

BAB IV

PEMBAHASAN DAN HASIL

IV.1. Pembahasan

Universitas Potensi Utama Medan yang merupakan suatu instansi perguruan tinggi swasta yang berlokasi di Medan. Pada umumnya menggunakan laptop sebagai salah satu media belajar khususnya pada fakultas Teknik dan Ilmu Komputer (FTIK). Laptop yang digunakan oleh para mahasiswa tersebut terdiri dari berbagai jenis merek dan juga spesifikasi yang berbeda. Oleh karena itu, pentingnya dilakukan suatu pengelompokan penggunaan laptop dikalangan mahasiswa untuk mengetahui jenis laptop dengan merek dan jenis spesifikasi yang mana yang lebih banyak digunakan di Universitas Potensi Utama Medan.

Pengelompokan yang dilakukan dalam penelitian ini menggunakan perhitungan algoritma dengan metode *K-Means clustering*. Dimana, metode *K-Means clustering* merupakan salah satu metode pengelompokan non-hirarki berusaha mengelompokkan data kedalam satu atau lebih bentuk *cluster*/kelompok. Tujuan penelitian ini adalah untuk mengetahui kelompok-kelompok penggunaan laptop dikalangan mahasiswa berdasarkan jenis merek dan juga spesifikasi dari laptop yang digunakan oleh para mahasiswa tersebut. Manfaat dilakukannya penelitian ini adalah dapat digunakan sebagai saran kepada calon mahasiswa baru dalam memilih laptop yang sesuai agar nantinya proses belajar dan mengajar di ruangan dapat berjalan dengan baik.

Cluster adalah kumpulan data yang memiliki kemiripan satu dengan yang lainnya dan tidak memiliki kemiripan dengan *cluster* yang lain. Sedangkan *Clustering* merupakan suatu metode yang digunakan dalam melakukan analisa data yang sering dimasukkan sebagai salah satu metode dalam *data mining* yang bertujuan untuk mengelompokkan data dengan karakteristik yang sama antara satu kelompok dengan karakteristik berbeda dengan kelompok yang lain.

IV.2. Penerapan Metode K-Means

Metode *K-Means Clustering* merupakan salah satu metode data *clustering non-hirarki* berusaha mengelompokkan data dalam bentuk satu atau lebih *cluster*/kelompok. Data-data yang memiliki karakteristik yang berbeda dikelompokkan dengan *cluster*/kelompok yang lain sehingga data yang berada dalam satu *cluster*/kelompok memiliki tingkat variasi yang kecil.

Langkah-langkah dalam melakukan *clustering* dengan metode *k-means* adalah sebagai berikut:

2. Menentukan jumlah *cluster* k ,

1. Tentukan *centroid* awal,

Centroid (titik pusat) awal ditentukan secara acak yang juga merupakan titik pusat *cluster* pertama.

2. Menghitung jarak setiap data yang ada terhadap setiap pusat *cluster* menggunakan persamaan *Euclidean Distance Space*.

Rumus *Euclidean distance* yaitu:

$$d = |x-y| = \sqrt{\sum_{i=1}^n (x_i - y_i)^2}$$

x = Pusat *cluster*

y = data

3. Melakukan pengelompokan data
4. Melakukan penghitungan ulang kembali pusat *cluster* yang baru berdasarkan rata-rata anggota yang ada pada *cluster*.

IV.2.1. Studi Kasus

Dalam studi kasus ini penulis menggunakan aplikasi weka untuk menganalisa Pengelompokan Pemakaian Laptop Di Kalangan Mahasiswa Universitas Potensi Utama yang menerapkan metode *K-Means Clustering*.

No.	Nama Laptop	Spesifikasi	RAM	Jumlah Pemakai
1	Toshiba	i3	2	20
2	Toshiba	i3	4	5
3	Toshiba	i3	6	5
4	Toshiba	i5	2	19
5	Toshiba	i5	4	6
6	Toshiba	i5	6	4
7	Toshiba	dual core	2	22
8	Toshiba	dual core	4	8
9	Toshiba	dual core	6	5
10	Acer	i3	2	25
11	Acer	i3	4	15
12	Acer	i3	6	9
13	Acer	i5	2	15
14	Acer	i5	4	2
15	Acer	i5	6	6
16	Acer	dual core	2	16
17	Acer	dual core	4	15
18	Acer	dual core	6	5
19	Asus	i3	2	10
20	Asus	i3	4	9
21	Asus	i3	6	7
22	Asus	i5	2	15
23	Asus	i5	4	5
24	Asus	i5	6	2
25	Asus	dual core	2	30
26	Asus	dual core	4	10
27	Asus	dual core	6	5
28	HP	i3	2	13
29	HP	i3	4	8
30	HP	i3	6	7
31	HP	i5	2	18
32	HP	i5	4	4
33	HP	i5	6	2
34	HP	dual core	2	20
35	HP	dual core	4	3
36	HP	dual core	6	2
37	Lenovo	i3	2	15
38	Lenovo	i3	4	3
39	Lenovo	i3	6	2
40	Lenovo	i5	2	8
41	Lenovo	i5	4	2
42	Lenovo	i5	6	2
43	Lenovo	dual core	2	17
44	Lenovo	dual core	4	1
45	Lenovo	dual core	6	1
46	Dell	i3	2	15
47	Dell	i3	4	2
48	Dell	i3	6	2
49	Dell	i5	2	14
50	Dell	i5	4	4
51	Dell	i5	6	2
52	Dell	dual core	2	15
53	Dell	dual core	4	5
54	Dell	dual core	6	3

IV.3. Pengujian data

Berdasarkan data diatas maka diperoleh :

a. Proses Iterasi I

Pusat awal cluster atau centroid didapatkan secara random (acak) dengan penentuan awal cluster di asumsikan sebagai berikut :

Pusat Cluster 1 = (2, 13)

Pusat Cluster 2 = (2, 20)

b. Proses perhitungan jarak pusat cluster

Dalam mengukur jarak data dengan pusat cluster digunakan metode Euclidean distance sebagai berikut :

$$d = x - y = \sqrt{(xi - yi)^2}$$

dengan ketentuan :

X = Pusat Cluster

y = Data

Dengan demikian dapat diperoleh data cluster sebagai berikut :

$$M1X = \sqrt{(2-2)^2 + (20-13)^2}$$

$$= 7$$

$$M2X = \sqrt{(4-2)^2 + (5-13)^2}$$

$$= 8.24$$

$$M3X = \sqrt{(6-2)^2 + (5-13)^2}$$

$$= 8.94$$

$$\text{M4X} = \sqrt{(2-2)^2 + (19-13)^2}$$

$$= 6$$

$$\text{M5X} = \sqrt{(4-2)^2 + (6-13)^2}$$

$$= 7.28$$

$$\text{M6X} = \sqrt{(6-2)^2 + (4-13)^2}$$

$$= 9.84$$

$$\text{M7X} = \sqrt{(2-2)^2 + (22-13)^2}$$

$$= 9$$

$$\text{M8X} = \sqrt{(4-2)^2 + (8-13)^2}$$

$$= 5.38$$

$$\text{M9X} = \sqrt{(6-2)^2 + (5-13)^2}$$

$$= 8.94$$

$$\text{M10X} = \sqrt{(2-2)^2 + (25-13)^2}$$

$$= 12$$

$$\text{M11X} = \sqrt{(4-2)^2 + (15-13)^2}$$

$$= 2.82$$

$$\text{M12X} = \sqrt{(6-2)^2 + (9-13)^2}$$

$$= 5.65$$

$$\text{M13X} = \sqrt{(2-2)^2 + (15-13)^2}$$

$$= 2$$

$$\text{M14X} = \sqrt{(4-2)^2 + (2-13)^2}$$

$$= 11.18$$

$$\text{M15X} = \sqrt{(6-2)^2 + (6-13)^2}$$

$$= 8.06$$

$$\text{M16X} = \sqrt{(2-2)^2 + (16-13)^2}$$

$$= 3$$

$$\text{M17X} = \sqrt{(4-2)^2 + (15-13)^2}$$

$$= 2.82$$

$$\text{M18X} = \sqrt{(6-2)^2 + (5-13)^2}$$

$$= 8.94$$

$$\text{M19X} = \sqrt{(2-2)^2 + (10-13)^2}$$

$$= 3$$

$$\text{M20X} = \sqrt{(4-2)^2 + (9-13)^2}$$

$$= 4.47$$

$$\text{M21X} = \sqrt{(6-2)^2 + (7-13)^2}$$

$$= 7.21$$

$$\text{M22X} = \sqrt{(2-2)^2 + (15-13)^2}$$

$$= 2$$

$$\text{M23X} = \sqrt{(4-2)^2 + (5-13)^2}$$

$$= 8.24$$

$$\text{M24X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M25X} = \sqrt{(2-2)^2 + (30-13)^2}$$

