CA1 Machine Learning for Business

**Performing Clustering Algorithm for Education Student Performance and Investigate how Covid 19 pandemic affect the stock market of hotel in 2020 and 2021**

*By*

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Higher Diploma in Science in Data Analytics for Business

Machine Learning for Business

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**Assessment Cover Page**

*To be provided separately as a word doc for students to include with every submission*

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**Declaration**

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**Introduction**

In data science, clustering analysis is a basic method for organizing related data points into clusters. Measuring how similar or distinct various clusters are to one another is a crucial component of clustering analysis. This assessment is essential for assessing the quality of clustering solutions and figuring out the data's underlying structure.

These days, education is the primary factor in shaping us for a brighter future. An important way to determine whether a student does well in school, particularly in class, is to examine the student's performance in multiple areas. How well children do on each test they take in school will be determined by their test scores for each topic. (Rasul and Bukhsh, 2011). This will make it easier for the teachers to assign the student correctly in the event that their test results show a lower or higher score.

Deciding how stock prices affect the hotel segment is one of the most important topics in stocks. This may be connected to the increase in stock prices toward the end of 2019. The COVID-19 pandemic caused significant issues for people all around the world. It significantly reduces the hotel industry's revenue. (Carter et al., 2021)

**Motivation:**

Effectively quantifying the cluster's similarity and dissimilarity is essential when clustering is being used. I analyse the clustering algorithm and ascertain its strength when the clustering is completed. Have in-depth understanding of stock analysis; this will help you predict the future value of the stocks by showing you which month and year they have the best growth and drop fluctuation.

**Description of the Problem Domain:**

Implementing cluster analysis is needed to have a deep understanding of the data and to observe patterns if the dataset is properly segmented. One of the major problems with the real-world dataset is the outliers. The outliers have a bad effect upon executing the clustering because it will cause noise or improperly cluster the X label numerical variables. (Hassan, 2023). In performing the ARIMA time series, it is necessary to determine residuals because this can also cause noise or outliers to the forecasting value that can affect the evaluation results, such as r2 scores and the root mean square error.

**Project objectives:**

This project primary objectives are to evaluate and identify the clustering technique that best captures the similarity and dissimilarity between various clusters. Using the time series autoregressive integrated moving average (ARIMA) model, one may predict future values by identifying trends, residuals, and seasonality in the stocks market dataset. The goal of this research is to assess the most effective clustering algorithms for segmentation as well as the precise values of p, d, and q for the ARIMA model.

**Secondary Objective will address these questions:**

* Use the clustering criteria to implement and determine the distinction between the Davies-Bouldin index and silhouette score.
* From the student performance dataset, compare the outcomes of the Davies-Bouldin index and silhouette score clustering algorithms.
* Determine the stock market dataset seasonality, trend, and residuals.

**Rationale for chosen dataset:**

In order to gain insight into the pattern for accurately segmenting the points in each cluster that I will execute; I have chosen to use the education dataset student performance for my data analysis of clustering in this project. In addition, I utilize the hotel stock market dataset to calculate the extent of the COVID-19 pandemic impact on inflation. It will determine which month sees a significant drop in hotel stock, as some hotels are forced to close as a result of the COVID-19 epidemic.

Task II

1. **Which clustering algorithms would you consider for segmentation, and why?**

The clustering algorithm that I analysed to be considered for segmentation is DBSCAN clustering. The DBSCAN clustering gives me a well-informed, detailed cluster of the student performance dataset using the X labels as numerical variables. In order for me to achieve this accurate circle type of clustering point, I used to convert the columns from integers to strings using the preprocessing function shown in Figure 1. The parameters of the DBSCAN that I used to execute to determine which has the highest number of epsilons to find out the circumference of the neighbours in the points. This is shown in figure 2. The DBSCAN is setting an epsilon value of 40 and a minimum sample score of 5, as clearly shown in figure 3. Implementing DBSCAN with these parameters resulted in proper segmentation of the dataset, even in the presence of noise or outliers (visualized in Figure 4). Density-based spatial clustering of applications with noise (DBSCAN) ability to identify dense regions of data points makes it particularly effective for segmentation tasks where the underlying structure of the data may be irregular or non-linear.

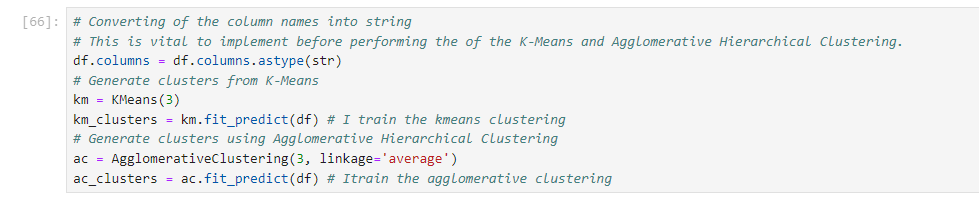


Figure 1. Code function for converting the integer column to string.

