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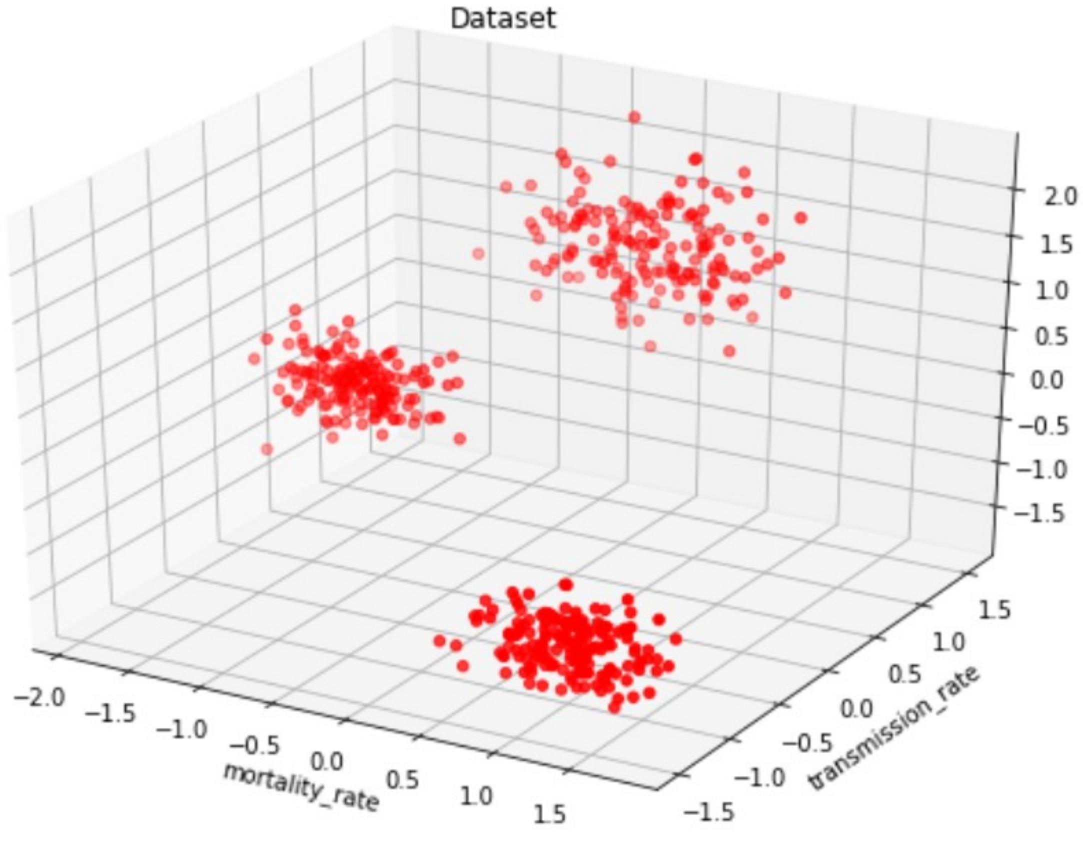
PROJECT-3 DC1

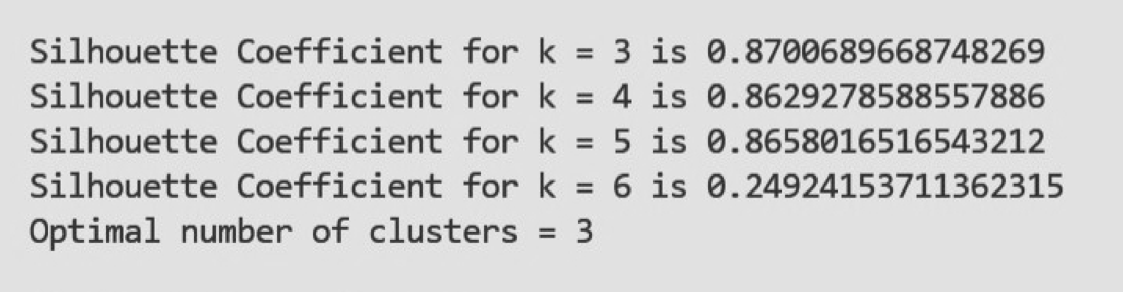
Coronavirus Data Clustering using Complete Linkage Hierarchical Clustering Technique



