

.1 Clustering 3

Student Said

For points (1, 2), (1, 3), (2, 3), (2, 4), (4, 6), (5, 6), (6, 6), (6, 8), (7, 7) Using manhattan distance, find the distance of each point from both of these centroids $u_1 = (2, 8)$, $u_2 = (8, 1)$

Tutor Said:

Manhattan Distances

Point	Distance to u_1 (2,8)	Distance to u_2 (8,1)
(1, 2)	7	8
(1, 3)	6	9
(2, 3)	5	8
(2, 4)	4	9
(4, 6)	4	9
(5, 6)	5	8
(6, 6)	6	7

I've calculated the Manhattan distances of each point from the centroids $u_1 = (2, 8)$ and $u_2 = (8, 1)$. You can review the table for the complete results. Let me know if you need further analysis!

Student Said-1

assign each point to the cluster whose centroid is closer to the point

Tutor Said:

Cluster Assignments

Point	Distance to u_1 (2,8)	Distance to u_2 (8,1)	Cluster Assignment
(1, 2)	7	8	u_1 (2,8)
(1, 3)	6	9	u_1 (2,8)
(2, 3)	5	8	u_1 (2,8)
(2, 4)	4	9	u_1 (2,8)
(4, 6)	4	9	u_1 (2,8)
(5, 6)	5	8	u_1 (2,8)
(6, 6)	6	7	u_1 (2,8)

I've assigned each point to the cluster whose centroid is closer based on the Manhattan distance. You can review the updated table for the full results. Let me know if you need any further modifications or analysis!

Student Said-2

find the new centroids using the mean of the points assigned to each cluster

Tutor Said:

The new centroid for cluster u_1 is approximately $(3.78, 5.0)$. However, no points were assigned to cluster u_2 , meaning its centroid remains undefined. Let me know if you would like to adjust the initial centroids or reassign points differently!

Student Said-3

Show the work for finding u_1 . If no points are assigned to a cluster, a new point is randomly assigned for that centroid.

Tutor Said:

step-by-step-calculation-for- u_1

Step-by-Step Calculation for u_1 : Step-by-Step Calculation for $u_{\{1\}}$:

1. **Summing up x-coordinates** of points assigned to u_1 :

$$1 + 1 + 2 + 2 + 4 + 5 + 6 + 6 + 7 = 34$$

$$1+1+2+2+4+5+6+6+7=34$$

2. **Summing up y-coordinates** of points assigned to u_1 :

$$2 + 3 + 3 + 4 + 6 + 6 + 6 + 8 + 7 = 45$$

$$2+3+3+4+6+6+6+8+7=45$$

3. **Total number of points assigned to u_1 :**

$$9$$

$$9$$

4. **Computing new centroid u_1 :**

$$\left(\frac{34}{9}, \frac{45}{9} \right) = (3.78, 5.0)$$

$$(934, 945) = (3.78, 5.0)$$

handling- u_2

Handling u_2 : Handling u_{-2} :

Since no points were assigned to u_2 , a random point was assigned as its new centroid. The randomly chosen point is **(7,7)**.

Thus, the new centroids are:

- $u_1 = (3.78, 5.0)$
- $u_2 = (7, 7)$

Let me know if you need any adjustments or further iterations!

Student Said-4

Find the distance of each point from the new centroids and assign to the cluster with centroid closest to the point

Tutor Said:

Updated Cluster Assignments

Point	Distance to new u_1 (3.78,5.0)	Distance to new u_2 (7,7)	Cluster Assignment
(1, 2)	5.779999999999999	11	u_1 (3.78,5.0)
(1, 3)	4.779999999999999	10	u_1 (3.78,5.0)
(2, 3)	3.78	9	u_1 (3.78,5.0)
(2, 4)	2.78	8	u_1 (3.78,5.0)
(4, 6)	1.2200000000000002	4	u_1 (3.78,5.0)
(5, 6)	2.22	3	u_1 (3.78,5.0)
(6, 6)	3.22	2	u_2 (7,7)

I've recalculated the Manhattan distances for each point from the new centroids and reassigned the clusters accordingly. You can review the updated table for the full results. Let me know if you need further iterations or analysis!