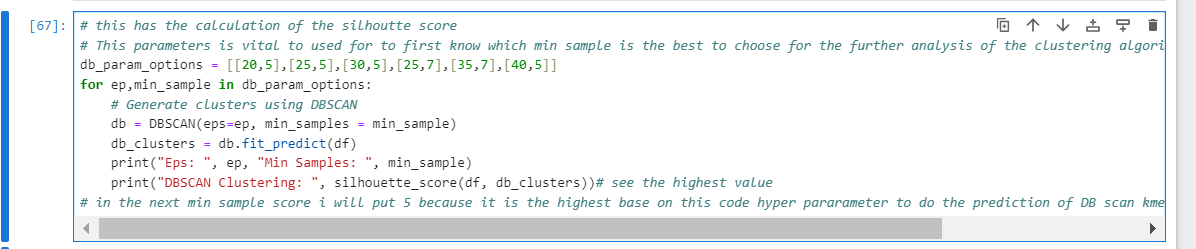


Figure 2. Using parameters in DBSCAN.

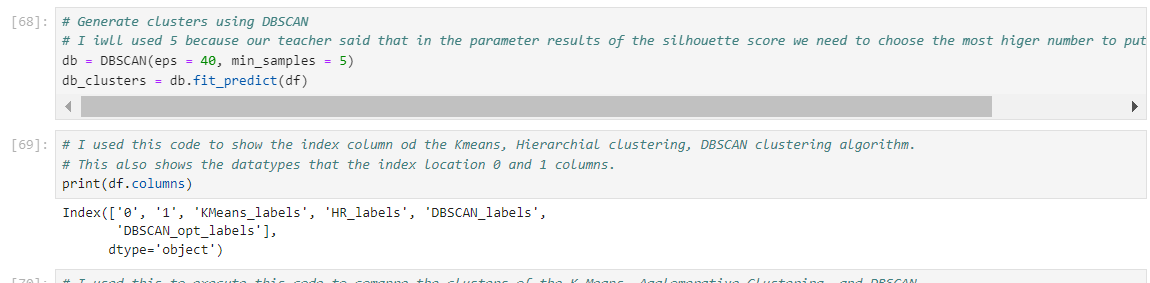


Figure 3. Setting the epsilon value and min sample for DBSCAN prediction.

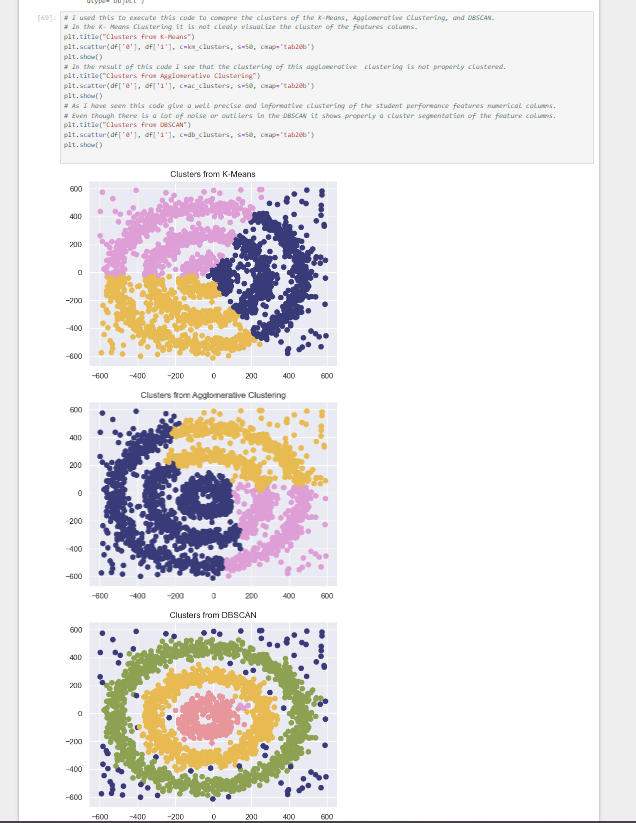


Figure 4. Visualizing the most informative clustering segmentation.

1. **Explain the differences between silhouette score and Davies-Bouldin index in the context of clustering.**

The silhouette score construe in any pattern which measure the similarity of its own cluster compared to the other cluster. It has a range of -1 and +1. The +1 range it is a high and well indicate a better clustering but it will be having a not good neighbouring clustering. While the silhouette score is O it will results to imbricated clustering resulting to have a negative value that will lead to a negative clustering. (ximnet, 2021). As I do my data analysis silhouette score on the first Kmeans that I have implemented it shows that the graph gets more convex flatten on the value if 0.35 this is shown in Figure 5. While I execute the silhouette score using the DBSCAN parameters for clustering it improves and increase the score in gives the results of 0.36. The Davies-Bouldin index measure moderate or the median similarity in each of the clusters. It has the ability to calculate the average of the overall cluster’s similarity. The lower the value of the Davies-Bouldin index meaning it will provide an accurate clustering. If it has a lower value this will indicate a well disconnected cluster. (GeeksforGeeks, 2023).

