Holistic Non-Unique Clustering

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Technical Note

Abstract

In this research technical Note the author have presented a novel method to find all Possible Clusters given a set of points in N Space.

Theory

Given M number of points $\bar{x}_i \in R^N, i = 1 \; to \; M$, each belonging to R^N, we first find the Proximity Matrix P_{ij} for each (M number of) point with each of all (M Number of points) points, inclusive of itself. The Proximity can be found using Euclidean distance or using the concept stated in [1]. We now find the *Proximity Contrast Ratio* $\delta_{\frac{Min}{Max}} = \dfrac{Min(P_{ij})}{Max(P_{ij})}$ $with \; only \; those \; values \; of \; P_{ij} \neq 0$. Now, we consider any $P(i, j)$ which are $\left(\dfrac{M^2 - M}{2}\right)$ in number as The Proximity Matrix is Symmetric and also all the diagonal elements are equal to zero, and compute the distance $d\left\{P(i, j), \delta_{\frac{Min}{Max}}\right\} = P(i, j) + \left(\delta_{\frac{Min}{Max}}\right)(P(i, j))$. Now, we consider any point $\bar{x}_i \in R^N$ and find all points (inclusive of $\bar{x}_i$) that have at least one neighbouring point within the distance $d\left\{P(i, j), \delta_{\frac{Min}{Max}}\right\}$, considered among themselves. We say that all such points form one Cluster. In this fashion, we can find at most $\left(\dfrac{M^2 - M}{2}\right)$ number of overlapping Clusters where the membership of a point may not be unique to a given Cluster. We call this type of Clustering as Holistic Non-Unique Clustering. Also, we can consider, all possible Proximity Contrast Ratio's among the $\left(\frac{M^2-M}{2}\right)$ number of unique elements in the Proximity Matrix and can get at most $\left(\frac{M^2-M}{2}\right)$number of overlapping Clusters for each of the ${}^{\left(\frac{M^2-M}{2}\right)}C_2$ number of possible Proximity Contrast Ratio's Possible. Therefore, we can see at most $\left\{{}^{\left(\frac{M^2-M}{2}\right)}C_2\right\}\left(\frac{M^2-M}{2}\right)$ number of clusters for the given Set of M Points.

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