**4.5 Perhitungan Manual**

*K-Means clustering* adalah suatu metode penganalisaan data atau metode *data mining* yang melakukan proses pemodelan tanpa supervisi (unsupervised) dan merupakan salah satu metode yang melakukan pengelompokan data dengan sistem partisi. Metode *K-Means clustering* mengelompokkan data dengan yang ada ke dalam beberapa kelompok, dimana data dalam satu kelompok mempunyai kerakteristik yang sama satu sama lainnya dan mempunyai karekteristik yang berbeda dengan data yang ada di dalam kelompok yang lain.

Dalam proses perhitungan manual ini akan dijelaskan lebih rinci dibawah ini :

1. Dataset

Tabel 4.6 merupakan dataset dari 20 data siswa yang akan dikelompokan menjadi 5 jurusan :

**Tabel 4.6** Dataset

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NIS | NAMA SISWA | C1 | C2 | C3 | C4 | C5 |
| 11 | AHMAD YUSUF | 90 | 78 | 90 | 78 | 80 |
| 22 | DENY GUNNTUR PUTRO SATRIO | 67 | 77 | 89 | 88 | 80 |
| 33 | LINDA WATI | 55 | 89 | 77 | 90 | 80 |
| 44 | MOHAMMAD ERNANDA ROBBY AL | 76 | 90 | 89 | 98 | 87 |
| 55 | YULI AULIYA BERLIANAN | 90 | 90 | 89 | 78 | 77 |
| 66 | ANDINI WARDANI | 90 | 90 | 90 | 78 | 77 |
| 77 | ANDRE DWI SAPUTRA | 98 | 88 | 98 | 78 | 87 |
| 88 | BERLIAN ANINDYA PUTRI | 90 | 89 | 88 | 89 | 80 |
| 99 | BERLIANI INDAH YUNIARTI | 87 | 78 | 76 | 90 | 90 |
| 111 | MAULINDA INDAH FAJARWATI | 88 | 87 | 56 | 90 | 90 |
| 222 | FIRDAUS FIRMANSYAH | 77 | 89 | 67 | 98 | 87 |
| 333 | NANDA IMROATUS SHOLIKHAH | 67 | 77 | 78 | 87 | 67 |
| 444 | RISKY NUR FITRIYAH | 87 | 67 | 87 | 76 | 68 |
| 555 | SITI ZULIANASARI | 90 | 86 | 78 | 78 | 76 |
| 666 | A'IM MATUZZAKIYYAH | 98 | 78 | 77 | 67 | 69 |
| 777 | AFNI NUR KHOFIFAH | 87 | 89 | 89 | 78 | 77 |
| 888 | AGMA BUDI PRASETYA | 89 | 77 | 78 | 89 | 87 |
| 999 | CHUSNI ABDUL AZIZ | 78 | 76 | 78 | 80 | 88 |
| 1111 | DWI NUR AULIYAUL HIDAYATI | 87 | 90 | 89 | 80 | 90 |
| 2222 | MUHAMMAD ZUKHRUF QOLBI | 67 | 90 | 78 | 80 | 96 |

1. Setelah mentukan dataset, maka perlu menentukan jumlah cluster yang akan dibentuk. Adapun cluster yang akan dibentuk antara lain

Cluster 1 (C1) = TKJ (Teknologi Komputer Jaringan)

Cluster 2 (C2) = Otomotif

Cluster 3 (C3) = Tataboga

Cluster 4 (C4) = Wirausaha/Pemasaran

Cluster 5 (C5) = Pertanian

1. Menentukan nilai dari setiap cluster yang di pilih dari tabel 4.14

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| TITIK PUSAT | | | | |
| C1 | C2 | C3 | C4 | C5 |
| 90 | 78 | 90 | 78 | 80 |
| 76 | 90 | 89 | 98 | 87 |
| 98 | 88 | 98 | 78 | 87 |
| 90 | 89 | 88 | 89 | 80 |
| 90 | 78 | 90 | 78 | 80 |

