

Assignment - 5

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Q] Use the K-means Algo and Euclidean distance to cluster the following 8 examples into 3 clusters.

$$A_1 = (1, 9) \quad A_2 = (1, 4) \quad A_3 = (7, 3) \quad A_4 = (4, 7), \quad A_5 = (6, 4)$$

$$A_6 = (5, 3), \quad A_7 = (0, 1) \quad A_8 = (3, 8)$$

Suppose that the initial seeds are A_1, A_4 and A_7 , Run the K-means Algo. for 1 epoch only. At the end of this epoch show:

a - The new clusters.

$$\text{seed 1} = A_1 = (1, 9)$$

$$\text{seed 2} = A_4 = (4, 7)$$

$$\text{seed 3} = A_7 = (0, 1)$$

$$A_1 : d(A_1, \text{seed 1}) = 0$$

$$d(A_1, \text{seed 2}) = \sqrt{13} > 0 = 3.6$$

$$d(A_1, \text{seed 3}) = \sqrt{65} > 0 = 8.06$$

$$A_1 \in C_1$$

$$A_2 : d(A_2, \text{seed 1}) = \sqrt{25} = 5$$

$$d(A_2, \text{seed 2}) = \sqrt{18} = 4.24$$

$$d(A_2, \text{seed 3}) = \sqrt{10} = 3.16$$

$$A_2 \in C_1$$

$$\underline{A_3} : d(A_3, \text{Seed 1}) = \sqrt{72} = 8.48$$

$$d(A_3, \text{Seed 2}) = \sqrt{25} = 5$$

$$d(A_3, \text{Seed 3}) = \sqrt{53} = 7.28$$

$$A_3 \in C_2$$

$$\underline{A_4} : d(A_4, \text{Seed 1}) = \sqrt{13} = 3.60$$

$$d(A_4, \text{Seed 2}) = \sqrt{13} = 3.60$$

$$d(A_4, \text{Seed 3}) = \sqrt{13} = 3.60$$

$$A_4 \in C_1$$

$$\underline{A_5} : d(A_5, \text{Seed 1}) = \sqrt{50} = 7.07$$

$$d(A_5, \text{Seed 2}) = \sqrt{13} = 3.60$$

$$d(A_5, \text{Seed 3}) = \sqrt{45} = 6.70$$

$$A_5 \in C_1$$

$$\underline{A_6} : d(A_6, \text{Seed 1}) = \sqrt{52} = 7.21$$

$$d(A_6, \text{Seed 2}) = \sqrt{17} = 4.12$$

$$d(A_6, \text{Seed 3}) = \sqrt{29} = 5.38$$

$$A_6 \in C_2$$

$$\underline{A_7} : d(A_7, \text{Seed 1}) = \sqrt{65} = 8.06$$

$$d(A_7, \text{Seed 2}) = \sqrt{45} = 6.70$$

$$d(A_7, \text{Seed 3}) = 0$$

$$A_7 \in C_3$$

$$\underline{A_8} : d(A_8, \text{Seed 1}) = \sqrt{5} = 2.23$$

$$d(A_8, \text{Seed 2}) = \sqrt{2} = 1.41$$

$$d(A_8, \text{Seed 3}) = \sqrt{58} = 7.61$$

$$A_8 \in C_3$$

hence the new clusters are

$$C_1 = \{A_1, A_2, A_4, A_5, A_8\}$$

$$C_2 = \{A_3, A_6\}$$

$$C_3 = \{A_7\}$$

b - The Centres of the new clusters.

$$C_1 = \{A_1, A_2, A_4, A_5, A_8\}$$

$$\begin{aligned} C_1 &= \left\{ (1+1+4+6+3)/5, (9+4+7+4+8)/5 \right\} \\ &= (3, 32/5) \\ &= (3, 6.4) \end{aligned}$$

$$C_2 = \{A_3, A_6\}$$

$$\begin{aligned} &= ((7+5)/2, (3+3)/2) \\ &= (6, 3) \end{aligned}$$

$$C_3 = (0, 1)$$

c) Draw a 10 by 10 space with all 8 points and show the clusters after the first epoch and new centroids

