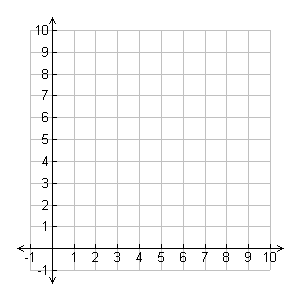
I Neha Moolchandani declare that I have completed this assignment completely and entirely on my own, without any consultation with others.  I understand that any breach of the UAB Academic Honor Code may result in severe penalties.

Assignment #3: DBSCAN, OPTICS, and Clustering Evaluation

1. If Epsilon is 2 and minpoint is 2 (including the centroid itself), what are the clusters that DBScan would discover with the following 8 examples: A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9). Use the Euclidean distance. Draw the 10 by 10 space and illustrate the discovered clusters. What if Epsilon is increased to sqrt(10)? (30 pts)





Here, epsilon is the radius around any given point and minpts is the min num of points around eps within the raidus.

When Epsilon = 2, the red circles in red above match the radius of two around points in clustered areas.

**First Cluster**: See distance is < 2

Euclidean Distance btwn A4 and A8: sqrt((5-4)^2 + (8-9)^2) = sqrt(2) = 1.4142

**Second Cluster**: See distance is < 2

Euclidean Distance btwn A3, A5: sqrt((8-7)^2 + (4-5)^2) = sqrt(2) = 1.4142

Euclidean Distance btwn A5, A6: sqrt((7-6)^2 + (5-4)^2) = sqrt(2) = 1.4142

Euclidean Distance btwn A3, A6: sqrt((8-6)^2 + (4-4)^2) = sqrt(4) = 2

Another Cluster? See distance is < 2

Euclidean Distance btwn A2, A7: sqrt((2-1)^2 + (5-2)^2) = sqrt(10) = 3.16>2 thus not a cluster

Euclidean Distance btwn A8, A1: sqrt((2-4)^2 + (10-9)^2) = sqrt(5) = 2.2360>2 thus not cluster

When Epsilon = sqrt(10) or 3.1623, the red circles in red circles below match the radius of 3.1623 around points in clustered areas.

**First Cluster**: See distance is < 3.1623

Euclidean Distance btwn A4 and A8: sqrt((5-4)^2 + (8-9)^2) = sqrt(2) = 1.4142

Euclidean Distance btwn A8, A1: sqrt((2-4)^2 + (10-9)^2) = sqrt(5) = 2.2360

**Second Cluster**: See distance is < 3.1623

Euclidean Distance btwn A3, A5: sqrt((8-7)^2 + (4-5)^2) = sqrt(2) = 1.4142

Euclidean Distance btwn A5, A6: sqrt((7-6)^2 + (5-4)^2) = sqrt(2) = 1.4142

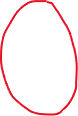
Euclidean Distance btwn A3, A6: sqrt((8-6)^2 + (4-4)^2) = sqrt(4) = 2

**Third Cluster**: See distance is < 3.1623

Euclidean Distance btwn A2, A7: sqrt((2-1)^2 + (5-2)^2) = sqrt(10) = 3.16

Chart, scatter chart

Description automatically generated



2. Use OPTICS algorithm to output the reachability distance and the cluster ordering for the dataset provided, starting from Instance 1. Use the following parameters for discovering the cluster ordering: minPts =2 and epsilon =2. Use epsilonprime =1.2 to generate clusters from the cluster ordering and their reachability distance. Don’t forget to record the core distance of a data point if it has a dense neighborhood. You don’t need to include the core distance in your result but you may need to use them in generating clusters. (45 pts)

16 17

15

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28

12 13

2

1

14

3

14

12

10

8

6

4

2



0

0 2 4 6 8 10 12 14 16

Dataset visualization

Below are the first few lines of the calculation. You need to complete the remaining lines and generate clusters based on the given epsilonprime value:

Instance (X,Y) Reachability Distance

====================================

**Instance 1: (1, 1) Undefined(or infinity)**

**Instance 2: (0, 1) 1.0**

**Instance 3: (1, 0) 1.0**

Instance 4: (11, 12) **Undefined**

Instance 5: (11, 13) **1.0**

Instance 6: (13, 13) **1.0**

Instance 7: (12, 8.5) **1.0**

Instance 8: (13, 8) **1.1**

Instance 9: (13, 9) **1.1**

Instance 10: (13, 7) **1.1**

Instance 11: (11, 7) **1.0**

Instance 12: (8, 2) **1.1**

Instance 13: (9, 2) **Undefined**

Instance 14: (10, 1) **Undefined**

Instance 15: (7, 13) **Undefined**

**Instance 16: (5, 9) Undefined**

Instance 17 (16, 16) **1.1**

Instance 18: (11.5, 8) **1.0**

Instance 19: (13, 10) **1.0**

Instance 20: (12, 13) **1.0**

Instance 21: (14, 12.5) **1.1**

Instance 22: (14.5, 11.5) **Undefined**

Instance 23: (15, 10.5) **1.0**

Instance 24: (15, 9.5) **1.0**

Instance 25: (12, 9.5) **1.0**

Instance 26: (10.5, 11) **1.0**

Instance 27: (10, 10.5) **Undefined**

Instance 28: (9, 3) **Undefined**

Instance 29: (9, 4) **Undefined**

Instance 30: (9, 5) **Undefined**

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|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | 0 | 1 | 1 | 14.9 | 15.6 | 16.9 | 13 | 13.4 | 14.4 | 13 | 11.6 | 7 | 8 | 13.4 | 8.9 | 21.2 | 13 | 15 | 16.2 | 17 | 17.2 | 17.2 | 16.6 | 16.6 | 13.6 | 14.1 | 13.4 | 8 | 8 | 8 |
| 2 |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| 23 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |  |
| 27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |  |
| 28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |  |
| 29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

***T2***

***C2***

3. Use F-measure and the Pairwise measures (TP, FN, FP, TN) to measure the agreement between a clustering result (C1, C2, C3) and the ground truth partitions (T1, T2, T3) as shown below. Show details of your calculation. (25 pts)

Table

Description automatically generated



***C3***

**Cluster *C1***

**Ground Truth *T1***

Graphical user interface, text, application

Description automatically generatedGraphical user interface, text

Description automatically generated with medium confidenceText

Description automatically generated