Untitled3

April 13, 2024

1 Clustering Pharmaceutical Financial Measures

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Importing all the needed modules :

[13]:
```
import pandas as pd
import numpy as np
import sklearn as sk
from sklearn import preprocessing
from sklearn.metrics import silhouette_score
import matplotlib.pyplot as plt
```

Importing the dataset :

[2]:
```
df = pd.read_csv("/Users/devmarwah/Downloads/Pharmaceuticals.csv")
```

1.1.1 Data Exploration

Having a look at the head of our data

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

[3]:
```
  Symbol                 Name  Market_Cap  Beta  PE_Ratio   ROE   ROA  \
0    ABT  Abbott Laboratories       68.44  0.32      24.7  26.4  11.8
1    AGN       Allergan, Inc.        7.58  0.41      82.5  12.9   5.5
2    AHM         Amersham plc        6.30  0.46      20.7  14.9   7.8
3    AZN     AstraZeneca PLC        67.63  0.52      21.5  27.4  15.4
4    AVE              Aventis       47.16  0.32      20.1  21.8   7.5

   Asset_Turnover  Leverage  Rev_Growth  Net_Profit_Margin  \
0             0.7      0.42        7.54               16.1
1             0.9      0.60        9.16                5.5
2             0.9      0.27        7.05               11.2
3             0.9      0.00       15.00               18.0
4             0.6      0.34       26.81               12.9

  Median_Recommendation Location Exchange
0          Moderate Buy       US     NYSE
```

```
1          Moderate Buy   CANADA     NYSE
2            Strong Buy       UK     NYSE
3         Moderate Sell       UK     NYSE
4          Moderate Buy   FRANCE     NYSE
```

[4]:
```
df.shape
```

[4]:
```
(21, 14)
```

Our dataset has 21 rows and 14 variables.

1.1.2 Data Preparation

Since Kmeans uses distances to cluster records, we will be using only the numeric variables.

[5]:
```
df.
 ↪drop(['Symbol','Name','Median_Recommendation','Location','Exchange'],axis=1,inplace=True)
```

Checking shape of our data after dropping non-numeric variables.

[6]:
```
df.shape
```

[6]:
```
(21, 9)
```

Normalizing our dataset:

[10]:
```
df_norm= preprocessing.StandardScaler().fit_transform(df)
```

[11]:
```
# Giving normalized data column names
df.iloc[:,:]=df.norm
```

Having a look at normalized values :

[12]:
```
df.head()
```

[12]:
```
   Market_Cap      Beta  PE_Ratio       ROE       ROA  Asset_Turnover  \
0    0.188642 -0.821041 -0.047867  0.041080  0.247579   -5.247542e-16
1   -0.875518 -0.461835  3.583430 -0.875950 -0.965557    9.453132e-01
2   -0.897899 -0.262277 -0.299168 -0.740094 -0.522666    9.453132e-01
3    0.174479 -0.022807 -0.248907  0.109009  0.940799    9.453132e-01
4   -0.183447 -0.821041 -0.336863 -0.271389 -0.580435   -4.726566e-01

   Leverage  Rev_Growth  Net_Profit_Margin
0 -0.217336   -0.540801           0.063205
1  0.018736   -0.390551          -1.592035
2 -0.414062   -0.586247          -0.701953
3 -0.768169    0.151089           0.359900
4 -0.322256    1.246425          -0.436490
```

Hence, our values are now normalized.

1.1.3 Model Construction

We will be using kmeans method to cluster this data. Firstly, we need to look for optimum value of k.

