TOP 3 PCA:

****KMeans****

* + Silhouette Score: 0.10620918704084167
  + Davies-Bouldin Index: 2.546142108935122
  + Calinski-Harabasz Index: 132.6615846590914

****Hierarchical Clustering****

* + Silhouette Score: 0.09300201364977101
  + Davies-Bouldin Index: 2.356118825989029
  + Calinski-Harabasz Index: 127.84743766503374

****Birch****

* + Silhouette Score: 0.09300201364977101
  + Davies-Bouldin Index: 2.356118825989029
  + Calinski-Harabasz Index: 127.84743766503374

TOP 3 MCA:

if isinstance(mca\_result\_S, pd.DataFrame):

    mca\_result\_S = mca\_result\_S.values

****Spectral Clustering****

* + Silhouette Score: 0.209168855081201
  + Davies-Bouldin Index: 1.5298074699224928
  + Calinski-Harabasz Index: 180.5907446966424

****Hierarchical Clustering****

* + Silhouette Score: 0.2051239072743607
  + Davies-Bouldin Index: 1.602983577108919
  + Calinski-Harabasz Index: 238.2166282998179

****Birch****

* + Silhouette Score: 0.2027885687728039
  + Davies-Bouldin Index: 1.6046870986781883
  + Calinski-Harabasz Index: 235.86084023130343

TOP 3 MDS:

****KMeans****

* + Silhouette Score: 0.3788986285092465
  + Davies-Bouldin Index: 0.8088694535185352
  + Calinski-Harabasz Index: 1286.549904707777

****Spectral Clustering****

* + Silhouette Score: 0.370915079934756
  + Davies-Bouldin Index: 0.8073312849346441
  + Calinski-Harabasz Index: 1236.617651691285

****GMM****

* + Silhouette Score: 0.3908014947504594
  + Davies-Bouldin Index: 0.8360514932779832
  + Calinski-Harabasz Index: 1161.3596797716887

TOP 3 LLE:

****KMeans****

* + Silhouette Score: 0.8118772797699046
  + Davies-Bouldin Index: 0.2116806079616247
  + Calinski-Harabasz Index: 7842.404608027991

****Spectral Clustering****

* + Silhouette Score: 0.8118772797699046
  + Davies-Bouldin Index: 0.2116806079616247
  + Calinski-Harabasz Index: 7842.404608027991

****Mean Shift****

* + Silhouette Score: 0.8133212346678093
  + Davies-Bouldin Index: 0.20797026982524977
  + Calinski-Harabasz Index: 7840.410975141381

TOP 3 ISOMAP:

****Spectral Clustering****

* + Silhouette Score: 0.6101917342863138
  + Davies-Bouldin Index: 0.5263590931745844
  + Calinski-Harabasz Index: 877.4988230897832

****Mean Shift****

* + Silhouette Score: 0.6089630067500269
  + Davies-Bouldin Index: 0.5996454915574887
  + Calinski-Harabasz Index: 928.5643203569626

****GMM****

* + Silhouette Score: 0.5613313909534542
  + Davies-Bouldin Index: 0.5747276776787492
  + Calinski-Harabasz Index: 2587.574660889836

TOP 3 UMAP:

****KMeans****

* + Silhouette Score: 0.6206486225128174
  + Davies-Bouldin Index: 0.4728139074219303
  + Calinski-Harabasz Index: 12140.047029281553

****Spectral Clustering****

* + Silhouette Score: 0.6209359765052795
  + Davies-Bouldin Index: 0.4716020347969282
  + Calinski-Harabasz Index: 12122.695393005095

****Mean Shift****

* + Silhouette Score: 0.7939804196357727
  + Davies-Bouldin Index: 0.20908448240886757
  + Calinski-Harabasz Index: 5118.705184155646

TOP 3 t-SNE:

****KMeans****

* + Silhouette Score: 0.49923673272132874
  + Davies-Bouldin Index: 0.6831263574296892
  + Calinski-Harabasz Index: 2527.8257720799697

****Mean Shift****

* + Silhouette Score: 0.45805397629737854
  + Davies-Bouldin Index: 0.8978272686618441
  + Calinski-Harabasz Index: 1390.6856093441552

****Hierarchical Clustering****

* + Silhouette Score: 0.3815615475177765
  + Davies-Bouldin Index: 0.9681222100001614
  + Calinski-Harabasz Index: 1401.0574520055995

TOP 3 ICA:

****Hierarchical Clustering****

* + Silhouette Score: 0.4152174681596392
  + Davies-Bouldin Index: 0.7861084656456349
  + Calinski-Harabasz Index: 888.5669664684674

****KMeans****

* + Silhouette Score: 0.3977958135039649
  + Davies-Bouldin Index: 0.8232690487961931
  + Calinski-Harabasz Index: 1225.3615554323746

****Spectral Clustering****

* + Silhouette Score: 0.39037554517047884
  + Davies-Bouldin Index: 0.7162095084622597
  + Calinski-Harabasz Index: 664.9255507519633

Here is the detailed explanation of why these are the best:

1. ****Silhouette Score****: Measures how similar an object is to its own cluster compared to other clusters. The score ranges from -1 to +1, where a higher score indicates better-defined clusters.
2. ****Davies-Bouldin Index****: Measures the average similarity ratio of each cluster with the cluster that is most similar to it. Lower values indicate better separation between clusters.
3. ****Calinski-Harabasz Index****: Measures the ratio of the sum of between-cluster dispersion and within-cluster dispersion. Higher values indicate better-defined clusters.

PCA KMeans - Silhouette Score: 0.4061488373303971

PCA KMeans - Davies-Bouldin Index: 0.8090427751308276

PCA KMeans - Calinski-Harabasz Index: 1326.6846932006424

MDS KMeans - Silhouette Score: 0.3718577606660517

MDS KMeans - Davies-Bouldin Index: 0.8161885937811473

MDS KMeans - Calinski-Harabasz Index: 1244.2224109934239

LLE KMeans - Silhouette Score: 0.5784596084005187

LLE KMeans - Davies-Bouldin Index: 0.48995733472422276

LLE KMeans - Calinski-Harabasz Index: 3509.3905580150868

Isomap MeanShift - Silhouette Score: 0.6527346842163164

Isomap MeanShift - Davies-Bouldin Index: 0.466386528150059

Isomap MeanShift - Calinski-Harabasz Index: 1344.9781632384434

UMAP KMeans - Silhouette Score: 0.6085922718048096

UMAP KMeans - Davies-Bouldin Index: 0.520276936698626

UMAP KMeans - Calinski-Harabasz Index: 8557.146559995392

t-SNE KMeans - Silhouette Score: 0.500392496585846

t-SNE KMeans - Davies-Bouldin Index: 0.6855801004881169

t-SNE KMeans - Calinski-Harabasz Index: 2328.7945331641654

ICA SpectralClustering - Silhouette Score: 0.42102851193123764

ICA SpectralClustering - Davies-Bouldin Index: 0.7444766139762461

ICA SpectralClustering - Calinski-Harabasz Index: 954.8779133731556

MCA AgglomerativeClustering - Silhouette Score: 0.9533542128722726

MCA AgglomerativeClustering - Davies-Bouldin Index: 0.06343084277550376 MCA AgglomerativeClustering - Calinski-Harabasz Index: 103263.88098761807

MCA Birch - Silhouette Score: 0.9533542128722726 MCA Birch - Davies-Bouldin Index: 0.06343084277550376 MCA Birch - Calinski-Harabasz Index: 103263.88098761807