1. Lakukan rekap dari setiap objek

Data Ke 1

Jarak Ke C1 =

Jarak Ke C2 =

Jarak Ke C3 =

Jarak Ke C4 =

Jarak Ke C5 =

Untuk mendapatkan pusat cluster yang baru lakukan perhitungan nilai rata-rata dari setiap anggota cluster dengan hasil seperti gambar.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITERASI 2 | | | | |
| C1 | C2 | C3 | C4 | C5 |
| 88,33333 | 79 | 83,16667 | 76,16667 | 76,33333 |
| 68,16667 | 85,33333 | 79,66667 | 90,16667 | 82,83333 |
| 98 | 88 | 98 | 78 | 87 |
| 88,71429 | 85,85714 | 80,85714 | 84,85714 | 84,42857 |
| 0 | 0 | 0 | 0 | 0 |

Tabel 4.8 Iterasi Ke-2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NIS | NAMA SISWA | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
| 11 | AHMAD YUSUF | 8,202303 | 28,16568 | 16,64332 | 14,61548 | 186,4618 |
| 22 | DENY GUNNTUR PUTRO SATRIO | 25,42855 | 13,06288 | 36,22154 | 25,41171 | 180,2304 |
| 33 | LINDA WATI | 38,13062 | 14,21169 | 49,83974 | 34,74866 | 177,1299 |
| 44 | MOHAMMAD ERNANDA ROBBY AL | 29,96016 | 15,77885 | 31,12876 | 20,60265 | 197,4082 |
| 55 | YULI AULIYA BERLIANAN | 12,71264 | 27,7063 | 15,77973 | 13,68673 | 190,0895 |
| 66 | ANDINI WARDANI | 13,20143 | 28,05897 | 15,23155 | 14,30427 | 190,5597 |
| 77 | ANDRE DWI SAPUTRA | 22,61882 | 37,39838 | 0 | 20,93625 | 201,5068 |
| 88 | BERLIAN ANINDYA PUTRI | 17,44356 | 23,85314 | 18,30301 | 9,96627 | 195,1563 |
| 99 | BERLIANI INDAH YUNIARTI | 20,79129 | 21,75559 | 29,29164 | 12,07291 | 188,7565 |
| 111 | MAULINDA INDAH FAJARWATI | 34,35517 | 31,74333 | 44,92215 | 26,02275 | 186,1424 |
| 222 | FIRDAUS FIRMANSYAH | 32,86758 | 18,18348 | 42,46175 | 22,76992 | 188,4463 |
| 333 | NANDA IMROATUS SHOLIKHAH | 26,27314 | 18,28402 | 44,30576 | 29,43585 | 168,997 |
| 444 | RISKY NUR FITRIYAH | 15,16392 | 34,13657 | 32,37283 | 27,28758 | 173,283 |
| 555 | SITI ZULIANASARI | 9,052317 | 25,97381 | 24,26932 | 11,3092 | 182,8661 |
| 666 | A'IM MATUZZAKIYYAH | 16,44013 | 40,97526 | 31,40064 | 26,82825 | 175,6901 |
| 777 | AFNI NUR KHOFIFAH | 11,81571 | 25,24491 | 17,4069 | 13,46575 | 188,2126 |
| 888 | AGMA BUDI PRASETYA | 17,59577 | 22,91227 | 26,88866 | 10,51044 | 188,2126 |
| 999 | CHUSNI ABDUL AZIZ | 17,12535 | 17,79435 | 30,80584 | 16,01466 | 179,1312 |
| 1111 | DWI NUR AULIYAUL HIDAYATI | 18,92823 | 24,86575 | 14,79865 | 11,87606 | 195,1666 |
| 2222 | MUHAMMAD ZUKHRUF QOLBI | 31,69034 | 17,39652 | 38,07887 | 25,57981 | 185,1729 |

