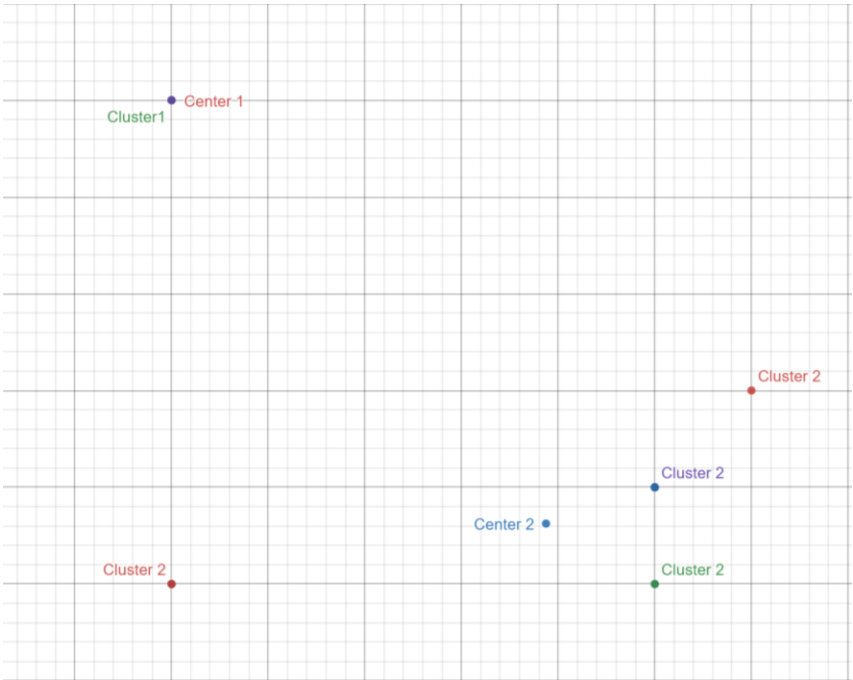


Homework 4

Task 1

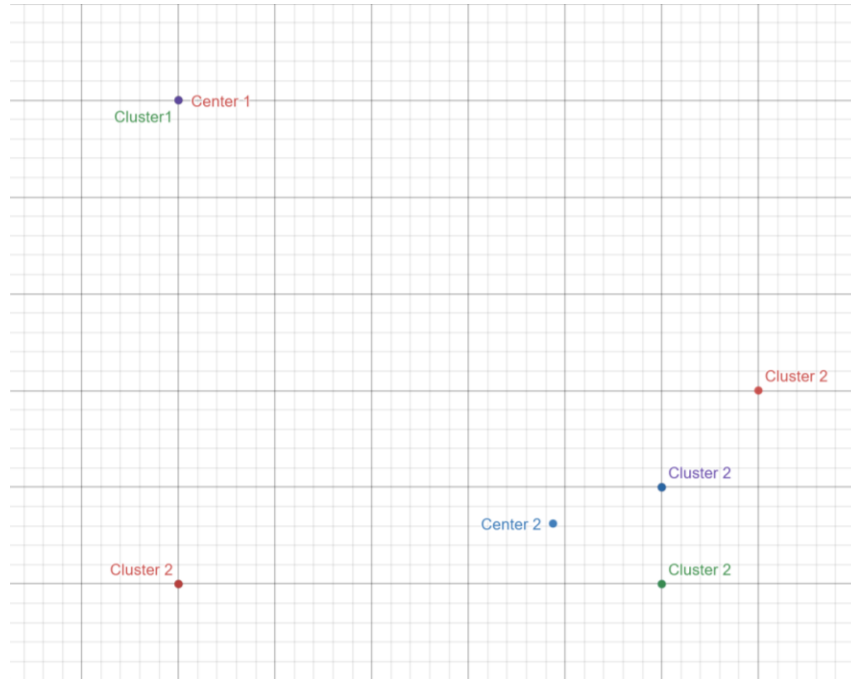
1. After the first interaction the centroid of the clusters are (2.0, 8.0) and (5.875, 3.625).