$$= 17$$

$$\text{M26X} = \sqrt{(4-2)^2 + (10-13)^2}$$

$$= 3.60$$

$$\text{M27X} = \sqrt{(6-2)^2 + (5-13)^2}$$

$$= 8.94$$

$$\text{M28X} = \sqrt{(2-2)^2 + (13-13)^2}$$

$$= 0$$

$$\text{M29X} = \sqrt{(4-2)^2 + (8-13)^2}$$

$$= 5.38$$

$$\text{M30X} = \sqrt{(6-2)^2 + (7-13)^2}$$

$$= 7.21$$

$$\text{M31X} = \sqrt{(2-2)^2 + (18-13)^2}$$

$$= 5$$

$$\text{M32X} = \sqrt{(4-2)^2 + (4-13)^2}$$

$$= 9.21$$

$$\text{M33X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M34X} = \sqrt{(2-2)^2 + (20-13)^2}$$

$$= 7$$

$$\text{M35X} = \sqrt{(4-2)^2 + (3-13)^2}$$

$$= 10.19$$

$$\text{M36X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M37X} = \sqrt{(2-2)^2 + (15-13)^2}$$

$$= 2$$

$$\text{M38X} = \sqrt{(4-2)^2 + (3-13)^2}$$

$$= 10.19$$

$$\text{M39X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M40X} = \sqrt{(2-2)^2 + (8-13)^2}$$

$$= 5$$

$$\text{M41X} = \sqrt{(4-2)^2 + (2-13)^2}$$

$$= 11.18$$

$$\text{M42X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M43X} = \sqrt{(2-2)^2 + (17-13)^2}$$

$$= 4$$

$$\text{M44X} = \sqrt{(4-2)^2 + (1-13)^2}$$

$$= 12.16$$

$$\text{M45X} = \sqrt{(6-2)^2 + (1-13)^2}$$

$$= 12.64$$

$$\text{M46X} = \sqrt{(2-2)^2 + (15-13)^2}$$

$$= 2$$

$$\text{M47X} = \sqrt{(4-2)^2 + (2-13)^2}$$

$$= 11.18$$

$$\text{M48X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M49X} = \sqrt{(2-2)^2 + (14-13)^2}$$

$$= 1$$

$$\text{M50X} = \sqrt{(4-2)^2 + (4-13)^2}$$

$$= 9.21$$

$$\text{M51X} = \sqrt{(6-2)^2 + (2-13)^2}$$

$$= 11.7$$

$$\text{M52X} = \sqrt{(2-2)^2 + (15-13)^2}$$

$$= 2$$

$$\text{M53X} = \sqrt{(4-2)^2 + (5-13)^2}$$

$$= 8.24$$

$$\text{M54X} = \sqrt{(6-2)^2 + (3-13)^2}$$

$$= 10.7$$

$$\text{M1Y} = \sqrt{(2-2)^2 + (20-20)^2}$$

$$= 0$$

$$\text{M2Y} = \sqrt{(4-2)^2 + (5-20)^2}$$

$$= 15.13$$

$$\text{M3Y} = \sqrt{(6-2)^2 + (5-20)^2}$$

$$= 15.52$$

$$\text{M4Y} = \sqrt{(2-2)^2 + (19-20)^2}$$

$$= 1$$

$$\text{M5Y} = \sqrt{(4-2)^2 + (6-20)^2}$$

$$= 14.14$$

$$\text{M6Y} = \sqrt{(6-2)^2 + (4-20)^2}$$

$$= 16.49$$

$$\text{M7Y} = \sqrt{(2-2)^2 + (22-20)^2}$$

$$= 2$$

$$\text{M8Y} = \sqrt{(4-2)^2 + (8-20)^2}$$

$$= 12.16$$

$$\text{M9Y} = \sqrt{(6-2)^2 + (5-20)^2}$$

$$= 15.52$$

$$\text{M10Y} = \sqrt{(2-2)^2 + (25-20)^2}$$

$$= 5$$

$$\text{M11Y} = \sqrt{(4-2)^2 + (15-20)^2}$$

$$= 5.38$$

$$\text{M12Y} = \sqrt{(6-2)^2 + (9-20)^2}$$

$$= 11.70$$

$$\text{M13Y} = \sqrt{(2-2)^2 + (15-20)^2}$$

$$= 5$$

$$\text{M14Y} = \sqrt{(4-2)^2 + (2-20)^2}$$

$$= 18.11$$

$$\text{M15Y} = \sqrt{(6-2)^2 + (6-20)^2}$$

$$= 14.56$$

$$\text{M16Y} = \sqrt{(2-2)^2 + (16-20)^2}$$

$$= 4$$

$$\text{M17Y} = \sqrt{(4-2)^2 + (15-20)^2}$$

$$= 5.38$$

$$\text{M18Y} = \sqrt{(6-2)^2 + (5-20)^2}$$

$$= 15.52$$

$$\text{M19Y} = \sqrt{(2-2)^2 + (10-20)^2}$$

$$= 10$$

$$\text{M20Y} = \sqrt{(4-2)^2 + (9-20)^2}$$

$$= 11.18$$

$$\text{M21Y} = \sqrt{(6-2)^2 + (7-20)^2}$$

$$= 13.60$$

$$\text{M22Y} = \sqrt{(2-2)^2 + (15-20)^2}$$

$$= 5$$

$$\text{M23Y} = \sqrt{(4-2)^2 + (5-20)^2}$$

$$= 15.13$$

$$\text{M24Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$\text{M25Y} = \sqrt{(2-2)^2 + (30-20)^2}$$

$$= 10$$

$$\text{M26Y} = \sqrt{(4-2)^2 + (10-20)^2}$$

$$= 10.19$$

$$\text{M27Y} = \sqrt{(6-2)^2 + (5-20)^2}$$

$$= 15.52$$

$$\text{M28Y} = \sqrt{(2-2)^2 + (13-20)^2}$$

$$= 7$$

$$\text{M29Y} = \sqrt{(4-2)^2 + (8-20)^2}$$

$$= 12.16$$

$$\text{M30Y} = \sqrt{(6-2)^2 + (7-20)^2}$$

$$= 13.60$$

$$\text{M31Y} = \sqrt{(2-2)^2 + (18-20)^2}$$

$$= 2$$

$$\text{M32Y} = \sqrt{(4-2)^2 + (4-20)^2}$$

$$= 16.12$$

$$\text{M33Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$\text{M34Y} = \sqrt{(2-2)^2 + (20-20)^2}$$

$$= 0$$

$$\text{M35Y} = \sqrt{(4-2)^2 + (3-20)^2}$$

$$= 17.11$$

$$\text{M36Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$\text{M37Y} = \sqrt{(2-2)^2 + (15-20)^2}$$

$$= 5$$

$$\text{M38Y} = \sqrt{(4-2)^2 + (3-20)^2}$$

$$= 17.11$$

$$\text{M39Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$\text{M40Y} = \sqrt{(2-2)^2 + (8-20)^2}$$

$$= 12$$

$$\text{M41Y} = \sqrt{(4-2)^2 + (2-20)^2}$$

$$= 18.11$$

$$\text{M42Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$\text{M43Y} = \sqrt{(2-2)^2 + (17-20)^2}$$

$$= 3$$

$$\text{M44Y} = \sqrt{(4-2)^2 + (1-20)^2}$$

$$= 19.10$$

$$\text{M45Y} = \sqrt{(6-2)^2 + (1-20)^2}$$

$$= 19.41$$

$$\text{M46Y} = \sqrt{(2-2)^2 + (15-20)^2}$$

$$= 5$$

$$\text{M47Y} = \sqrt{(4-2)^2 + (2-20)^2}$$

$$= 18.11$$

$$\text{M48Y} = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$M49Y = \sqrt{(2-2)^2 + (14-20)^2}$$

$$= 6$$

$$M50Y = \sqrt{(4-2)^2 + (4-20)^2}$$

$$= 16.12$$

$$M51Y = \sqrt{(6-2)^2 + (2-20)^2}$$

$$= 18.43$$

$$M52Y = \sqrt{(2-2)^2 + (15-20)^2}$$

$$= 5$$

$$M53Y = \sqrt{(4-2)^2 + (5-20)^2}$$

$$= 15.13$$

$$M54Y = \sqrt{(6-2)^2 + (3-20)^2}$$

$$= 17.46$$

Dengan menerapkan metode Euclidean Distance maka diperoleh hasil Iterasi sebagai berikut :