Scatter plot of the given Dataset

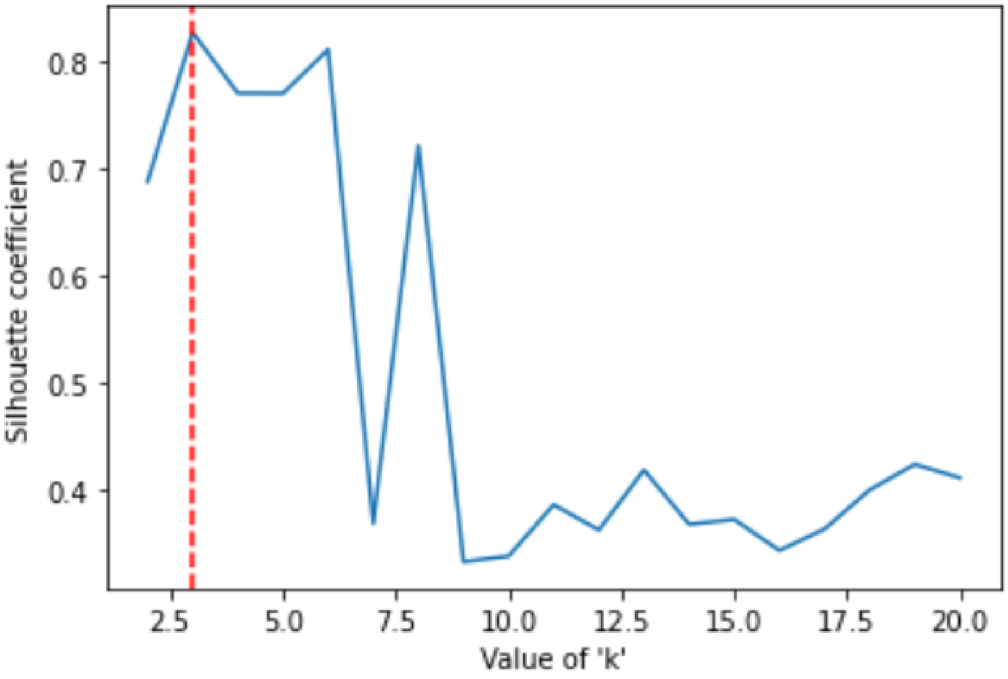
Optimal Number of Clusters

The optimal number of clusters obtained after calculating the silhouette coefficient for k = 3, 4, 5, and 6 is **3.** The values obtained are listed below.



```
Silhouette Coefficient for k = 3 is 0.8700689668748269
Silhouette Coefficient for k = 4 is 0.8629278588557886
Silhouette Coefficient for k = 5 is 0.8658016516543212
Silhouette Coefficient for k = 6 is 0.24924153711362315
Optimal number of clusters = 3
```

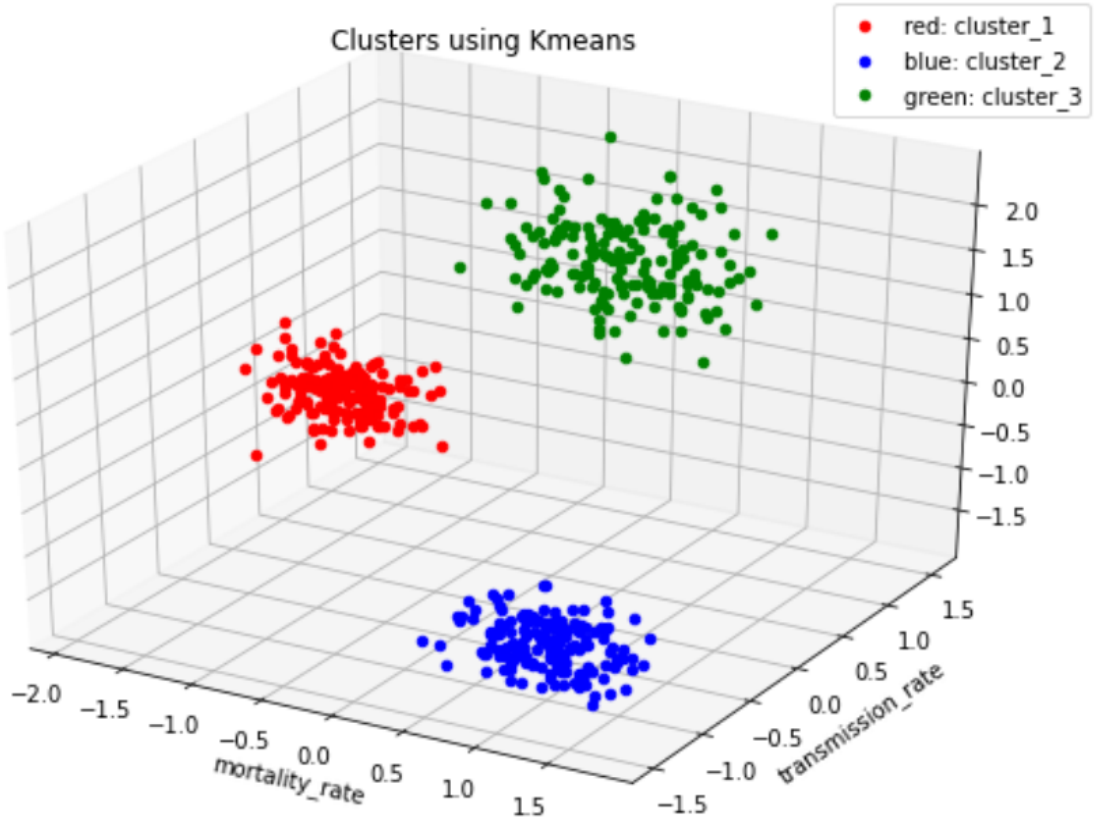
The graph below records silhouette coefficients for various values of k. The dashed line is of k = 3, which has the maximum value of silhouette coefficient.