Cluster 1	Cluster 2
(2, 8)	(2, 3)
(2, 8)	(2, 3)
	(7, 3)
	(7, 3)
	(7, 4)
	(7, 4)
	(8, 5)
	(7, 4)



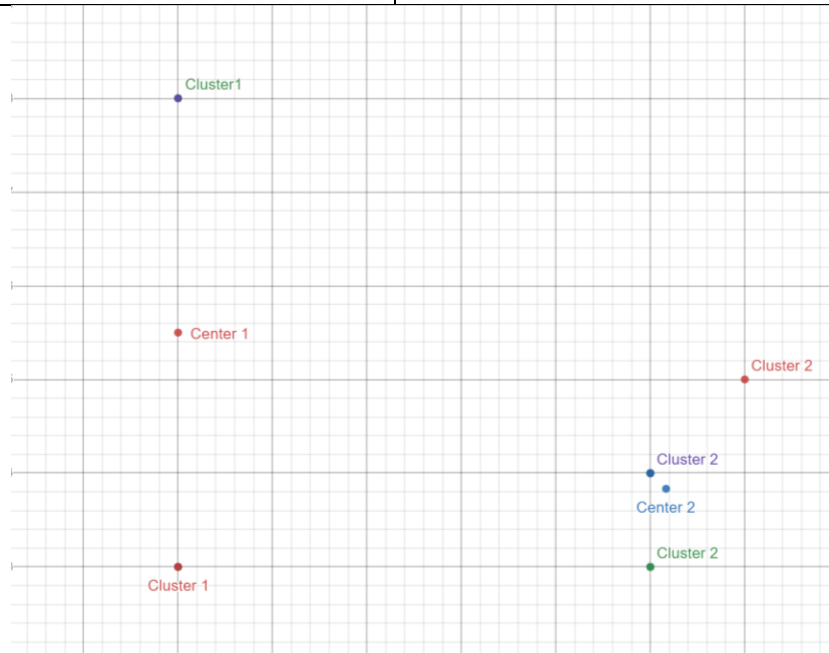
2. After the first interaction the centroid of the clusters are (2.0, 8.0) and (5.875, 3.625).

Cluster 1	Cluster 2
(2, 8)	(2, 3)
(2, 8)	(2, 3)
	(7, 3)
	(7, 3)
	(7, 4)
	(7, 4)
	(8, 5)
	(7, 4)



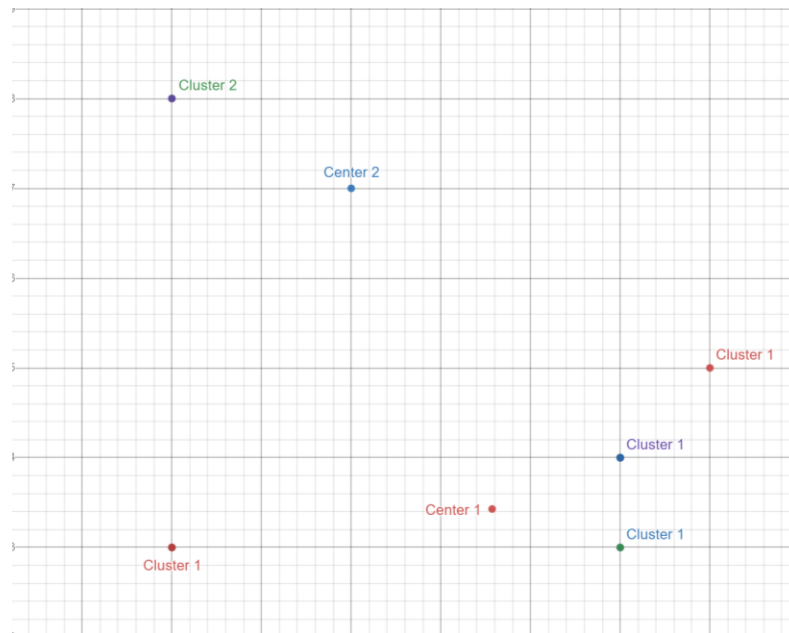
3. After the first interaction the centroid of the clusters are (2.0, 5.5) and (7.16666666666667, 3.833333333333335).