Lakukan kembali update pusat cluster seperti gambar

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITERASI 3 | | | | |
| C1 | C2 | C3 | C4 | C5 |
| 90,28571 | 82,57143 | 85,71429 | 76,14286 | 74,85714 |
| 68,16667 | 85,33333 | 79,66667 | 90,16667 | 82,83333 |
| 98 | 88 | 98 | 78 | 87 |
| 86,5 | 82,83333 | 77,5 | 86,33333 | 87,5 |
| 0 | 0 | 0 | 0 | 0 |

Tabel 4.9 Iterasi Ke-3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NIS | NAMA SISWA | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
| 11 | AHMAD YUSUF | 8,321352 | 28,16568 | 16,64332 | 17,82009 | 186,4618 |
| 22 | DENY GUNNTUR PUTRO SATRIO | 27,40624 | 13,06288 | 36,22154 | 24,60804 | 180,2304 |
| 33 | LINDA WATI | 39,75948 | 14,21169 | 49,83974 | 33,1696 | 177,1299 |
| 44 | MOHAMMAD ERNANDA ROBBY AL | 29,92064 | 15,77885 | 31,12876 | 20,7418 | 197,4082 |
| 55 | YULI AULIYA BERLIANAN | 8,608254 | 27,7063 | 15,77973 | 19,37926 | 190,0895 |
| 66 | ANDINI WARDANI | 9,037338 | 28,05897 | 15,23155 | 19,98889 | 190,5597 |
| 77 | ANDRE DWI SAPUTRA | 19,76908 | 37,39838 | 0 | 25,4733 | 201,5068 |
| 88 | BERLIAN ANINDYA PUTRI | 15,43981 | 23,85314 | 18,30301 | 14,96292 | 195,1563 |
| 99 | BERLIANI INDAH YUNIARTI | 23,39632 | 21,75559 | 29,29164 | 6,749486 | 188,7565 |
| 111 | MAULINDA INDAH FAJARWATI | 36,45685 | 31,74333 | 44,92215 | 22,39544 | 186,1424 |
| 222 | FIRDAUS FIRMANSYAH | 34,54338 | 18,18348 | 42,46175 | 19,36205 | 188,4463 |
| 333 | NANDA IMROATUS SHOLIKHAH | 28,50242 | 18,28402 | 44,30576 | 28,90021 | 168,997 |
| 444 | RISKY NUR FITRIYAH | 17,37697 | 34,13657 | 32,37283 | 28,77885 | 173,283 |
| 555 | SITI ZULIANASARI | 8,723648 | 25,97381 | 24,26932 | 14,97405 | 182,8661 |
| 666 | A'IM MATUZZAKIYYAH | 16,56034 | 40,97526 | 31,40064 | 29,52776 | 175,6901 |
| 777 | AFNI NUR KHOFIFAH | 8,423727 | 25,24491 | 17,4069 | 18,71423 | 188,2126 |
| 888 | AGMA BUDI PRASETYA | 20,1236 | 22,91227 | 26,88866 | 6,92018 | 188,2126 |
| 999 | CHUSNI ABDUL AZIZ | 21,00583 | 17,79435 | 30,80584 | 12,63153 | 179,1312 |
| 1111 | DWI NUR AULIYAUL HIDAYATI | 17,91533 | 24,86575 | 14,79865 | 15,17308 | 195,1666 |
| 2222 | MUHAMMAD ZUKHRUF QOLBI | 33,44871 | 17,39652 | 38,07887 | 23,32857 | 185,1729 |

Lakukan kembali update pusat cluster seperti gambar

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITERASI 4 | | | | |
| C1 | C2 | C3 | C4 | C5 |
| 90,28571 | 82,57143 | 85,71429 | 76,14286 | 74,85714 |
| 68,16667 | 85,33333 | 79,66667 | 90,16667 | 82,83333 |
| 92,5 | 89 | 93,5 | 79 | 88,5 |
| 86,4 | 81,4 | 75,2 | 87,6 | 87 |
| 0 | 0 | 0 | 0 | 0 |