Tabel IV.1 Hasil perhitungan dengan iterasi pertama

No.	Nama Laptop	Spesifikasi	RAM	Jumlah Pemakai		C1	C2	CLUSTER
1	Toshiba	i3	2	20		7	0	2
2	Toshiba	i3	4	5		8,246211	15,13275	1
3	Toshiba	i3	6	5		8,944272	15,52417	1
4	Toshiba	i5	2	19		6	1	2
5	Toshiba	i5	4	6		7,28011	14,14214	1
6	Toshiba	i5	6	4		9,848858	16,49242	1
7	Toshiba	dual core	2	22		9	2	2
8	Toshiba	dual core	4	8		5,385165	12,16553	1
9	Toshiba	dual core	6	5		8,944272	15,52417	1
10	Acer	i3	2	25		12	5	2
11	Acer	i3	4	15		2,828427	5,385165	1
12	Acer	i3	6	9		5,656854	11,7047	1
13	Acer	i5	2	15		2	5	1
14	Acer	i5	4	2		11,18034	18,11077	1
15	Acer	i5	6	6		8,062258	14,56022	1
16	Acer	dual core	2	16		3	4	1
17	Acer	dual core	4	15		2,828427	5,385165	1
18	Acer	dual core	6	5		8,944272	15,52417	1
19	Asus	i3	2	10		3	10	1
20	Asus	i3	4	9		4,472136	11,18034	1
21	Asus	i3	6	7		7,211103	13,60147	1
22	Asus	i5	2	15		2	5	1
23	Asus	i5	4	5		8,246211	15,13275	1
24	Asus	i5	6	2		11,7047	18,43909	1
25	Asus	dual core	2	30		17	10	2
26	Asus	dual core	4	10		3,605551	10,19804	1
27	Asus	dual core	6	5		8,944272	15,52417	1
28	HP	i3	2	13	C1	0	7	1
29	HP	i3	4	8		5,385165	12,16553	1
30	HP	i3	6	7		7,211103	13,60147	1
31	HP	i5	2	18		5	2	2
32	HP	i5	4	4		9,219544	16,12452	1
33	HP	i5	6	2		11,7047	18,43909	1
34	HP	dual core	2	20	C2	7	0	2
35	HP	dual core	4	3		10,19804	17,11724	1
36	HP	dual core	6	2		11,7047	18,43909	1
37	Lenovo	i3	2	15		2	5	1
38	Lenovo	i3	4	3		10,19804	17,11724	1
39	Lenovo	i3	6	2		11,7047	18,43909	1
40	Lenovo	i5	2	8		5	12	1
41	Lenovo	i5	4	2		11,18034	18,11077	1
42	Lenovo	i5	6	2		11,7047	18,43909	1
43	Lenovo	dual core	2	17		4	3	2
44	Lenovo	dual core	4	1		12,16553	19,10497	1
45	Lenovo	dual core	6	1		12,64911	19,41649	1
46	Dell	i3	2	15		2	5	1
47	Dell	i3	4	2		11,180	18,11077	1
48	Dell	i3	6	2		11,7047	18,43909	1
49	Dell	i5	2	14		1	6	1
50	Dell	i5	4	4		9,219544	16,12452	1
51	Dell	i5	6	2		11,7047	18,43909	1
52	Dell	dual core	2	15		2	5	1
53	Dell	dual core	4	5		8,246211	15,13275	1
54	Dell	dual core	6	3		10,770	17,46425	1

Dari perhitungan tersebut maka diperoleh hasil sebagai berikut :

C1 =

{M2,M3,M5,M6,M8,M9,M11,M12,M13,M14,M15,M16,M17,M18,M19,M20,M21,M22,
M23,M24,M26,M27,M28,M29,M30,M32,M33,M35,M36,M37,M38,M39,M40,M41,M4
2,M43,M45,M46,M47,M48,M49,M50,M51,M52,M53,M54}

C2 = {M1,M4,M7,M10,M25,M31,M34,M43}

Proses iterasi ke-2 :

1. Menghitung titik pusat baru

Menentukan posisi Centroid Baru (C_k) dengan cara menghitung nilai rata-rata dari data yang telah ada, yaitu dengan rumus :

$$C_k = \left(\frac{1}{n_k} \right) \sum d_1$$

n_k = Jumlah data dalam Cluster K

C1X={

(8.24+8.94+7.28+9.84+5.38+8.94+2.82+5.65+2+11.18+8.06+3+2.82+8.94+3+4.4
7+7.21+2+8.24+11.7+3.60+8.94+0+5.38+7.21+9.21+11.7+10.19+10.70+5+11.18
+11.70+1+9.21+11.7+2+8.24+10.77) / 46 } = 7.43

C1Y={

(15.13+15.52+1+14.14+16.49+12.16+15.52+5.38+11.70+5+18.11+14.56+4+5.38
+15.52+10+11.18+13.60+5+15.13+18.43+10.19+15.52+7+12.16+13.60+16.12+1
8.43+17.11+18.43+5+17.11+18.43+12+18.11+18.43+19.10+19.41+5+18.11+18.
43+6+16.12+18.43+5+15.13+17.46) / 46 } = 13.43

Maka diperoleh titik pusat cluster baru untuk C1 yaitu : 7.43 & 13.43

Untuk titik pusat baru pada C2 sebagai berikut :

$$C2\ X = \{ (7+6+9+12+17+3+7+4) / 8 \} = \underline{8.37}$$

$$C2\ Y = \{ (0+1+2+5+10+2+0+3) / 8 \} = \underline{2.87}$$

Maka diperoleh titik pusat cluster baru untuk C2 yaitu : 8.37 & 2.87

Sehingga dapat disimpulkan dengan titik pusat atau centroid baru : C1 = (7.43 ,), C2 = (13.43)

2. Melakukan iterasi dengan menghitung jarak titik pusat yang baru

$$\begin{aligned} M1X &= \sqrt{(2-7.43)^2 + (20-13.43)^2} \\ &= 8.52 \end{aligned}$$

$$\begin{aligned} M2X &= \sqrt{(4-7.43)^2 + (5-13.43)^2} \\ &= 9.10 \end{aligned}$$

$$\begin{aligned} M3X &= \sqrt{(6-7.43)^2 + (5-13.43)^2} \\ &= 8.55 \end{aligned}$$

$$\begin{aligned} M4X &= \sqrt{(2-7.43)^2 + (19-13.43)^2} \\ &= 7.78 \end{aligned}$$

$$\begin{aligned} M5X &= \sqrt{(4-7.43)^2 + (6-13.43)^2} \\ &= 8.19 \end{aligned}$$

$$\begin{aligned} M6X &= \sqrt{(6-7.43)^2 + (4-13.43)^2} \\ &= 9.54 \end{aligned}$$

$$\begin{aligned} M7X &= \sqrt{(2-7.43)^2 + (22-13.43)^2} \\ &= 10.14 \end{aligned}$$

$$\begin{aligned} M8X &= \sqrt{(4-7.43)^2 + (8-13.43)^2} \\ &= 6.43 \end{aligned}$$

$$\begin{aligned}
\text{M9X} &= \sqrt{(6-7.43)^2 + (5-13.43)^2} \\
&= 8.55 \\
\text{M10X} &= \sqrt{(2-7.43)^2 + (25-13.43)^2} \\
&= 12.78 \\
\text{M11X} &= \sqrt{(4-7.43)^2 + (15-13.43)^2} \\
&= 3.77 \\
\text{M12X} &= \sqrt{(6-7.43)^2 + (9-13.43)^2} \\
&= 4.66 \\
\text{M13X} &= \sqrt{(2-7.43)^2 + (15-13.43)^2} \\
&= 5.65 \\
\text{M14X} &= \sqrt{(4-7.43)^2 + (2-13.43)^2} \\
&= 11.93 \\
\text{M15X} &= \sqrt{(6-7.43)^2 + (6-13.43)^2} \\
&= 7.57 \\
\text{M16X} &= \sqrt{(2-7.43)^2 + (16-13.43)^2} \\
&= 6.01 \\
\text{M17X} &= \sqrt{(4-7.43)^2 + (15-13.43)^2} \\
&= 3.77 \\
\text{M18X} &= \sqrt{(6-7.43)^2 + (5-13.43)^2} \\
&= 5.55 \\
\text{M19X} &= \sqrt{(2-7.43)^2 + (10-13.43)^2} \\
&= 6.43 \\
\text{M20X} &= \sqrt{(4-7.43)^2 + (9-13.43)^2} \\
&= 5.61
\end{aligned}$$

$$\begin{aligned}\text{M21X} &= \sqrt{(6-7.43)^2 + (7-13.43)^2} \\ &= 6.59\end{aligned}$$

$$\begin{aligned}\text{M22X} &= \sqrt{(2-7.43)^2 + (15-13.43)^2} \\ &= 5.65\end{aligned}$$

$$\begin{aligned}\text{M23X} &= \sqrt{(4-7.43)^2 + (5-13.43)^2} \\ &= 9.10\end{aligned}$$

$$\begin{aligned}\text{M24X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M25X} &= \sqrt{(2-7.43)^2 + (30-13.43)^2} \\ &= 17.43\end{aligned}$$

$$\begin{aligned}\text{M26X} &= \sqrt{(4-7.43)^2 + (10-13.43)^2} \\ &= 4.85\end{aligned}$$

$$\begin{aligned}\text{M27X} &= \sqrt{(6-7.43)^2 + (5-13.43)^2} \\ &= 8.55\end{aligned}$$

$$\begin{aligned}\text{M28X} &= \sqrt{(2-7.43)^2 + (13-13.43)^2} \\ &= 5.45\end{aligned}$$

$$\begin{aligned}\text{M29X} &= \sqrt{(4-7.43)^2 + (8-13.43)^2} \\ &= 6.43\end{aligned}$$