Cluster 1	Cluster 2
(2, 3)	(7, 3)
(2, 3)	(7, 3)
(2, 8)	(7, 4)
(2, 8)	(7, 4)
	(8, 5)
	(7, 4)



4. After the first interaction the centroid of the clusters are (5.571428571428571, 3.4285714285714284) and (4.0, 7.0).

Cluster 1	Cluster 2
(2, 3)	(2, 8)
(2, 3)	(2, 8)
(7, 3)	
(7, 3)	
(7, 4)	
(7, 4)	
(8, 5)	
(7, 4)	



## Task 2

5. The way that I coded up the algorithms took too long too run on my computer. Next time I will optimize my code so that this does not occur.

## Task 3

- The distance between the two farthest members, which are (4.6,2.9) and (6.7,3.1), is 2.1095.
- The distance between the two closest members, which are (5.0,3.0) and (5.9,3.2) is 0.9220.
- The average distance between all pairs is 1.4129. This can be done by adding all of the distances which equals 22.6061 and then divide it by 16, which is the total number of different distances

Work

A: (4.7, 3.2)

E: (5.9, 3.2)

B: (4.9, 3.1)

F: (6.7, 3.1)

C: (5.0, 3.0)

G: (6.0, 3.0)

D: (4.6, 2.9)

H: (6.2, 2.8)

$$AE: \sqrt{(4.7 - 5.9)^2 + (3.2 - 3.2)^2} = 1.2$$

$$AF: \sqrt{(4.7 - 6.7)^2 + (3.2 - 3.1)^2} = 2.0025$$

$$AG: \sqrt{(4.7 - 6.0)^2 + (3.2 - 3.0)^2} = 1.3153$$

$$AH: \sqrt{(4.7 - 6.2)^2 + (3.2 - 2.8)^2} = 1.5524$$

$$BE: \sqrt{(4.9 - 5.9)^2 + (3.1 - 3.2)^2} = 1.0050$$

$$BF: \sqrt{(4.9 - 6.7)^2 + (3.1 - 3.1)^2} = 1.8$$

$$BG: \sqrt{(4.9 - 6.0)^2 + (3.1 - 3.0)^2} = 1.1045$$

$$BH: \sqrt{(4.9 - 6.2)^2 + (3.1 - 2.8)^2} = 1.3342$$

$$CE: \sqrt{(5.0 - 5.9)^2 + (3.0 - 3.2)^2} = 0.9220$$

$$CF: \sqrt{(5.0 - 6.7)^2 + (3.0 - 3.1)^2} = 1.7029$$

$$CG: \sqrt{(5.0 - 6.0)^2 + (3.0 - 3.0)^2} = 1$$

$$CH: \sqrt{(5.0 - 6.2)^2 + (3.0 - 2.8)^2} = 1.2166$$

$$DE: \sqrt{(4.6 - 5.9)^2 + (2.9 - 3.2)^2} = 1.3342$$

$$DF: \sqrt{(4.6 - 6.7)^2 + (2.9 - 3.1)^2} = 2.1095$$

$$DG: \sqrt{(4.6 - 6.0)^2 + (2.9 - 3.0)^2} = 1.4036$$

$$DH: \sqrt{(4.6 - 6.2)^2 + (2.9 - 2.8)^2} = 1.6031$$

### Additional Questions

1. I spend around 30 hours completing this assignment. However the majority of it was spend waiting for the code to run for task 2.
2. One of the aspects that I found the most challenging was creating the k means algorithm from scratch.
3. I really enjoyed the assignment since it helped me polish my understanding on the k means machine learning algorithm and my coding skills. There is nothing that I would have changed.

Github: <https://github.com/ZulySoto/Machine-Learning-.git>

Please go to the folder named Homework 4 to see the code for task 1 and task 2.