Graph of Silhouette coefficient vs Value of 'k'

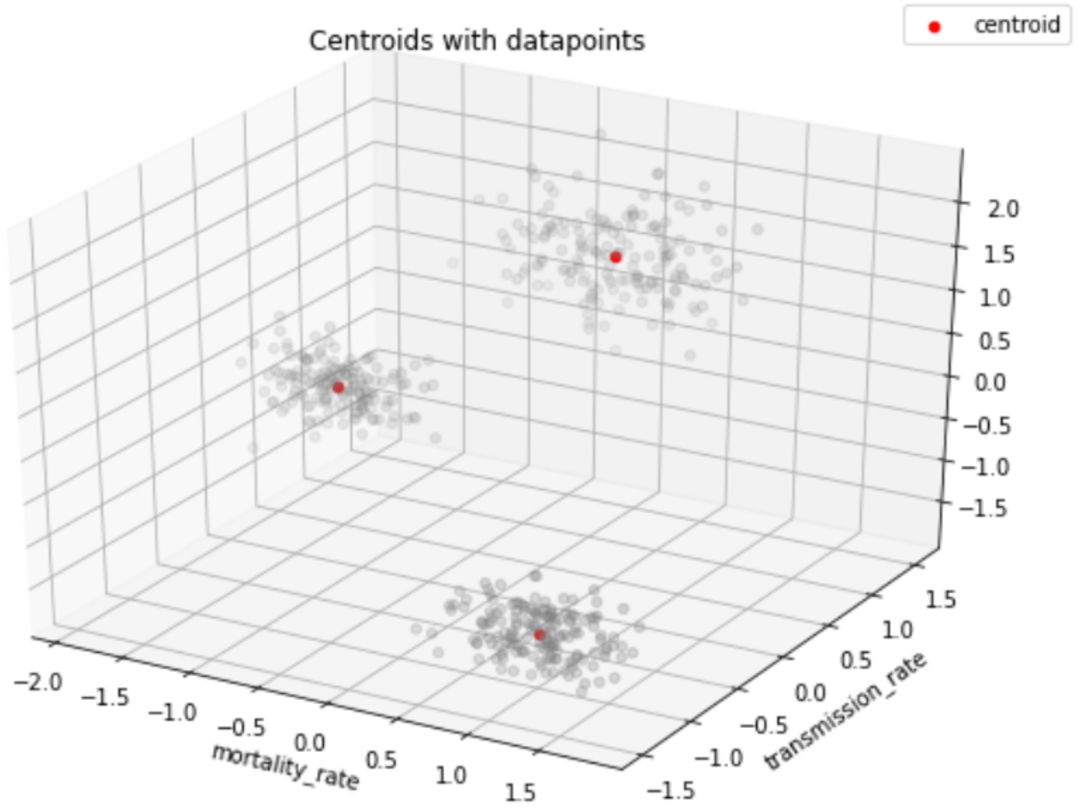
Analysis of Silhouette Coefficient (in step - 2)

The silhouette coefficient is a metric used to calculate the goodness of a clustering technique. Its value ranges from -1 to 1. The values closer to one are considered good. In my case, I obtained a silhouette coefficient of `0.8700689668748269` for k = 3 using k-means Clustering. The value is close to one and hence is good. We can also visualize the clusters and centroids for the algorithm.