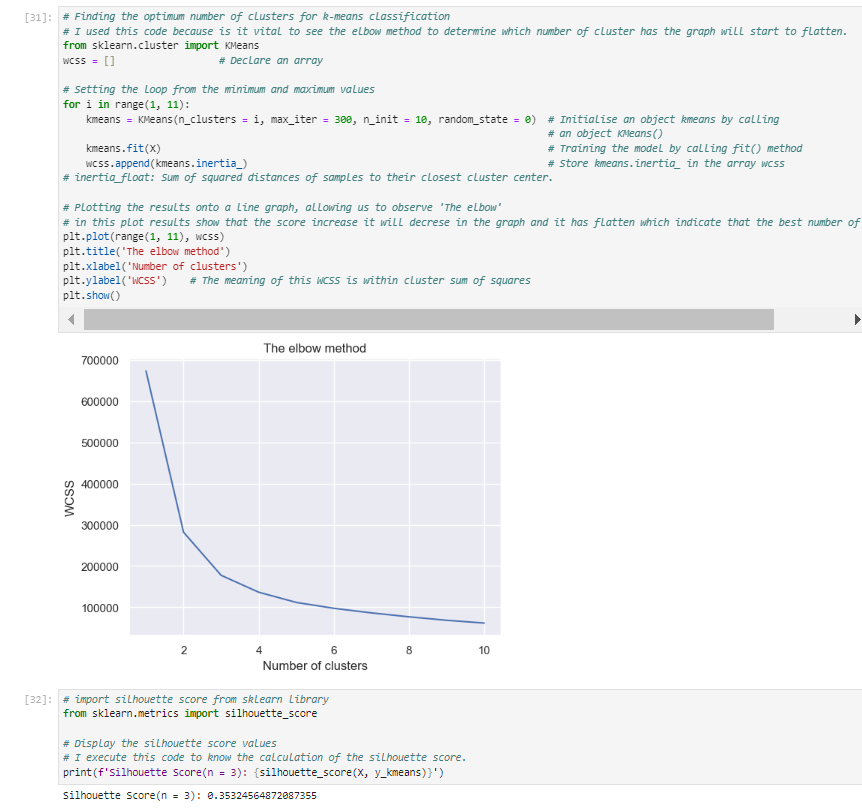


Figure 5. First K means Clustering silhouette score using the X labels numerical columns.

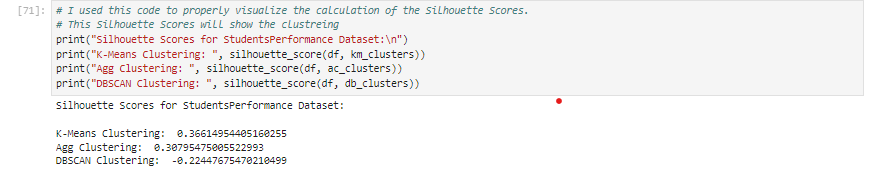
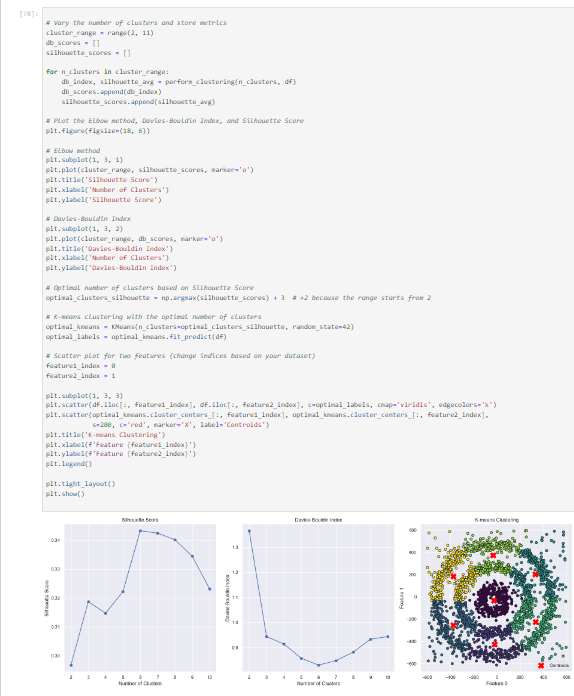


Figure 6. Silhouette score results using the DBSCAN parameter.

**C. Compare the results obtained from any two clustering algorithms from the chosen dataset.**

The results of the two-clustering algorithm that I used to do my analysis is having a significant plot of the elbow method. It is because the Davies-Bouldin index have a decrease the index which that can have an accurate performance of the clustering disengagement amid the clusters. One of the reasons why it forms a convex elbow plot because it has a greater convex clustering aside from the other density predicated cluster. (Wei, 2020).



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