Student Said-5

find the new centroids using the mean of the points assigned to each cluster. Show work

Tutor Said:

step-by-step-calculation-for-the-new-centroids

Step-by-Step Calculation for the New Centroids:

for- u_1u_1 – cluster – with – centroid – 3.785.03.785.0

1. **Summing up x-coordinates** of points assigned to u_1u_1 :

$$1 + 1 + 2 + 2 + 4 + 5 = 15$$

$$1+1+2+2+4+5=15$$

2. **Summing up y-coordinates** of points assigned to u_1u_1 :

$$2 + 3 + 3 + 4 + 6 + 6 = 24$$

$$2+3+3+4+6+6=24$$

3. **Total number of points assigned to u_1u_1 :**

$$6$$

$$6$$

4. **Computing new centroid u_1u_1 :**

$$\left(\frac{15}{6}, \frac{24}{6}\right) = (2.5, 4.0)$$

$$(615, 624) = (2.5, 4.0)$$

for- u_2u_2 – cluster – with – centroid – 7777

1. **Summing up x-coordinates** of points assigned to u_2u_2 :

$$6 + 6 + 7 = 19$$

$$6+6+7=19$$

2. **Summing up y-coordinates** of points assigned to u_2u_2 :

$$6 + 8 + 7 = 21$$

$$6+8+7=21$$

3. Total number of points assigned to u_2 **u2**:

3

3

4. Computing new centroid u_2 **u2**:

$$\left(\frac{19}{3}, \frac{21}{3}\right) = (6.33, 7.0)$$

$$(319, 321) = (6.33, 7.0)$$

new-centroids

New Centroids: New Centroids:

- $u_1 = (2.5, 4.0)$ **u1=(2.5,4.0)**
- $u_2 = (6.33, 7.0)$ **u2=(6.33,7.0)**

Let me know if you'd like to continue iterating!

Student Said-6

Find the distance of each point from the new centroids and assign to the cluster with centroid closest to the point

Tutor Said:

Final Cluster Assignments

Point	Distance to final u1 (2.5,4.0)	Distance to final u2 (6.33,7.0)	Cluster Assignment
(1, 2)	3.5	10.33	u1 (2.5,4.0)
(1, 3)	2.5	9.33	u1 (2.5,4.0)
(2, 3)	1.5	8.33	u1 (2.5,4.0)
(2, 4)	0.5	7.33	u1 (2.5,4.0)
(4, 6)	3.5	3.33	u2 (6.33,7.0)
(5, 6)	4.5	2.33	u2 (6.33,7.0)
(6, 6)	5.5	1.33	u2 (6.33,7.0)

I've recalculated the Manhattan distances for each point from the latest centroids and reassigned them to the closest cluster. You can review the final table for the results. Let me know if you need further iterations or any adjustments!

Student Said-7

find the new centroids using the mean of the points assigned to each cluster. Show work

Tutor Said:

step-by-step-calculation-for-the-new-centroids-1

Step-by-Step Calculation for the New Centroids:

for- u_1u_1 – cluster – with – centroid – 2.54.02.54.0

1. **Summing up x-coordinates** of points assigned to u_1u_1 :

$$1 + 1 + 2 + 2 = 6$$

$$1+1+2+2=6$$

2. **Summing up y-coordinates** of points assigned to u_1u_1 :

$$2 + 3 + 3 + 4 = 12$$

$$2+3+3+4=12$$

3. **Total number of points assigned to u_1u_1 :**

$$4$$

$$4$$

4. **Computing new centroid u_1u_1 :**

$$\left(\frac{6}{4}, \frac{12}{4}\right) = (1.5, 3.0)$$

$$(46,412)=(1.5,3.0)$$

for- u_2u_2 – cluster – with – centroid – 6.337.06.337.0

1. **Summing up x-coordinates** of points assigned to u_2u_2 :