Scatter plot of the clusters categorized by K-means

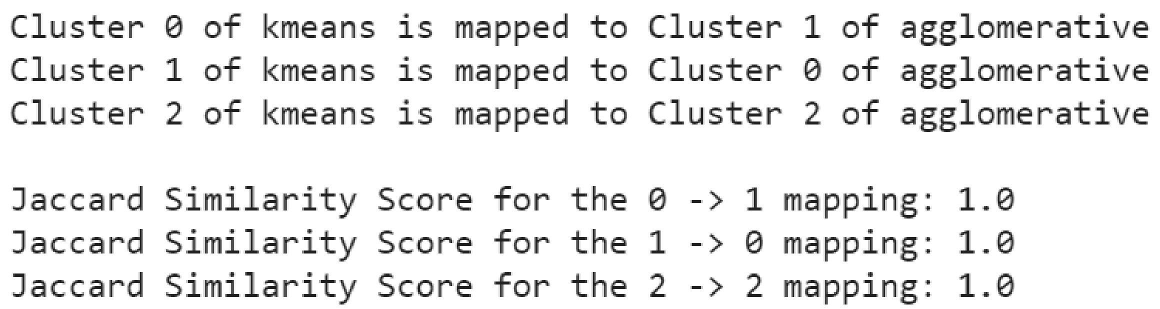
We can see that my algorithm has categorized all three clusters perfectly. Hence we got a good value of silhouette coefficient. But the value is not exactly 1 because the silhouette coefficient depends upon both **cohesion** and **separation** of clusters and we can see that the clusters are somewhat spread out hence leading to a decrement in cohesion value and therefore the whole coefficient.



Scatter plot of datapoints with centroids marked

Analysis of Jaccard Similarity Scores (in step - 4)

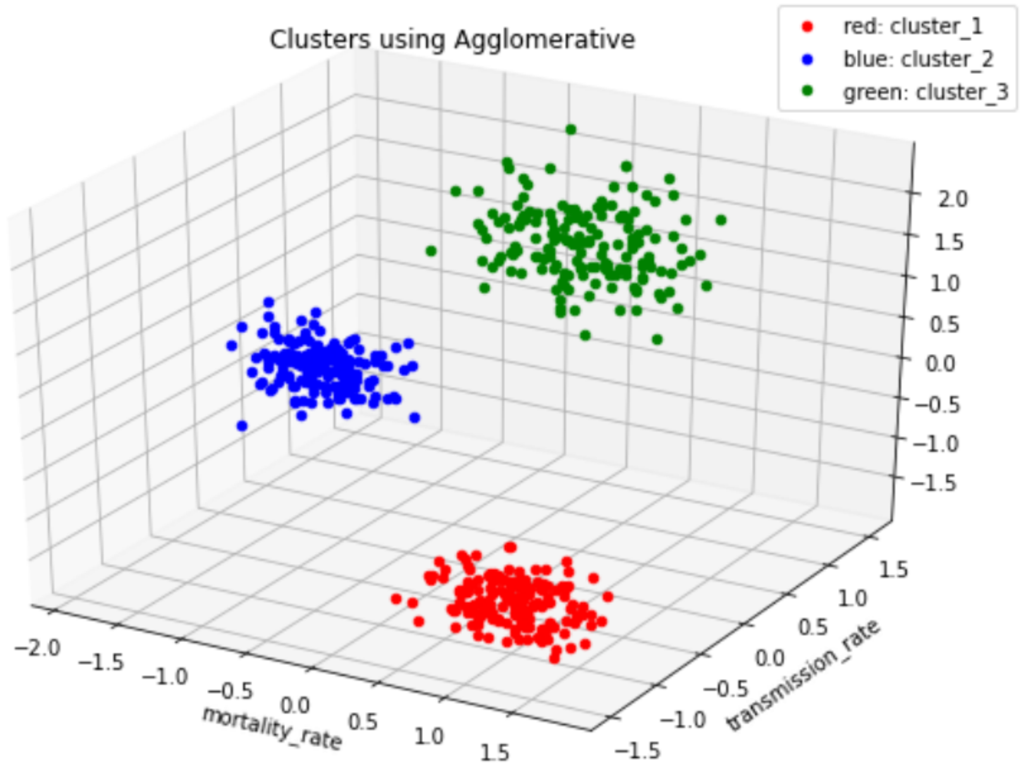
The Jaccard Similarity Scores obtained for all the three mappings from k-means deduced clusters to agglomerative hierarchical clusters is **1**. It is because the Jaccard similarity score is the ratio of intersection of clusters and union of clusters, and the clusters that I received from both algorithms are the same. So union(A,B) = intersection(A,B) , which implies their ratio will be one.



```
Cluster 0 of kmeans is mapped to Cluster 1 of agglomerative
Cluster 1 of kmeans is mapped to Cluster 0 of agglomerative
Cluster 2 of kmeans is mapped to Cluster 2 of agglomerative

Jaccard Similarity Score for the 0 -> 1 mapping: 1.0
Jaccard Similarity Score for the 1 -> 0 mapping: 1.0
Jaccard Similarity Score for the 2 -> 2 mapping: 1.0
```

We can also visualize that the clusters obtained from agglomerative are the same as that of k-means.



Scatter plot of the clusters categorized by Agglomerative clustering

THE END