* 1. Iterasi Ke-4

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NIS | NAMA SISWA | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
| 11 | AHMAD YUSUF | 8,280924 | 28,16568 | 14,58595 | 19,61428 | 186,4618 |
| 22 | DENY GUNNTUR PUTRO SATRIO | 27,32437 | 13,06288 | 31,10868 | 25,20555 | 180,2304 |
| 33 | LINDA WATI | 39,6935 | 14,21169 | 43,26373 | 33,19217 | 177,1299 |
| 44 | MOHAMMAD ERNANDA ROBBY AL | 29,78178 | 15,77885 | 25,62713 | 21,92533 | 197,4082 |
| 55 | YULI AULIYA BERLIANAN | 8,56918 | 27,7063 | 12,67872 | 21,66841 | 190,0895 |
| 66 | ANDINI WARDANI | 9,000126 | 28,05897 | 12,35921 | 22,3186 | 190,5597 |
| 77 | ANDRE DWI SAPUTRA | 19,75209 | 37,39838 | 7,399324 | 28,10907 | 201,5068 |
| 88 | BERLIAN ANINDYA PUTRI | 15,28156 | 23,85314 | 14,44818 | 16,89734 | 195,1563 |
| 99 | BERLIANI INDAH YUNIARTI | 23,28401 | 21,75559 | 24,09876 | 5,226854 | 188,7565 |
| 111 | MAULINDA INDAH FAJARWATI | 36,38488 | 31,74333 | 39,41764 | 20,42841 | 186,1424 |
| 222 | FIRDAUS FIRMANSYAH | 34,42317 | 18,18348 | 36,13516 | 17,93098 | 188,4463 |
| 333 | NANDA IMROATUS SHOLIKHAH | 28,43041 | 18,28402 | 39,50633 | 28,35348 | 168,997 |
| 444 | RISKY NUR FITRIYAH | 17,37958 | 34,13657 | 31,39666 | 29,0262 | 173,283 |
| 555 | SITI ZULIANASARI | 8,685093 | 25,97381 | 20,31625 | 15,97248 | 182,8661 |
| 666 | A'IM MATUZZAKIYYAH | 16,66626 | 40,97526 | 30,78555 | 29,96198 | 175,6901 |
| 777 | AFNI NUR KHOFIFAH | 8,383793 | 25,24491 | 13,55544 | 20,99333 | 188,2126 |
| 888 | AGMA BUDI PRASETYA | 20,00244 | 22,91227 | 22,33271 | 5,99333 | 188,2126 |
| 999 | CHUSNI ABDUL AZIZ | 20,97169 | 17,79435 | 24,91486 | 12,89651 | 179,1312 |
| 1111 | DWI NUR AULIYAUL HIDAYATI | 17,87529 | 24,86575 | 7,399324 | 18,20769 | 195,1666 |
| 2222 | MUHAMMAD ZUKHRUF QOLBI | 33,42728 | 17,39652 | 30,80179 | 24,43195 | 185,1729 |

1. Apabila titik pusat setiap cluster tidak berubah tidak berubah maka perhitungan dihentikan. Tabel dibawah ini merupakan hasil perhitungan yang di lakukan dengan 4 kali perhitungan jarak dari setiap cluster.