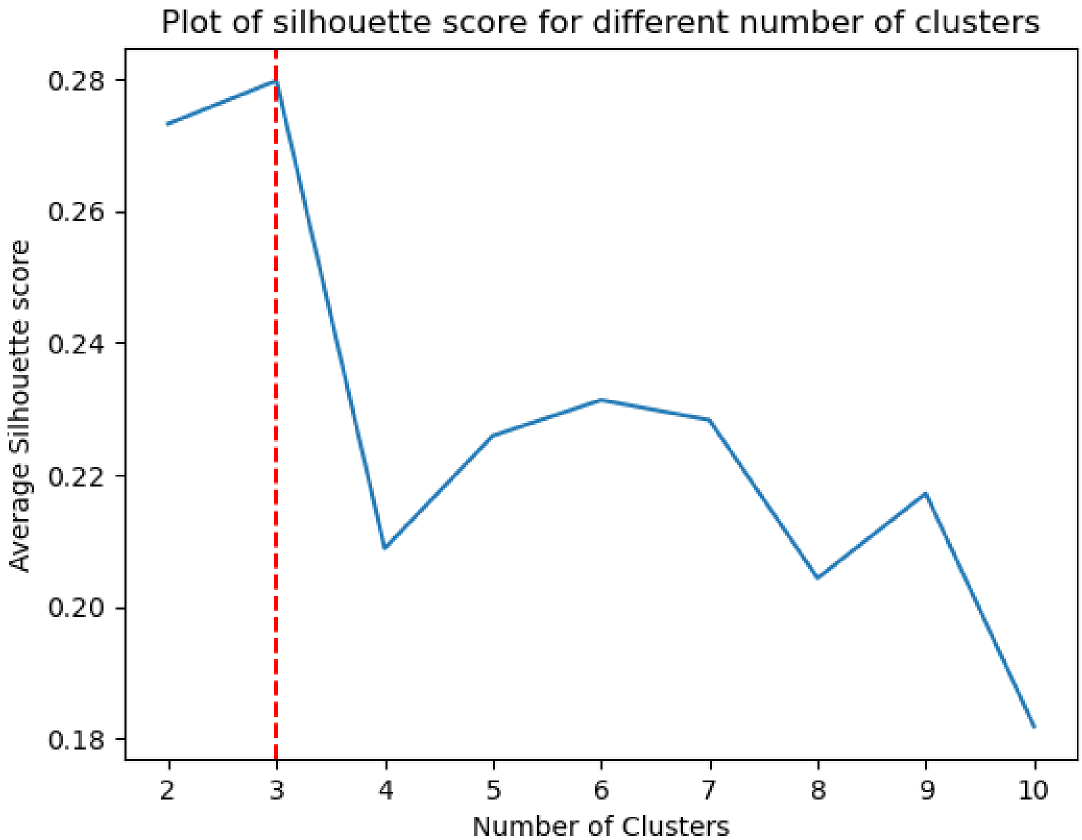
Using silhouette method

[15]:
```
from sklearn.cluster import KMeans
sh = []
for i in range(2,11):
    km=KMeans(n_clusters=i,n_init=10,random_state=40)
    km.fit(df)
    y=km.predict(df)
    s=silhouette_score(df,y)
    sh.append(s)
```

Plotting silhouette scores :

[20]:
```
plt.plot(range(2,11),sh)
plt.xlabel("Number of Clusters")
plt.ylabel("Average Silhouette score")
plt.title("Plot of silhouette score for different number of clusters")
plt.axvline(x=3,color="r",linestyle="--")
```