$$\begin{aligned}\text{M30X} &= \sqrt{(6-7.43)^2 + (7-13.43)^2} \\ &= 6.59\end{aligned}$$

$$\begin{aligned}\text{M31X} &= \sqrt{(2-7.43)^2 + (18-13.43)^2} \\ &= 7.10\end{aligned}$$

$$\begin{aligned}\text{M32X} &= \sqrt{(4-7.43)^2 + (4-13.43)^2} \\ &= 10.04\end{aligned}$$

$$\begin{aligned}\text{M33X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M34X} &= \sqrt{(2-7.43)^2 + (20-13.43)^2} \\ &= 8.52\end{aligned}$$

$$\begin{aligned}\text{M35X} &= \sqrt{(4-7.43)^2 + (3-13.43)^2} \\ &= 10.98\end{aligned}$$

$$\begin{aligned}\text{M36X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M37X} &= \sqrt{(2-7.43)^2 + (15-13.43)^2} \\ &= 5.65\end{aligned}$$

$$\begin{aligned}\text{M38X} &= \sqrt{(4-7.43)^2 + (3-13.43)^2} \\ &= 10.98\end{aligned}$$

$$\begin{aligned}\text{M39X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M40X} &= \sqrt{(2-7.43)^2 + (8-13.43)^2} \\ &= 7.68\end{aligned}$$

$$\begin{aligned}\text{M41X} &= \sqrt{(4-7.43)^2 + (2-13.43)^2} \\ &= 11.93\end{aligned}$$

$$\begin{aligned}\text{M42X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M43X} &= \sqrt{(2-7.43)^2 + (17-13.43)^2} \\ &= 6.50\end{aligned}$$

$$\begin{aligned}\text{M44X} &= \sqrt{(4-2)^2 + (1-13.43)^2} \\ &= 12.90\end{aligned}$$

$$\begin{aligned}\text{M45X} &= \sqrt{(6-7.43)^2 + (1-13.43)^2} \\ &= 12.51\end{aligned}$$

$$\begin{aligned}\text{M46X} &= \sqrt{(2-7.43)^2 + (15-13.43)^2} \\ &= 5.65\end{aligned}$$

$$\begin{aligned}\text{M47X} &= \sqrt{(4-7.43)^2 + (2-13.43)^2} \\ &= 11.93\end{aligned}$$

$$\begin{aligned}\text{M48X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M49X} &= \sqrt{(2-7.43)^2 + (14-13.43)^2} \\ &= 5.46\end{aligned}$$

$$\begin{aligned}\text{M50X} &= \sqrt{(4-7.43)^2 + (4-13.43)^2} \\ &= 10.04\end{aligned}$$

$$\begin{aligned}\text{M51X} &= \sqrt{(6-7.43)^2 + (2-13.43)^2} \\ &= 11.52\end{aligned}$$

$$\begin{aligned}\text{M52X} &= \sqrt{(2-7.43)^2 + (15-13.43)^2} \\ &= 5.65\end{aligned}$$

$$\begin{aligned}\text{M53X} &= \sqrt{(4-7.43)^2 + (5-13.43)^2} \\ &= 9.10\end{aligned}$$

$$\begin{aligned}\text{M54} &= \sqrt{(6-7.43)^2 + (3-13.43)^2} \\ &= 10.53\end{aligned}$$

$$\begin{aligned}\text{M1Y} &= \sqrt{(2-8.37)^2 + (20-2.87)^2} \\ &= 18.27\end{aligned}$$

$$\begin{aligned}\text{M2Y} &= \sqrt{(4-8.37)^2 + (5-13.43)^2} \\ &= 4.86\end{aligned}$$

$$\begin{aligned}\text{M3Y} &= \sqrt{(6-8.37)^2 + (5-13.43)^2} \\ &= 3.18\end{aligned}$$

$$\begin{aligned}\text{M4Y} &= \sqrt{(2-8.37)^2 + (19-13.43)^2} \\ &= 17.33\end{aligned}$$

$$\begin{aligned}\text{M5Y} &= \sqrt{(4-8.37)^2 + (6-13.43)^2} \\ &= 5.37\end{aligned}$$

$$\begin{aligned}\text{M6Y} &= \sqrt{(6-8.37)^2 + (4-13.43)^2} \\ &= 2.62\end{aligned}$$

$$\begin{aligned}\text{M7Y} &= \sqrt{(2-8.37)^2 + (22-13.43)^2} \\ &= 20.15\end{aligned}$$

$$\begin{aligned}\text{M8Y} &= \sqrt{(4-8.37)^2 + (8-13.43)^2} \\ &= 6.73\end{aligned}$$

$$\begin{aligned}\text{M9Y} &= \sqrt{(6-8.37)^2 + (5-13.43)^2} \\ &= 3.18\end{aligned}$$

$$\begin{aligned}\text{M10Y} &= \sqrt{(2-8.37)^2 + (25-13.43)^2} \\ &= 23.02\end{aligned}$$

$$\begin{aligned}\text{M11Y} &= \sqrt{(4-8.37)^2 + (15-13.43)^2} \\ &= 12.89\end{aligned}$$

$$\begin{aligned}\text{M12Y} &= \sqrt{(6-8.37)^2 + (9-13.43)^2} \\ &= 6.56\end{aligned}$$

$$\begin{aligned}\text{M13Y} &= \sqrt{(2-8.37)^2 + (15-13.43)^2} \\ &= 13.69\end{aligned}$$

$$\begin{aligned}\text{M14Y} &= \sqrt{(4-8.37)^2 + (2-13.43)^2} \\ &= 4.46\end{aligned}$$

$$\begin{aligned}
\text{M15Y} &= \sqrt{(6-8.3)^2 + (6-13.43)^2} \\
&= 3.92 \\
\text{M16Y} &= \sqrt{(2-8.37)^2 + (16-13.43)^2} \\
&= 14.59 \\
\text{M17Y} &= \sqrt{(4-8.37)^2 + (15-13.43)^2} \\
&= 12.89 \\
\text{M18Y} &= \sqrt{(6-8.37)^2 + (5-13.43)^2} \\
&= 3.18 \\
\text{M19Y} &= \sqrt{(2-8.37)^2 + (10-13.43)^2} \\
&= 9.56 \\
\text{M20Y} &= \sqrt{(4-8.37)^2 + (9-13.43)^2} \\
&= 7.52 \\
\text{M21Y} &= \sqrt{(6-8.37)^2 + (7-13.43)^2} \\
&= 4.75 \\
\text{M22Y} &= \sqrt{(2-8.37)^2 + (15-13.43)^2} \\
&= 13.69 \\
\text{M23Y} &= \sqrt{(4-8.37)^2 + (5-13.43)^2} \\
&= 4.86 \\
\text{M24Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\
&= 2.53 \\
\text{M25Y} &= \sqrt{(2-8.37)^2 + (30-13.43)^2} \\
&= 27.86 \\
\text{M26Y} &= \sqrt{(4-8.37)^2 + (10-13.43)^2} \\
&= 8.36
\end{aligned}$$

$$\begin{aligned}\text{M27Y} &= \sqrt{(6-8.37)^2 + (5-13.43)^2} \\ &= 3.18\end{aligned}$$

$$\begin{aligned}\text{M28Y} &= \sqrt{(2-8.37)^2 + (13-13.43)^2} \\ &= 11.96\end{aligned}$$

$$\begin{aligned}\text{M29Y} &= \sqrt{(4-8.37)^2 + (8-13.43)^2} \\ &= 6.73\end{aligned}$$

$$\begin{aligned}\text{M30Y} &= \sqrt{(6-8.37)^2 + (7-13.43)^2} \\ &= 4.75\end{aligned}$$

$$\begin{aligned}\text{M31Y} &= \sqrt{(2-8.37)^2 + (18-13.43)^2} \\ &= 16.41\end{aligned}$$

$$\begin{aligned}\text{M32Y} &= \sqrt{(4-8.37)^2 + (4-13.43)^2} \\ &= 4.51\end{aligned}$$

$$\begin{aligned}\text{M33Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\ &= 2.53\end{aligned}$$

$$\begin{aligned}\text{M34Y} &= \sqrt{(2-8.37)^2 + (20-13.43)^2} \\ &= 18.27\end{aligned}$$

$$\begin{aligned}\text{M35Y} &= \sqrt{(4-8.37)^2 + (3-13.43)^2} \\ &= 4.37\end{aligned}$$

$$\begin{aligned}\text{M36Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\ &= 2.53\end{aligned}$$

$$\begin{aligned}\text{M37Y} &= \sqrt{(2-8.37)^2 + (15-13.43)^2} \\ &= 13.59\end{aligned}$$

$$\begin{aligned}\text{M38Y} &= \sqrt{(4-8.37)^2 + (3-13.43)^2} \\ &= 4.37\end{aligned}$$

$$\begin{aligned}\text{M39Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\ &= 2,53\end{aligned}$$

