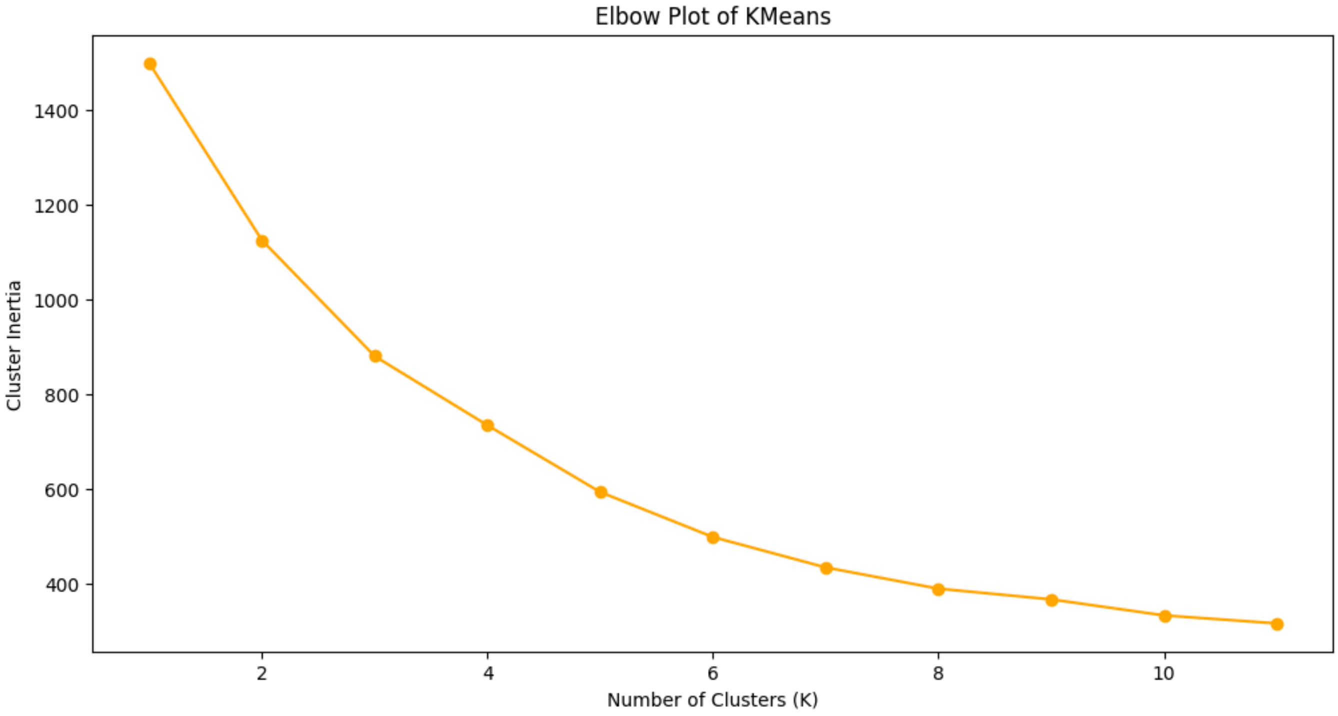
```
894.1212186553034
```

```
#dataset_clients.to_csv('dataset_clients_cluster', index = False)
```

```
#Determine the best number of cluster
def find_best_clusters(dataset_clients, maximum_K):

  clusters_centers = []
  k_values = []

  for k in range(1, maximum_K):

   model_kmeans = KMeans(n_clusters = k)
   model_kmeans.fit(dataset_clients)

  clusters_centers.append(model_kmeans.inertia_)
  k_values.append(k)


  return clusters_centers, k_values
```

```
def generate_elbow_plot(clusters_centers, k_values):

  figure = plt.subplots(figsize = (12, 6))
  plt.plot(k_values, clusters_centers, 'o-', color = 'orange')
  plt.xlabel("Number of Clusters (K)")
  plt.ylabel("Cluster Inertia")
  plt.title("Elbow Plot of KMeans")
  plt.show()
```

```
clusters_centers, k_values = find_best_clusters(standardize_dataset, 12)

generate_elbow_plot(clusters_centers, k_values)
```



6.Power BI report

```
define_authentication = DeviceCodeLoginAuthentication()
```

```
Performing device flow authentication. Please follow the instructions below.
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code FRNEGA53F to authenticat

Device flow authentication successfully completed.
You are now logged in .

The result should be passed only to trusted code in your notebook.
```

```
from google.colab import output
output.enable_custom_widget_manager()
```

```
report_PBI = QuickVisualize(get_dataset_config(dataset_clients), auth=define_authentication)
```

```
report_PBI
```