|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TABLE 1.** Three cluster validation approaches applied for n\_clusters of 2 to 10 without data normalization | | | | |
| **random\_state** | **n\_clusters** | **davies\_bouldin\_index** | **silhouette\_coefficient** | **calinski\_harabasz\_score** |
| 0 | 2 | 0.59550 | 0.56143 | 211.52930 |
| 3 | 0.52989 | 0.58057 | 321.16709 |
| 4 | 0.58010 | 0.53028 | 314.29867 |
| 5 | 0.55503 | 0.53243 | 382.46376 |
| 6 | 0.63636 | 0.50342 | 418.25436 |
| 7 | 0.72660 | 0.44524 | 394.06781 |
| 8 | 0.74971 | 0.43582 | 382.81835 |
| 9 | 0.78211 | 0.41990 | 373.39128 |
| 10 | 0.83312 | 0.37796 | 364.30845 |
| 1 | 2 | 0.59550 | 0.56143 | 211.52930 |
| 3 | 0.52989 | 0.58057 | 321.16709 |
| 4 | 0.58010 | 0.53027 | 314.29867 |
| 5 | 0.55503 | 0.53242 | 382.46376 |
| 6 | 0.63636 | 0.50341 | 418.25436 |
| 7 | 0.71510 | 0.45367 | 396.80149 |
| 8 | 0.74971 | 0.43582 | 382.81835 |
| 9 | 0.83384 | 0.41074 | 383.49037 |
| 10 | 0.75908 | 0.41718 | 382.08865 |
| 2 | 2 | 0.59573 | 0.55865 | 211.29145 |
| 3 | 0.52989 | 0.58057 | 321.16709 |
| 4 | 0.58010 | 0.53028 | 314.29867 |
| 5 | 0.55503 | 0.53243 | 382.46376 |
| 6 | 0.63636 | 0.50342 | 418.25436 |
| 7 | 0.74425 | 0.43877 | 396.19259 |
| 8 | 0.74971 | 0.43582 | 382.81835 |
| 9 | 0.79036 | 0.41609 | 372.40857 |
| 10 | 0.76174 | 0.41830 | 373.10078 |
| 3 | 2 | 0.59573 | 0.55865 | 211.29145 |
| 3 | 0.52989 | 0.58057 | 321.16709 |
| 4 | 0.58010 | 0.53028 | 314.29867 |
| 5 | 0.55503 | 0.53243 | 382.46376 |
| 6 | 0.63636 | 0.50342 | 418.25436 |
| 7 | 0.73170 | 0.44063 | 395.27341 |
| 8 | 0.81583 | 0.42013 | 384.24160 |
| 9 | 0.80837 | 0.41903 | 386.22894 |
| 10 | 0.89990 | 0.38015 | 372.42763 |
| 4 | 2 | 0.59550 | 0.56143 | 211.52930 |
| 3 | 0.52989 | 0.58057 | 321.16709 |
| 4 | 0.58010 | 0.53028 | 314.29867 |
| 5 | 0.55503 | 0.53243 | 382.46376 |
| 6 | 0.63636 | 0.50342 | 418.25436 |
| 7 | 0.71510 | 0.45367 | 396.80149 |
| 8 | 0.75893 | 0.43652 | 381.75152 |
| 9 | 0.77698 | 0.41854 | 368.70925 |
| 10 | 0.87017 | 0.40317 | 369.43016 |
|  | | | | |
| **TABLE 2.** Three cluster validation approaches applied for n\_clusters of 2 to 10 with data normalization | | | | |
| **random\_state** | **n\_clusters** | **davies\_bouldin\_index** | **silhouette\_coefficient** | **calinski\_harabasz\_score** |
| 0 | 2 | 0.89320 | 0.46342 | 97.827026 |
| 3 | 0.93309 | 0.47902 | 90.918390 |
| 4 | 1.09892 | 0.31464 | 78.389534 |
| 5 | 1.14668 | 0.31380 | 67.24460 |
| 6 | 1.13250 | 0.31053 | 62.09718 |
| 7 | 1.27261 | 0.26957 | 59.00505 |
| 8 | 1.17590 | 0.27410 | 52.76202 |
| 9 | 1.13557 | 0.28354 | 54.93112 |
| 10 | 1.07901 | 0.29256 | 54.30758 |
| 1 | 2 | 0.89320 | 0.46342 | 97.82702 |
| 3 | 0.93309 | 0.47902 | 90.91839 |
| 4 | 1.09817 | 0.32587 | 78.67025 |
| 5 | 1.20961 | 0.27465 | 67.52226 |
| 6 | 1.21982 | 0.28066 | 60.37866 |
| 7 | 1.29431 | 0.25612 | 58.36444 |
| 8 | 1.11413 | 0.27353 | 54.64883 |
| 9 | 1.12192 | 0.28790 | 53.91166 |
| 10 | 1.00363 | 0.29411 | 53.47133 |
| 2 | 2 | 0.89320 | 0.463418 | 97.82703 |
| 3 | 0.93309 | 0.479019 | 90.91839 |
| 4 | 1.09680 | 0.323553 | 78.67620 |
| 5 | 1.19259 | 0.326343 | 68.27771 |
| 6 | 1.05193 | 0.312608 | 61.97022 |
| 7 | 1.18013 | 0.269695 | 59.17009 |
| 8 | 1.23372 | 0.272986 | 55.32299 |
| 9 | 1.10403 | 0.298517 | 54.52791 |
| 10 | 1.07038 | 0.304617 | 53.07755 |
| 3 | 2 | 0.89320 | 0.558650 | 97.82703 |
| 3 | 0.93309 | 0.580574 | 90.91839 |
| 4 | 1.09680 | 0.530276 | 78.67620 |
| 5 | 1.14208 | 0.532427 | 67.50712 |
| 6 | 1.16915 | 0.503418 | 62.09250 |
| 7 | 1.15511 | 0.440629 | 55.89958 |
| 8 | 1.23166 | 0.420131 | 54.30454 |
| 9 | 1.10231 | 0.419028 | 54.45828 |
| 10 | 1.07032 | 0.380146 | 53.37933 |
| 4 | 2 | 0.89320 | 0.463418 | 97.82703 |
| 3 | 0.93309 | 0.479019 | 90.91839 |
| 4 | 1.09817 | 0.325869 | 78.67025 |
| 5 | 1.11366 | 0.328290 | 67.96815 |
| 6 | 1.22925 | 0.272331 | 62.34323 |
| 7 | 1.29213 | 0.250527 | 58.99693 |
| 8 | 1.13294 | 0.292957 | 55.20385 |
| 9 | 1.09234 | 0.298190 | 54.28997 |
| 10 | 1.04626 | 0.302093 | 53.68811 |