Tabel 4.11 Hasil Perhitungan

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NIS | NAMA SISWA | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | HASIL | JURUSAN |
| 11 | AHMAD YUSUF | 8,321352 | 27,88763 | 13,32083 | 24,72893 | 186,4618 | CLUSTER 1 | TKJ |
| 22 | DENY GUNNTUR PUTRO SATRIO | 27,40624 | 10,42689 | 28,70153 | 26,42196 | 180,2304 | CLUSTER 2 | OTOMOTIF |
| 33 | LINDA WATI | 39,75948 | 13,50259 | 40,62566 | 31,52967 | 177,1299 | CLUSTER 2 | OTOMOTIF |
| 44 | MOHAMMAD ERNANDA ROBBY AL | 29,92064 | 16,76067 | 22,37806 | 23,12401 | 197,4082 | CLUSTER 2 | OTOMOTIF |
| 55 | YULI AULIYA BERLIANAN | 8,608254 | 27,74383 | 10,2361 | 26,38788 | 190,0895 | CLUSTER 1 | TKJ |
| 66 | ANDINI WARDANI | 9,037338 | 28,00571 | 10,0222 | 27,07988 | 190,5597 | CLUSTER 1 | TKJ |
| 77 | ANDRE DWI SAPUTRA | 19,76908 | 37,37807 | 10,0885 | 33,25838 | 201,5068 | CLUSTER 3 | TATABOGA |
| 88 | BERLIAN ANINDYA PUTRI | 15,43981 | 24,78144 | 9,632122 | 21,35228 | 195,1563 | CLUSTER 3 | TATABOGA |
| 99 | BERLIANI INDAH YUNIARTI | 23,39632 | 23,92321 | 21,58189 | 7,051241 | 188,7565 | CLUSTER 4 | WIRAUSAHA/PEMASARAN |
| 111 | MAULINDA INDAH FAJARWATI | 36,45685 | 34,996 | 36,97447 | 16,64091 | 186,1424 | CLUSTER 4 | WIRAUSAHA/PEMASARAN |
| 222 | FIRDAUS FIRMANSYAH | 34,54338 | 21,82017 | 32,72274 | 13,99714 | 188,4463 | CLUSTER 4 | WIRAUSAHA/PEMASARAN |
| 333 | NANDA IMROATUS SHOLIKHAH | 28,50242 | 17,41608 | 36,18625 | 28,53629 | 168,997 | CLUSTER 2 | OTOMOTIF |
| 444 | RISKY NUR FITRIYAH | 17,37697 | 33,34546 | 29,66105 | 32,70046 | 173,283 | CLUSTER 1 | TKJ |
| 555 | SITI ZULIANASARI | 8,723648 | 26,92434 | 17,62889 | 19,80707 | 182,8661 | CLUSTER 1 | TKJ |
| 666 | A'IM MATUZZAKIYYAH | 16,56034 | 41,28825 | 29,81797 | 33,57559 | 175,6901 | CLUSTER 1 | TKJ |
| 777 | AFNI NUR KHOFIFAH | 8,423727 | 25,04636 | 11,08051 | 25,53272 | 188,2126 | CLUSTER 1 | TKJ |
| 888 | AGMA BUDI PRASETYA | 20,1236 | 24,72489 | 19,59875 | 9,875222 | 188,2126 | CLUSTER 4 | WIRAUSAHA/PEMASARAN |
| 999 | CHUSNI ABDUL AZIZ | 21,00583 | 18,33358 | 23,5254 | 14,15344 | 179,1312 | CLUSTER 4 | WIRAUSAHA/PEMASARAN |
| 1111 | DWI NUR AULIYAUL HIDAYATI | 17,91533 | 25,25312 | 7,356025 | 22,34099 | 195,1666 | CLUSTER 3 | TATABOGA |
| 2222 | MUHAMMAD ZUKHRUF QOLBI | 33,44871 | 17,80786 | 30,14041 | 23,4802 | 185,1729 | CLUSTER 2 | OTOMOTIF |

Hasil Akhir

Berdasarkan Perhitungan diatas maka dapat disimpulkan :

C1 Merupakan kelompok siswa dengan jurusan TKJ(Teknik Komputer Jarungan)

C2 Merupakan kelompok siswa dengan jurusan Otomotif

C3 Merupakan kelompok siswa dengan jurusan Tataboga

C4 Merupakan kelompok siswa dengan jurusan Wirausaha / Pemasaran

C5 Merupakan kelompok siswa dengan jurusan Pertanian