$$4 + 5 + 6 + 6 + 7 = 28$$

$$4+5+6+6+7=28$$

2. **Summing up y-coordinates** of points assigned to u_2 :

$$6 + 6 + 6 + 8 + 7 = 33$$

$$6+6+6+8+7=33$$

3. **Total number of points assigned to u_2 :**

$$5$$

$$5$$

4. **Computing new centroid u_2 :**

$$\left(\frac{28}{5}, \frac{33}{5}\right) = (5.6, 6.6)$$

$$(5.6, 6.6)$$

new-centroids-1

New Centroids:

$$\bullet u_1 = (1.5, 3.0)$$

$$\bullet u_2 = (5.6, 6.6)$$

Would you like to continue with another iteration or stop here?

Student Said-

Find the distance of each point from the new centroids and assign to the cluster with centroid closest to the point

Tutor Said:

Latest Cluster Assignments

Point	Distance to latest u_1 (1.5,3.0)	Distance to latest u_2 (5.6,6.6)	Cluster Assignment
(1, 2)	1.5	9.2	u_1 (1.5,3.0)
(1, 3)	0.5	8.2	u_1 (1.5,3.0)
(2, 3)	0.5	7.199999999999999	u_1 (1.5,3.0)
(2, 4)	1.5	6.199999999999999	u_1 (1.5,3.0)
(4, 6)	5.5	2.1999999999999993	u_2 (5.6,6.6)

Point	Distance to latest u1 (1.5,3.0)	Distance to latest u2 (5.6,6.6)	Cluster Assignment
(5, 6)	6.5	1.1999999999999993	u2 (5.6,6.6)
(6, 6)	7.5	1.0	u2 (5.6,6.6)

I've recalculated the Manhattan distances for each point from the latest centroids and reassigned them to the closest cluster. You can review the updated table for the results. Let me know if you need further iterations or any adjustments!

Student Said-9

is the cluster assignment same as the last run?

Tutor Said:

The cluster assignments have changed compared to the last iteration. This indicates that the centroids are still adjusting, and further iterations may be needed for convergence. Let me know if you'd like to continue iterating!

Student Said-10

find the new centroids using the mean of the points assigned to each cluster. Show work

Tutor Said:

step-by-step-calculation-for-the-new-centroids-2

Step-by-Step Calculation for the New Centroids:

for- u_1 u_1 - cluster - with - centroid - 1.53.01.53.0

1. **Summing up x-coordinates** of points assigned to u_1 :

$$1 + 1 + 2 + 2 = 6$$

$$1+1+2+2=6$$

2. **Summing up y-coordinates** of points assigned to u_1 :

$$2 + 3 + 3 + 4 = 12$$

$$2+3+3+4=12$$

3. **Total number of points assigned to u_1 :**

$$4$$

$$4$$

4. **Computing new centroid u_1 u1:**

$$\left(\frac{6}{4}, \frac{12}{4}\right) = (1.5, 3.0)$$

$$(46, 412) = (1.5, 3.0)$$

for- u_2 u2 – cluster – with – centroid – 5.66.65.66.6

1. **Summing up x-coordinates** of points assigned to u_2 u2:

$$4 + 5 + 6 + 6 + 7 = 28$$

$$4 + 5 + 6 + 6 + 7 = 28$$

2. **Summing up y-coordinates** of points assigned to u_2 u2:

$$6 + 6 + 6 + 8 + 7 = 33$$

$$6 + 6 + 6 + 8 + 7 = 33$$

3. **Total number of points assigned to u_2 u2:**

$$5$$

$$5$$

4. **Computing new centroid u_2 u2:**

$$\left(\frac{28}{5}, \frac{33}{5}\right) = (5.6, 6.6)$$

$$(528, 533) = (5.6, 6.6)$$

new-centroids-2

New Centroids:New Centroids:

- $u_1 = (1.5, 3.0)$ u1=(1.5,3.0)

- $u_2 = (5.6, 6.6)$ u2=(5.6,6.6)

Since the centroids have not changed from the previous iteration, the clustering has converged, and the algorithm has reached a stable solution. Let me know if you need any further analysis!