**SELECTIVE ATTENTION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **K-Means** | | | | |
| **DIMENSIONS** | **Cluster 01** | **Cluster 02** | **Cluster 03** | **Cluster 04** |
| **TD** | 4780 – 20177 | 3000 – 25719 | 5112 – 19055 | 17495 – 50461 |
| **PCR** | 66.67 – 100.00 | 66.67 – 100.00 | 0.00 – 50.00 | 83.34 – 100.00 |
| **POE** | 0 – 33.34 | 0.00 – 33.34 | 50.00 – 100.00 | 0.00 – 16.67 |
| **PCE** | 0 – 33.34 | 0.00 – 22.23 | 0.00 – 50.00 | 0.00 – 83.34 |
| **Count** | 49 | 98 | 9 | 8 |
| **Age** | 6 - 7 | 4 - 5 | 4 - 7 | 4, 5, 7 |

**FOCUSED ATTENTION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **K-Means** | | | | |
| **Test Variables** | **Age 4 & 5** | | **Age 6 & 7** | |
| **Cluster 01** | **Cluster 02** | **Cluster 01** | **Cluster 02** |
| **MRT** | 1040 – 1998 | 1162 – 2032 | 783 – 1374 | 792 – 1102 |
| **PCR** | 90.00 – 100.00 | 70.00 – 90.00 | 100.00 | 83.33 – 91.66 |
| **OER** | 0.00 – 10.00 | 10.00 – 30.00 | 0.00 | 8.33 – 16.66 |
| **Count** | 41 | 11 | 25 | 4 |

**DIVIDED ATTENTION**

|  |  |  |
| --- | --- | --- |
| **K-Means** | | |
| **DIMENSIONS** | **Cluster 01** | **Cluster 02** |
| **MRT** | 589 – 1239 | 832 – 1428 |
| **PCR** | 62.50 – 100.00 | 12.50 – 87.50 |
| **POE** | 0 – 37.50 | 12.50 – 87.50 |
| **PCE** | 0 – 62.50 | 25.00 – 87.50 |
| **Count** | 27 | 13 |
| **Age** | 4 - 7 | 4 - 6 |

**SUSTAINED ATTENTION**

|  |  |  |  |
| --- | --- | --- | --- |
| **K-Means** | | | |
| **DIMENSIONS** | **Cluster 01** | **Cluster 02** | **Cluster 03** |
| **MRT** | 719 – 1324 | 998 – 1655 | 757 – 1173 |
| **PCR** | 77.78 – 100.00 | 75.00 – 100.00 | 50.00 – 100.00 |
| **POE** | 0 – 22.23 | 0.00 – 25.00 | 20.00 – 100.00 |
| **TD** | 2125 – 179629 | 25196 – 220070 | 8137 – 44919 |
| **Count** | 22 | 10 | 7 |
| **Age** | 5 - 7 | 4 - 5 | 5 - 7 |

**ALTERNATING ATTENTION**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **K-Means** | | | | | |
| **Test Variables** | **Age 4 & 5** | | **Age 6 & 7** | | |
| **Cluster 01** | **Cluster 02** | **Cluster 01** | **Cluster 02** | **Cluster 03** |
| **MRT** | 823 – 1782 | 1043 – 1540 | 448 – 1181 | 1023 – 1397 | 771 – 1180 |
| **PCR** | 89.47 – 100 | 68.42 – 84.21 | 89.47 – 94.3 | 100 | 100 |
| **OER** | 0 – 10.52 | 15.78 – 31.57 | 5.26 – 10.52 | 0 | 0 |
| **CER** | 0 – 57.89 | 0 – 47.36 | 5.26 – 47.36 | 0 | 42.10 – 78.94 |
| **Count** | 17 | 5 | 8 | 5 | 4 |

Attention Type

Age & Gender

RESPONSE FOR TEST VARIABLES

OWN vs. age GROUP --> Confidence Interval of the Mean 95%

CLUTSTER

CLUSTER DESCRPTION

# Clustering quality

Once clustering is done, how well the clustering has performed can be quantified by a number of metrics. Ideal clustering is characterised by minimal intra cluster distance and maximal inter cluster distance.

There are majorly two types of measures to assess the clustering performance.

(i) Extrinsic Measures which require ground truth labels. Examples are Adjusted Rand index, Fowlkes-Mallows scores, Mutual information based scores, Homogeneity, Completeness and V-measure.

(ii) Intrinsic Measures that does not require ground truth labels. Some of the clustering performance measures are Silhouette Coefficient, Calinski-Harabasz Index, Davies-Bouldin Index etc.

# ****1. Elbow method****

The Elbow method uses a plot between the average of the sum of the intra-cluster sum of squares of distances between the respective cluster centroids and the cluster points and the number of clusters (or K). To determine the optimal number of clusters, we have to select such a value of K at the ‘elbow’ point or the point after which the error starts decreasing linearly. The curve can either go up or down, but if there is a strong inflection point, it is a good indication that the underlying model fits best at that point with regard to the number of clusters.

# 2. Silhouette score

The silhouette score also tells us how good the clustering algorithm performs. The below formula tells us how to calculate the silhouette score for one data point. The overall silhouette score is calculated by taking the mean.

The silhouette score varies between +1 and -1, +1 being the best score and -1 being the worst. 0 indicates an overlapping cluster while negative values indicate that the point is assigned to the wrong cluster.

## **Calinski-Harabasz Index**

The Calinski-Harabasz index (also known as the Variance Ratio Criterion) is defined as a ratio of the squared inter-cluster distance sum and the squared intra-cluster distance sum for all clusters. The sum of squared distance is corrected by the degree of freedom.

However, if the clusters do not have such shapes, the centroids-based distances will not be that informative to tell the quality of the clustering algorithm. So, the CH index is **NOT** recommended to be used to the density based methods, such as [mean-shift](https://towardsdatascience.com/understanding-mean-shift-clustering-and-implementation-with-python-6d5809a2ac40) clustering, [DBSCAN](https://towardsdatascience.com/understanding-dbscan-and-implementation-with-python-5de75a786f9f), [OPTICS](https://towardsdatascience.com/understanding-optics-and-implementation-with-python-143572abdfb6), etc..

## Davies-Bouldin Index

Davies-Bouldin index is similar to the CH index, but the inter/intra cluster distance ratio calculation is reverse to that of CH index. In the calculation of Davies-Bouldin index, there’s a concept, similarity score, that measures how similar two clusters are to each other

We can see that the smaller the DB index is, the better the cluster separation is.

It has similar disadvantage as the CH index does, which is bad at handling clustering methods without specific shape assumption (like density-based clustering). But both CH and DB index are much faster than Silhouette score calculation.

**ALTERNATING ATTENTION**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mean Shift** | | | | | |
| **Test Variables** | **Age 4 & 5** | | | | |
| **Cluster 01** | **Cluster 02** | **Cluster 03** | **Cluster 04** | **Cluster 05** |
| **MRT** | 1076 – 1782 | 1439 – 1540 | 1489 | 823 – 912 | 771 – 1180 |
| **PCR** | 94.73 – 100 | 68.42 – 89.47 | 68.42 | 100 | 100 |
| **OER** | 0 – 5.26 | 10.52 – 31.57 | 31.57 | 0 | 0 |
| **CER** | 0 – 31.57 | 0 – 10.52 | 47.36 | 26.31 – 57.89 | 42.10 – 78.94 |
| **Count** | 14 | 4 | 1 | 2 | 1 |