$$\begin{aligned}\text{M40Y} &= \sqrt{(2-8.37)^2 + (8-13.43)^2} \\ &= 8,17\end{aligned}$$

$$\begin{aligned}\text{M41Y} &= \sqrt{(4-8.37)^2 + (2-13.43)^2} \\ &= 4.46\end{aligned}$$

$$\begin{aligned}\text{M42Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\ &= 2.53\end{aligned}$$

$$\begin{aligned}\text{M43Y} &= \sqrt{(2-8.37)^2 + (17-13.43)^2} \\ &= 15.49\end{aligned}$$

$$\begin{aligned}\text{M44Y} &= \sqrt{(4-8.37)^2 + (1-13.43)^2} \\ &= 4.75\end{aligned}$$

$$\begin{aligned}\text{M45Y} &= \sqrt{(6-8.37)^2 + (1-13.43)^2} \\ &= 3.02\end{aligned}$$

$$\begin{aligned}\text{M46Y} &= \sqrt{(2-8.37)^2 + (15-13.43)^2} \\ &= 13.69\end{aligned}$$

$$\begin{aligned}\text{M47Y} &= \sqrt{(4-8.37)^2 + (2-13.43)^2} \\ &= 4.46\end{aligned}$$

$$\begin{aligned}\text{M48Y} &= \sqrt{(6-8.37)^2 + (2-13.43)^2} \\ &= 2.53\end{aligned}$$

$$\begin{aligned}\text{M49Y} &= \sqrt{(2-8.37)^2 + (14-13.43)^2} \\ &= 12.82\end{aligned}$$

$$\begin{aligned}\text{M50Y} &= \sqrt{(4-8.37)^2 + (4-13.43)^2} \\ &= 4.51\end{aligned}$$

$$M51Y = \sqrt{(6-8.37)^2 + (2-13.43)^2}$$

$$= 2.53$$

$$M52Y = \sqrt{(2-8.37)^2 + (15-2.87)^2}$$

$$= 13.69$$

$$M53Y = \sqrt{(4-8.37)^2 + (5-2.87)^2}$$

$$= 4.86$$

$$M54Y = \sqrt{(6-8.37)^2 + (3-2.87)^2}$$

$$= 2.37$$

Dari iterasi kedua kali diperoleh hasil berikut :

Tabel IV.2 Hasil Perhitungan dengan iterasi kedua

C1	C2	CLUSTER		C1	C2	CLUSTER
7	0	2		8,526211	18,2731	1
8,246211	15,13275	1		9,107877	4,863769	2
8,944272	15,52417	1		8,555595	3,186887	2
6	1	2		7,782273	17,33944	1
7,28011	14,14214	1		8,1906	5,376453	2
9,848858	16,49242	1		9,542835	2,627975	2
9	2	2		10,14698	20,15952	1
5,385165	12,16553	1		6,43047	6,738416	1
8,944272	15,52417	1		8,555595	3,186887	2
12	5	2		12,78119	23,02512	1
2,828427	5,385165	1		3,778693	12,89016	1
5,656854	11,7047	1		4,661357	6,569342	1
2	5	1		5,659835	13,69877	1
11,18034	18,11077	1		11,93968	4,461642	2
8,062258	14,56022	1		7,571705	3,92508	2
3	4	1		6,013837	14,59131	1
2,828427	5,385165	1		3,778693	12,89016	1
8,944272	15,52417	1		8,555595	3,186887	2
3	10	1		6,432043	9,560662	1
4,472136	11,18034	1		5,611012	7,527035	1
7,211103	13,60147	1		6,592665	4,759858	2
2	5	1		5,659835	13,69877	1
8,246211	15,13275	1		9,107877	4,863769	2
11,7047	18,43909	1		11,52392	2,531057	2
17	10	2		17,43621	27,86407	1
3,605551	10,19804	1		4,859627	8,360996	1
8,944272	15,52417	1		8,555595	3,186887	2
0	7	1		5,456071	11,96479	1
5,385165	12,16553	1		6,43047	6,738416	1
7,211103	13,60147	1		6,592665	4,759858	2
5	2	2		7,101497	16,4136	1
9,219544	16,12452	1		10,04096	4,517328	2
11,7047	18,43909	1		11,52392	2,531057	2
7	0	2		8,526211	18,2731	1
10,19804	17,11724	1		10,98583	4,376785	2
11,7047	18,43909	1		11,52392	2,531057	2
2	5	1		5,659835	13,69877	1
10,19804	17,11724	1		10,98583	4,376785	2
11,7047	18,43909	1		11,52392	2,531057	2
5	12	1		7,688053	8,179624	1
11,18034	18,11077	1		11,93968	4,461642	2
11,7047	18,43909	1		11,52392	2,531057	2
4	3	2		6,503749	15,49698	1
12,16553	19,10497	1		12,90052	4,759858	2
12,64911	19,41649	1		12,51672	3,02593	2
2	5	1		5,659835	13,69877	1
11,180	18,11077	1		11,93968	4,461642	2
11,7047	18,43909	1		11,52392	2,531057	2
1	6	1		5,468201	12,8221	1
9,219544	16,12452	1		10,04096	4,517328	2
11,7047	18,43909	1		11,52392	2,531057	2
2	5	1		5,659835	13,69877	1
8,246211	15,13275	1		9,107877	4,863769	2
10,770	17,46425	1		10,53248	2,378287	2

Karena hasil perhitungan yang kedua belum sama dengan hasil perhitungan awal (belum konvergen) maka dilakukan proses iterasi ke-3 sampai hasil menjadi konvergen atau tidak berubah-ubah. Dari perhitungan tersebut maka diperoleh hasil sebagai berikut :

C1=

(M1,M4,M7,M8,M10,M11,M12,M13,M16,M17,M19,M20,M22,M25,M26,M28,
M29,M31,M34,M37,M40,M43,M46,M49,M52)

C2=

(M2,M3,M5,M6,M9,M14,M15,M18,M21,M23,M24,M27,M30,M32,M33,M35,M
36,M38,M39,M41,M42,M44,M45,M47,M48,M50,M51,M53,M54) }

1. Proses iterasi ke-3 :

Menghitung titik pusat baru

Menentukan posisi Centroid Baru (Ck) dengan cara menghitung nilai rata-rata dari data yang telah ada, yaitu dengan rumus :

$$C_k = \left(\frac{1}{n_k} \right) \sum d_1$$

n_k = Jumlah data dalam Cluster K

$$C1X = \{ (8.52 + 7.78 + 10.14 + 6.43 + 12.78 + 3.77 + 4.66 + 5.65 + 6.01 + 3.77 + 6.43 + 5.61 + 5.65 + 17.43 + 4.85 + 5.45 + 6.43 + 7.10 + 8.52 + 9.69 + 7.68 + 6.90 + 5.65 + 5.46 + 5.65) / 25 \} = \underline{6.94}$$

$$C1Y = \{ (18.28 + 17.33 + 20.15 + 6.73 + 23.02 + 12.89 + 6.56 + 13.69 + 14.59 + 12.89 + 9.56 + 7.52 + 13.69 + 27.86 + 8.36 + 11.96 + 6.73 + 16.41 + 18.27 + 18.69 + 8.17 + 15.49 + 13.69 + 12.82 + 13.69) / 25 \} = \underline{13.76}$$

Maka diperoleh titik pusat cluster baru untuk C1 yaitu : 6.94 & 13.76

Untuk titik pusat baru pada C2 sebagai berikut :

$$C2X = \{(9.10+8.55+8.19+9.54+8.55+11.93+7.57+8.55+6.59+9.10+11.52+8.55+6.59+10.04+11.52+10.98+11.52+10.98+11.52+11.93+11.52+12.90+12.51+11.93+11.52+10.04+11.52+9.10+10.53) / 29\} = \underline{10.15}$$

$$C2Y = \{(4.86+3.18+5.37+2.62+3.18+4.46+3.92+3.18+4.75+4.86+2.53+3.18+4.75+4.51+2.53+4.37+2.53+4.37+2.53+4.46+2.53+4.75+3.02+4.46+2.53+4.51+2.53+4.86+2.37) / 29\} = \underline{3.71}$$

