k Mean Cluster Vishnu Vardhan

Shopper	Spending Index	Income Index
4	2	6
2	3	4
1	3	5
5	4	5
3	5	6
9	5	6
7	6	2
8	6	3
10	6	7
6	6	8
11	7	2
14	8	2
17	8	3
12	8	5
13	9	1
16	9	1

$P_2 (3,4)$, $P_{16} (9,1)$

Cluster 1 (C_1)	Cluster 2 (C_2)

centroid $(3,4)$ $(9,1)$

$P_4 \left(2,6\right)$, $P̶̶̶(̶9̶,̶1̶)̶$

$$D_1 = \sqrt{(3-2)^2 + (4-6)^2} = \sqrt{1+4} = \sqrt{5}$$

$$D_2 = \sqrt{(9-2)^2 + (1-6)^2} = \sqrt{49+25} = \sqrt{74}$$

$$\text{centroid} = \left(\frac{3+2}{2}, \frac{6+4}{2}\right) = (2.5, 5)$$

C_1	C_2

centroid $(2.5, 5)$ $(9,1)$

$P_1 (3, 5)$

$$D_1 = \sqrt{(2.5-3)^2 + (5-5)^2} = \sqrt{0.25} = 0.5$$

$$D_2 = \sqrt{(9-3)^2 + (1-5)^2} = \sqrt{36+16} = \sqrt{52}$$

centroid $(2.75, 5)$

C_1

C_2

$(2.75, 5)$

$(9, 1)$

$P_5 (4, 5)$

$$D_1 = \sqrt{(2.75 \dot{=} 4)^2 + (5-5)^2} = \boxed{1.25}$$

$$D_2 = \sqrt{(9-4)^2 + (1-5)^2} = \sqrt{25+16} = \sqrt{41}$$

Centroid $= (3.375, 5)$

C_1

C_2

Centroid $(3.29, 5)$

$(9, 1)$

$P_3 (5, 6)$

$$D_1 = \sqrt{(3.4-5)^2 + (5-6)^2} = \sqrt{(1.6)^2 + 1} = 1.88$$

$$P_2 = \sqrt{16 + 25} = \sqrt{41}$$

Centroid $= (4.\dot{8}, 5.5)$

C_1 C_2

Centroid $(4.2, 5.5)$ $(5.9, 1)$

$P_a (5, 6)$

$$D_1 = \sqrt{(4.2-5)^2 + (5.5-6)^2} = \sqrt{0.64 + 0.25}$$
$$= \sqrt{0.89}$$

$$D_2 = \sqrt{(16) + (25)} = \sqrt{41}$$

Centroid $= (4.6, 5.7)$

C_1 C_2

Centroid $(4.6, 5.7)$ $(9, 1)$

$P_a (6, 2)$

$$D_1 = \sqrt{(4.6-6)^2 + (5.7-2)^2} = \sqrt{15.65}$$
$$= 3.95$$

$$D_2 = \sqrt{9+1} = \sqrt{10} = 3.16$$

Centroid $= (7.5, 1.5)$

$$C_1 \qquad\qquad\qquad C_2$$

Centroid. $(4.6, 5.7)$ $\qquad\qquad (7.5, 1.5)$

$P_8(6, 3)$

$$D_1 = \sqrt{(4.6-6)^2 + (5.7-3)^2} = \cancel{\ } \ 3.04$$

$$D_2 = \sqrt{(7.5-6)^2 + (1.5-3)^2} = 2.12$$

Centroid $= \ (6.75, \ 2.25)$

$$C_1 \qquad\qquad\qquad C_2$$

Centroid $(4.6, 5.7)$ $\qquad\qquad (6.75, 2.25)$

$P_{10}(6, 7)$

$$D_1 = \sqrt{(4.6-6)^2 + (5.7-7)^2} = \cancel{\ } \ \cancel{\ } = 1.91$$

$$D_2 = \sqrt{(6.7-6)^2 + (2.25-7)^2} = 4.80$$

Centroid $= (5.3, \ 6.35)$

$$C_1 \qquad\qquad C_2$$

Centroid $(5.3, 6.3) \qquad (6.7, 2.2)$

$P_6 (6, 8)$

$$D_1 = \sqrt{(5.3-6)^2 + (6.3-8)^2} = 1.88$$

$$D_2 = \sqrt{(6.7-6)^2 + (2.2-8)^2} = 5.8$$

Centroid $(5.65, 7.15)$

$$C_1 \qquad\qquad C_2$$

Centroid $(5.68, 7.1) \qquad (6.7, 2.2)$

$P_{61} (8, 2)$

$$D_1 = \sqrt{(5.68)^2 + (7.1-2)^2} = 5.28$$

$$D_2 = \sqrt{(6.7-8)^2 + (2.2-2)^2} = 1.18$$

Centroid $= (6.85, 2.2)$

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C_1 $\qquad$ C_2

Centroid $(5.6, 7.1)$ $\qquad$ $(6.8, 2.2)$

$P_{14}(8, 2)$

$$D_1 = \sqrt{(5.6-8)^2 + (7.1-2)^2} = 5.63$$

$$D_2 = \sqrt{(6.8-8)^2 + (2.2-2)^2} = 1.34$$

Centroid $= (7.4, 2.1)$

C_1 $\qquad$ C_2

Centroid $(5.6, 7.1)$ $\qquad$ $(7.4, 2.1)$

$P_{17}(8, 3)$

$$D_1 = \sqrt{(5.6-8)^2 + (7.1-3)^2} = 4.75$$

$$D_2 = \sqrt{(7.4-8)^2 + (2.1-3)^2} = 1.08$$

Centroid $= (7.7, 2.55)$

$$C_1$$
Centroid $(5.6, 7.1)$

$$C_2$$
$(7.7, 2.5)$

$$P_{12} \quad (8, 5)$$

$$D_1 = \sqrt{(5.6-8)^2 + (7.1-5)^2} = 3.18$$

$$D_2 = \sqrt{(7.7-8)^2 + (2.5-5)^2} = 1.07$$

$$\text{Centroid} = (7.8, 3.7)$$

$$C_1$$
Centroid $(5.6, 7.1)$

$$C_2$$
$(7.8, 3.7)$

$$P_{13} (9, 1)$$

$$D_1 = \sqrt{(5.6-9)^2 + (7.1-1)^2} = 6.98$$

$$D_2 = \sqrt{(7.8-9)^2 + (3.7-1)^2} = 2.08$$

$$\text{Catroid} = (8.4, 2.39)$$

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$$C_1$$
$$\text{Centroid} \left(5.6, 7.1\right)$$

$$C_2$$
$$\left(8.4, 2.3\right)$$

$$P_{15} \left(9, 6\right)$$

$$D_1 = \sqrt{\left(5.6-9\right)^2 + \left(7.1-6\right)^2} = 3.5$$

$$D_2 = \sqrt{\left(8.4-9\right)^2 + \left(2.3-6\right)^2} = 0.92$$

$$P_{15} \text{ is in } C_2^*$$

cluster 1	cluster 2
shopper points	$P_2, P_4, P_1, P_5, P_3,$	$P_{16}, P_8, P_{11}, P_{14},$
	P_{10}, P_6	$P_{17}, P_{12}, P_{13}, P_{15},$
		P_7

cluster 1

1, 2, 3, 4, 5, 6, 10

cluster 2

7, 8, 11, 12, 13, 14,
15, 16, 17