[20]:
```
<matplotlib.lines.Line2D at 0x144389290>
```



Hence, k=3 is the most optimum value

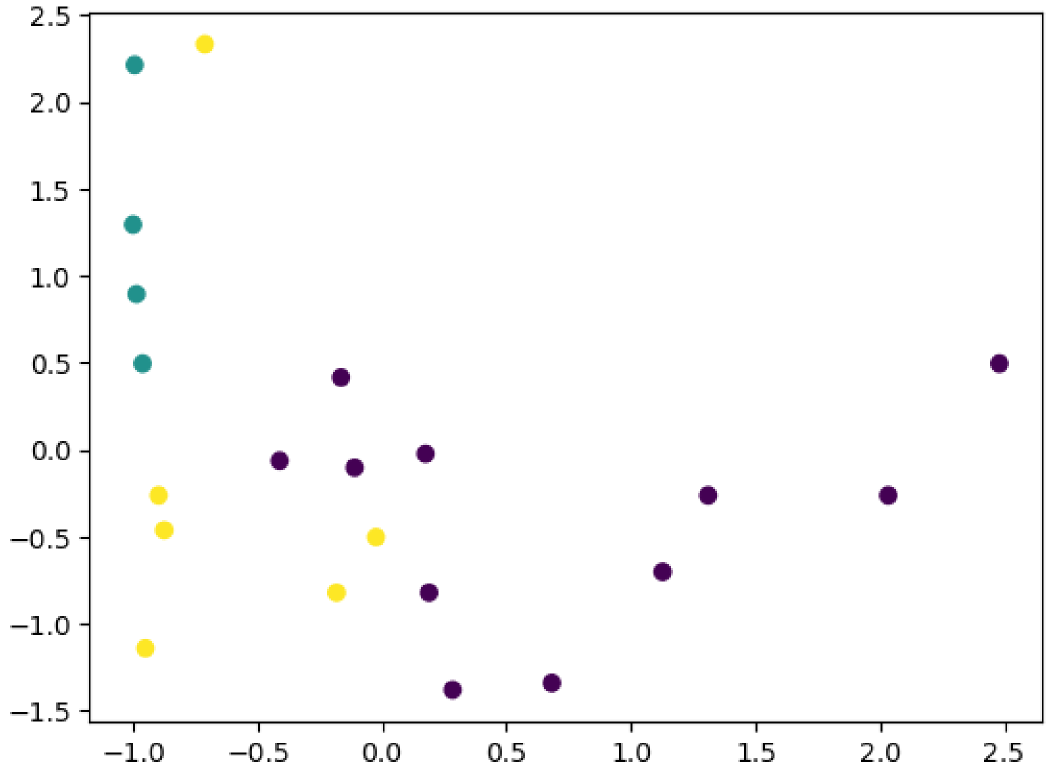
Appying Kmeans on data for k=3

[27]:
```
k=KMeans(n_clusters=3,n_init=10,random_state=10)
k.fit(df)
y=k.labels_
```

Visualising results :

[35]:
```
plt.scatter(df.iloc[:,0],df.iloc[:,1],c=y,cmap="viridis")
```

[35]:
```
<matplotlib.collections.PathCollection at 0x169365d50>
```



1.1.4 Cluster Interpretation

Adding predictions as a column in the dataframe

[39]:
```
df["Cluster"]=y
df.head()
```

[39]:
```
   Market_Cap      Beta  PE_Ratio       ROE       ROA  Asset_Turnover  \
0    0.188642 -0.821041 -0.047867  0.041080  0.247579   -5.247542e-16
1   -0.875518 -0.461835  3.583430 -0.875950 -0.965557    9.453132e-01
2   -0.897899 -0.262277 -0.299168 -0.740094 -0.522666    9.453132e-01
3    0.174479 -0.022807 -0.248907  0.109009  0.940799    9.453132e-01
4   -0.183447 -0.821041 -0.336863 -0.271389 -0.580435   -4.726566e-01

   Leverage  Rev_Growth  Net_Profit_Margin  Cluster
0 -0.217336   -0.540801           0.063205        0
1  0.018736   -0.390551          -1.592035        2
2 -0.414062   -0.586247          -0.701953        2
3 -0.768169    0.151089           0.359900        0
4 -0.322256    1.246425          -0.436490        2
```

Interpreting clusters on the basis of Market Cap and Net profit

Cluster-1

[51]:
```
for i in range(0,df.shape[1]):
    if df.iloc[i,9]==0:
        display(df.iloc[i,[0,8]])
```

```
Market_Cap           0.188642
Net_Profit_Margin    0.063205
Name: 0, dtype: float64
```

```
Market_Cap           0.174479
Net_Profit_Margin    0.359900
Name: 3, dtype: float64
```

```
Market_Cap          -0.110533
Net_Profit_Margin    0.765902
Name: 6, dtype: float64
```

```
Market_Cap           0.283063
Net_Profit_Margin    1.203135
Name: 9, dtype: float64
```

Cluster-2

[52]:
```
for i in range(0,df.shape[1]):
    if df.iloc[i,9]==1:
        display(df.iloc[i,[0,8]])
```

```
Market_Cap          -1.000888
Net_Profit_Margin   -1.279725
Name: 7, dtype: float64
```

```
Market_Cap          -0.994419
Net_Profit_Margin   -0.374028
Name: 8, dtype: float64
```

Cluster-3

[53]:
```
for i in range(0,df.shape[1]):
    if df.iloc[i,9]==2:
        display(df.iloc[i,[0,8]])
```

```
Market_Cap          -0.875518
Net_Profit_Margin   -1.592035
Name: 1, dtype: float64
```

```
Market_Cap          -0.897899
Net_Profit_Margin   -0.701953
Name: 2, dtype: float64
```

```
Market_Cap          -0.183447
Net_Profit_Margin   -0.436490
Name: 4, dtype: float64
```

```
Market_Cap           -0.712554
Net_Profit_Margin    -2.044884
Name: 5, dtype: float64
```