Maka diperoleh titik pusat cluster baru untuk C2 yaitu : 10.15 & 3.71

Sehingga dapat disimpulkan dengan titik pusat atau centroid baru :

$$C1 = (\underline{6.94}), (13.76) \text{ dan } C2 = (10.15), (3.71)$$

2. Melakukan Kembali perhitungan dengan pusat kluster yang baru

$$\begin{aligned} M1X &= \sqrt{(2-6.94)^2 + (20-13.76)^2} \\ &= 7.95 \end{aligned}$$

$$\begin{aligned} M2X &= \sqrt{(4-6.94)^2 + (5-13.76)^2} \\ &= 9.24 \end{aligned}$$

$$\begin{aligned} M3X &= \sqrt{(6-6.94)^2 + (5-13.76)^2} \\ &= 8.81 \end{aligned}$$

$$\begin{aligned} M4X &= \sqrt{(2-6.94)^2 + (19-13.76)^2} \\ &= 7.20 \end{aligned}$$

$$\begin{aligned} M5X &= \sqrt{(4-26.4)^2 + (6-13.76)^2} \\ &= 8.30 \end{aligned}$$

$$M6X = \sqrt{(6-6.94)^2 + (4-13.76)^2}$$

$$\begin{aligned}
&= 9.81 \\
\text{M7X} &= \sqrt{(2-6.94)^2 + (22-13.76)^2} \\
&= 9.60 \\
\text{M8X} &= \sqrt{(4-6.94)^2 + (8-13.76)^2} \\
&= 6.47 \\
\text{M9X} &= \sqrt{(6-6.94)^2 + (5-13.76)^2} \\
&= 8.81 \\
\text{M10X} &= \sqrt{(2-6.94)^2 + (25-13.76)^2} \\
&= 12.27 \\
\text{M11X} &= \sqrt{(4-6.94)^2 + (15-13.76)^2} \\
&= 3.19 \\
\text{M12X} &= \sqrt{(6-6.94)^2 + (9-13.76)^2} \\
&= 4.86 \\
\text{M13X} &= \sqrt{(2-6.94)^2 + (15-13.76)^2} \\
&= 5.09 \\
\text{M14X} &= \sqrt{(4-6.94)^2 + (2-13.76)^2} \\
&= 12.13 \\
\text{M15X} &= \sqrt{(6-6.94)^2 + (6-13.76)^2} \\
&= 7.82 \\
\text{M16X} &= \sqrt{(2-6.94)^2 + (16-13.76)^2} \\
&= 5.42 \\
\text{M17X} &= \sqrt{(4-6.94)^2 + (15-13.76)^2} \\
&= 3.19 \\
\text{M18X} &= \sqrt{(6-6.94)^2 + (5-13.76)^2}
\end{aligned}$$

$$\begin{aligned}
&= 8.81 \\
\text{M19X} &= \sqrt{(2-6.94)^2 + (10-13.76)^2} \\
&= 6.21 \\
\text{M20X} &= \sqrt{(4-6.94)^2 + (9-13.76)^2} \\
&= 5.60 \\
\text{M21X} &= \sqrt{(6-6.94)^2 + (7-13.76)^2} \\
&= 6.83 \\
\text{M22X} &= \sqrt{(2-6.94)^2 + (15-13.76)^2} \\
&= 5.09 \\
\text{M23X} &= \sqrt{(4-6.94)^2 + (5-13.76)^2} \\
&= 9.24 \\
\text{M24X} &= \sqrt{(6-6.94)^2 + (2-13.76)^2} \\
&= 11.80 \\
\text{M25X} &= \sqrt{(2-6.)^2 + (30-13.76)^2} \\
&= 16.97 \\
\text{M26X} &= \sqrt{(4-6.94)^2 + (10-13.76)^2} \\
&= 4.78 \\
\text{M27X} &= \sqrt{(6-6.94)^2 + (5-13.76)^2} \\
&= 8.81 \\
\text{M28X} &= \sqrt{(2-6.94)^2 + (13-13.76)^2} \\
&= 5 \\
\text{M29X} &= \sqrt{(4-6.94)^2 + (8-13.76)^2} \\
&= 6.47 \\
\text{M30X} &= \sqrt{(6-6.94)^2 + (7-13.76)^2}
\end{aligned}$$

$$\begin{aligned}
&= 6.83 \\
\text{M31X} &= \sqrt{(2-6.94)^2 + (18-13.76)^2} \\
&= 6.51 \\
\text{M32X} &= \sqrt{(4-6.94)^2 + (4-13.76)^2} \\
&= 10.20 \\
\text{M33X} &= \sqrt{(6-6.94)^2 + (2-13.76)^2} \\
&= 11.80 \\
\text{M34X} &= \sqrt{(2-6.94)^2 + (20-13.76)^2} \\
&= 7.95 \\
\text{M35X} &= \sqrt{(4-6.94)^2 + (3-13.76)^2} \\
&= 11.16 \\
\text{M36X} &= \sqrt{(6-6.94)^2 + (2-13.76)^2} \\
&= 11.80 \\
\text{M37X} &= \sqrt{(2-6.94)^2 + (15-13.76)^2} \\
&= 5.09 \\
\text{M38X} &= \sqrt{(4-6.94)^2 + (3-13.76)^2} \\
&= 11.16 \\
\text{M39X} &= \sqrt{(6-6.94)^2 + (2-13.76)^2} \\
&= 11.80 \\
\text{M40X} &= \sqrt{(2-6.94)^2 + (8-13.76)^2} \\
&= 7.59 \\
\text{M41X} &= \sqrt{(4-6.94)^2 + (2-13.76)^2} \\
&= 12.13 \\
\text{M42X} &= \sqrt{(6-6.94)^2 + (2-13.76)^2}
\end{aligned}$$

$$= 11.80$$

$$\text{M43X} = \sqrt{(2-6.94)^2 + (17-13.76)^2}$$

$$= 5.91$$

$$\text{M44X} = \sqrt{(4-6.94)^2 + (1-13.76)^2}$$

$$= 13.10$$

$$\text{M45X} = \sqrt{(6-6.94)^2 + (1-13.76)^2}$$

$$= 12.80$$

$$\text{M46X} = \sqrt{(2-6.94)^2 + (15-13.76)^2}$$

$$= 5.09$$

$$\text{M47X} = \sqrt{(4-6.94)^2 + (2-13.76)^2}$$

$$= 12.13$$

$$\text{M48X} = \sqrt{(6-6.94)^2 + (2-13.76)^2}$$

$$= 11.80$$

$$\text{M49X} = \sqrt{(2-6.94)^2 + (14-13.76)^2}$$

$$= 4.95$$

$$\text{M50X} = \sqrt{(4-6.94)^2 + (4-13.76)^2}$$

$$= 10.20$$

$$\text{M51X} = \sqrt{(6-6.94)^2 + (2-13.76)^2}$$

$$= 11.80$$

$$\text{M52X} = \sqrt{(2-6.94)^2 + (15-13.76)^2}$$

$$= 5.09$$

$$\text{M53X} = \sqrt{(4-6.94)^2 + (5-13.76)^2}$$

$$= 9.24$$

$$\text{M54X} = \sqrt{(6-6.94)^2 + (3-13.76)^2}$$

$$\begin{aligned}
&= 10.80 \\
\text{M1Y} &= \sqrt{(2-10.15)^2 + (20-3.71)^2} \\
&= 18.21 \\
\text{M2Y} &= \sqrt{(4-10.15)^2 + (5-3.71)^2} \\
&= 6.28 \\
\text{M3Y} &= \sqrt{(6-10.15)^2 + (5-3.71)^2} \\
&= 4.34 \\
\text{M4Y} &= \sqrt{(2-10.15)^2 + (19-3.71)^2} \\
&= 17.32 \\
\text{M5Y} &= \sqrt{(4-10.15)^2 + (6-3.71)^2} \\
&= 6.56 \\
\text{M6Y} &= \sqrt{(6-10.15)^2 + (4-3.71)^2} \\
&= 4.16 \\
\text{M7Y} &= \sqrt{(2-10.15)^2 + (22-3.71)^2} \\
&= 20 \\
\text{M8Y} &= \sqrt{(4-10.15)^2 + (8-3.71)^2} \\
&= 7.49 \\
\text{M9Y} &= \sqrt{(6-10.15)^2 + (5-3.71)^2} \\
&= 4.34 \\
\text{M10Y} &= \sqrt{(2-10.15)^2 + (25-3.71)^2} \\
&= 22.79 \\
\text{M11Y} &= \sqrt{(4-10.15)^2 + (15-3.71)^2} \\
&= 12.85 \\
\text{M12Y} &= \sqrt{(6-10.15)^2 + (9-3.71)^2}
\end{aligned}$$

$$\begin{aligned}
&= \\
\text{M13Y} &= \sqrt{(2-10.15)^2 + (15-3.71)^2} \\
&= 13.92 \\
\text{M14Y} &= \sqrt{(4-10.15)^2 + (2-3.71)^2} \\
&= 6.39 \\
\text{M15Y} &= \sqrt{(6-10.15)^2 + (6-3.71)^2} \\
&= 4.74 \\
\text{M16Y} &= \sqrt{(2-10.15)^2 + (16-3.71)^2} \\
&= 14.74 \\
\text{M17Y} &= \sqrt{(4-10.15)^2 + (15-3.71)^2} \\
&= 12.85 \\
\text{M18Y} &= \sqrt{(6-10.15)^2 + (5-3.71)^2} \\
&= 4.34 \\
\text{M19Y} &= \sqrt{(2-10.15)^2 + (10-3.71)^2} \\
&= 10.29 \\
\text{M20Y} &= \sqrt{(4-10.15)^2 + (9-3.71)^2} \\
&= 8.11 \\
\text{M21Y} &= \sqrt{(6-10.15)^2 + (7-3.71)^2} \\
&= 5.29 \\
\text{M22Y} &= \sqrt{(2-10.15)^2 + (15-3.71)^2} \\
&= 13.92 \\
\text{M23Y} &= \sqrt{(4-10.15)^2 + (5-3.71)^2} \\
&= 6.28 \\
\text{M24Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2}
\end{aligned}$$

$$\begin{aligned}
&= 4.49 \\
\text{M25Y} &= \sqrt{(2-10.15)^2 + (30-3.71)^2} \\
&= 27.51 \\
\text{M26Y} &= \sqrt{(4-10.15)^2 + (10-3.71)^2} \\
&= 8.79 \\
\text{M27Y} &= \sqrt{(6-10.15)^2 + (5-3.71)^2} \\
&= 4.34 \\
\text{M28Y} &= \sqrt{(2-10.15)^2 + (13-3.71)^2} \\
&= 12.35 \\
\text{M29Y} &= \sqrt{(4-10.15)^2 + (8-3.71)^2} \\
&= 7.49 \\
\text{M30Y} &= \sqrt{(6-10.15)^2 + (7-3.71)^2} \\
&= 5.29 \\
\text{M31Y} &= \sqrt{(2-10.15)^2 + (18-3.71)^2} \\
&= 16.44 \\
\text{M32Y} &= \sqrt{(4-10.15)^2 + (4-3.71)^2} \\
&= 6.16 \\
\text{M33Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2} \\
&= 4.49 \\
\text{M34Y} &= \sqrt{(2-10.15)^2 + (20-3.71)^2} \\
&= 18.21 \\
\text{M35Y} &= \sqrt{(4-10.15)^2 + (3-3.71)^2} \\
&= 6.19 \\
\text{M36Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2}
\end{aligned}$$

$$\begin{aligned}
&= 4.49 \\
\text{M37Y} &= \sqrt{(2-10.15)^2 + (15-3.71)^2} \\
&= 13.92 \\
\text{M38Y} &= \sqrt{(4-10.15)^2 + (3-3.71)^2} \\
&= 6.19 \\
\text{M39Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2} \\
&= 4.49 \\
\text{M40Y} &= \sqrt{(2-10.15)^2 + (8-3.71)^2} \\
&= 9.21 \\
\text{M41Y} &= \sqrt{(4-10.15)^2 + (2-3.71)^2} \\
&= 6.39 \\
\text{M42Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2} \\
&= 4.49 \\
\text{M43Y} &= \sqrt{(2-10.15)^2 + (17-3.71)^2} \\
&= 15.58 \\
\text{M44Y} &= \sqrt{(4-10.15)^2 + (1-3.71)^2} \\
&= 6.72 \\
\text{M45Y} &= \sqrt{(6-10.15)^2 + (1-3.71)^2} \\
&= 4.96 \\
\text{M46Y} &= \sqrt{(2-10.15)^2 + (15-3.71)^2} \\
&= 13.92 \\
\text{M47Y} &= \sqrt{(4-10.15)^2 + (2-3.71)^2} \\
&= 6.39 \\
\text{M48Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2}
\end{aligned}$$

$$\begin{aligned}
&= 4.49 \\
\text{M49Y} &= \sqrt{(2-10.15)^2 + (14-3.71)^2} \\
&= 13.13 \\
\text{M50Y} &= \sqrt{(4-10.15)^2 + (4-3.71)^2} \\
&= 6.16 \\
\text{M51Y} &= \sqrt{(6-10.15)^2 + (2-3.71)^2} \\
&= 4.49 \\
\text{M52Y} &= \sqrt{(2-10.15)^2 + (15-3.71)^2} \\
&= 13.92 \\
\text{M53Y} &= \sqrt{(4-10.15)^2 + (5-3.71)^2} \\
&= 6,28 \\
\text{M54Y} &= \sqrt{(6-10.15)^2 + (3-3.71)^2} \\
&= 4.21
\end{aligned}$$

Sehingga diperoleh hasil sebagai berikut

Tabel IV.3. Hasil Perhitungan dengan iterasi ketiga

C1	C2	CLUSTER		C1	C2	CLUSTER
8,526211	18,2731	1		7,958603	18,20994	1
9,107877	4,863769	2		9,249409	6,288003	2
8,555595	3,186887	2		8,81803	4,3491	2
7,782273	17,33944	1		7,202298	17,32164	1
8,1906	5,376453	2		8,307697	6,565177	2
9,542835	2,627975	2		9,812818	4,165585	2
10,14698	20,15952	1		9,605825	20,01817	1
6,43047	6,738416	1		6,476909	7,498446	1
8,555595	3,186887	2		8,81803	4,3491	2
12,78119	23,02512	1		12,2748	22,79067	1
3,778693	12,89016	1		3,195958	12,85164	1
4,661357	6,569342	1		4,860317	6,720488	1
5,659835	13,69877	1		5,099811	13,92081	1
11,93968	4,461642	2		12,13066	6,391499	2
7,571705	3,92508	2		7,824571	4,741017	2
6,013837	14,59131	1		5,429027	14,74285	1
3,778693	12,89016	1		3,195958	12,85164	1
8,555595	3,186887	2		8,81803	4,3491	2
6,432043	9,560662	1		6,219066	10,29447	1
5,611012	7,527035	1		5,605052	8,111058	1
6,592665	4,759858	2		6,83302	5,295263	2
5,659835	13,69877	1		5,099811	13,92081	1
9,107877	4,863769	2		9,249409	6,288003	2
11,52392	2,531057	2		11,80504	4,497439	2
17,43621	27,86407	1		16,97062	27,51777	1
4,859627	8,360996	1		4,783603	8,794989	1
8,555595	3,186887	2		8,81803	4,3491	2
5,456071	11,96479	1		5,00755	12,35572	1
6,43047	6,738416	1		6,476909	7,498446	1
6,592665	4,759858	2		6,83302	5,295263	2
7,101497	16,4136	1		6,512054	16,44618	1
10,04096	4,517328	2		10,20222	6,1625	2
11,52392	2,531057	2		11,80504	4,497439	2
8,526211	18,2731	1		7,958603	18,20994	1
10,98583	4,376785	2		11,16329	6,197889	2
11,52392	2,531057	2		11,80504	4,497439	2
5,659835	13,69877	1		5,099811	13,92081	1
10,98583	4,376785	2		11,16329	6,197889	2
11,52392	2,531057	2		11,80504	4,497439	2
7,688053	8,179624	1		7,598965	9,21146	1
11,93968	4,461642	2		12,13066	6,391499	2
11,52392	2,531057	2		11,80504	4,497439	2
6,503749	15,49698	1		5,911056	15,5857	1
12,90052	4,759858	2		13,10292	6,729687	2
12,51672	3,02593	2		12,80206	4,966325	2
5,659835	13,69877	1		5,099811	13,92081	1
11,93968	4,461642	2		12,13066	6,391499	2
11,52392	2,531057	2		11,80504	4,497439	2
5,468201	12,8221	1		4,95397	13,12351	1
10,04096	4,517328	2		10,20222	6,1625	2
11,52392	2,531057	2		11,80504	4,497439	2
5,659835	13,69877	1		5,099811	13,92081	1
9,107877	4,863769	2		9,249409	6,288003	2
10,53248	2,378287	2		10,80857	4,217763	2

Dari hasil perhitungan yang dilakukan, maka dengan melakukan tiga kali proses iterasi maka hasil dari data sudah konvergen dan tidak berubah kelompok klusternya.

Adapun tahapan analisa menggunakan aplikasi weka dapat dilihat pada tabel diatas dan hasil dapat kita lihat sebagai berikut :

1. Ubah dataset kedalam excel.csv agar dapat terbaca di aplikasi weka dapat dilihat pada gambar dibawah ini :

No.	Nama Laptop	Spesifikasi	RAM	Jumlah Pemakai
1	Toshiba	"i3", "2", "20"		
2	Toshiba	"i3", "4", "5"		
3	Toshiba	"i3", "6", "5"		
4	Toshiba	"i5", "2", "15"		
5	Toshiba	"i5", "4", "6"		
6	Toshiba	"i5", "6", "4"		
7	Toshiba	"dual core", "2", "22"		
8	Toshiba	"dual core", "4", "8"		
9	Toshiba	"dual core", "6", "5"		
10	Acer	"i3", "2", "25"		
11	Acer	"i3", "4", "15"		
12	Acer	"i3", "6", "9"		
13	Acer	"i5", "2", "15"		
14	Acer	"i5", "4", "2"		
15	Acer	"i5", "6", "6"		
16	Acer	"dual core", "2", "16"		
17	Acer	"dual core", "4", "15"		
18	Acer	"dual core", "6", "5"		
19	Asus	"i3", "2", "10"		
20	Asus	"i3", "4", "9"		
21	Asus	"i3", "6", "7"		
22	Asus	"i5", "2", "15"		
23	Asus	"i5", "4", "5"		

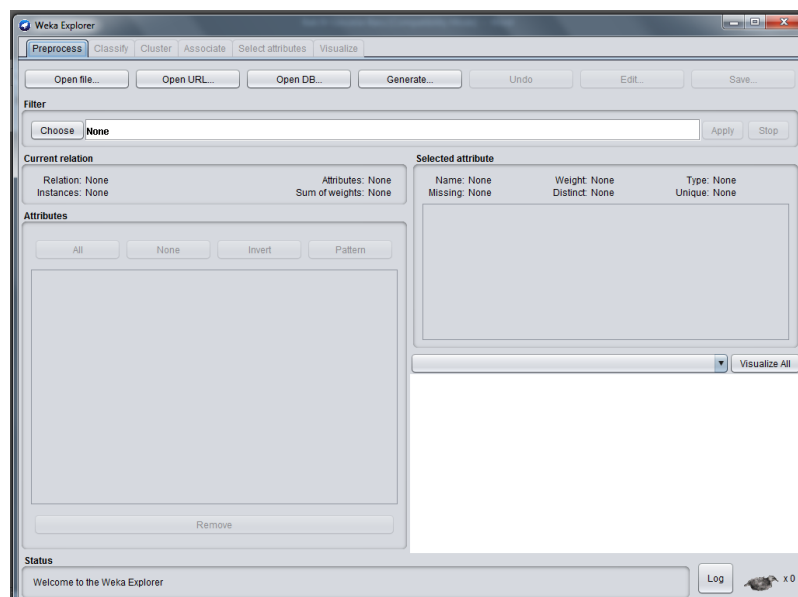
Gambar IV.1. Dataset Data Laptop

2. Jalankan aplikasi weka



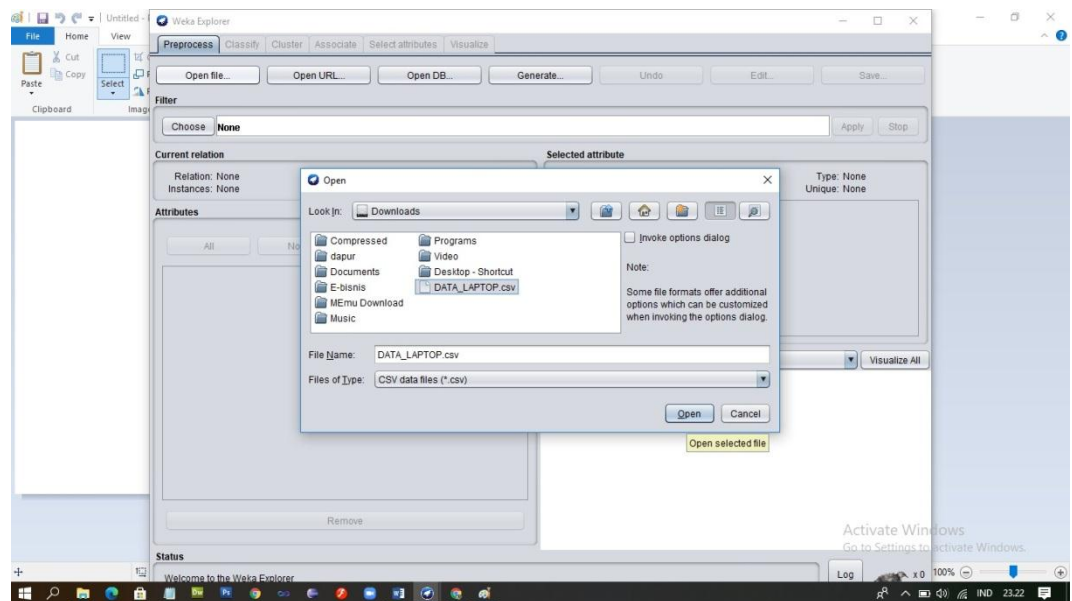
Gambar IV.2. Tampilan Utama Weka

3. Pada aplikasi weka pilih explorer



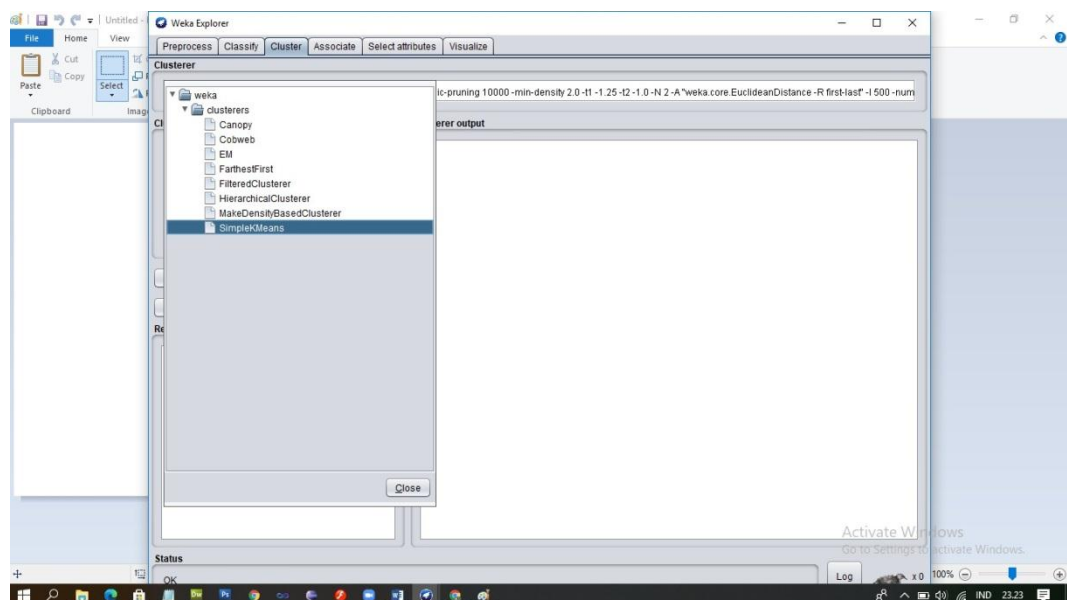
Gambar IV.3. Tampilan Explore Weka

4. Pada aplikasi weka, Open File. Berikut tampilan dari Open File lalu pilih data dengan format .csv pada folder.

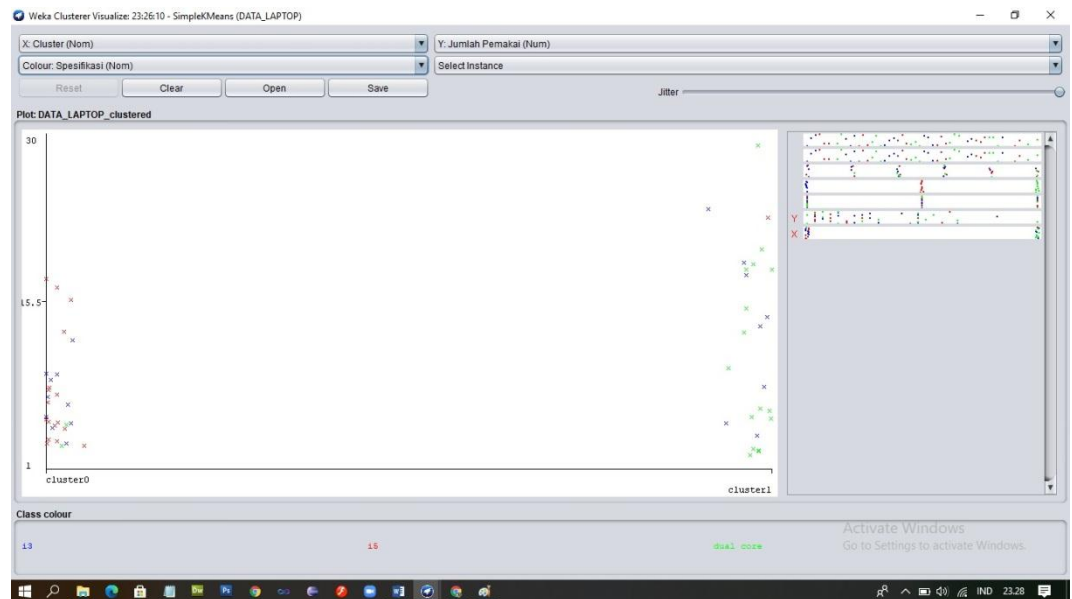


Gambar IV.4. Tampilan File .csv

5. Pilih cluster, untuk memilih metode yang digunakan choose – lazy – Simple K-Means, kemudian atur nilai K-Means menjadi 2



Gambar IV.5. Tampilan pemilihan metode



Gambar IV.8. Tampilan grafik penyebaran *cluster*

IV.4. Hasil Analisa Weka

Adapun hasil dari analisis data dengan menggunakan Weka Dapat diketahui bahwa pada Cluster 1 terdapat 29 anggota dari 54 data atau dengan jumlah sebanyak 54% dengan merek laptop dan spesifikasi yang memiliki kemiripan antara data yang satu dengan data yang lain. Pada Cluster 2 terdapat 25 anggota dari 54 atau dengan jumlah 46% data yang dikelompokkan sesuai dengan perhitungan yang telah diterapkan dengan cara mengelompokkan menggunakan metode *K-Means*.