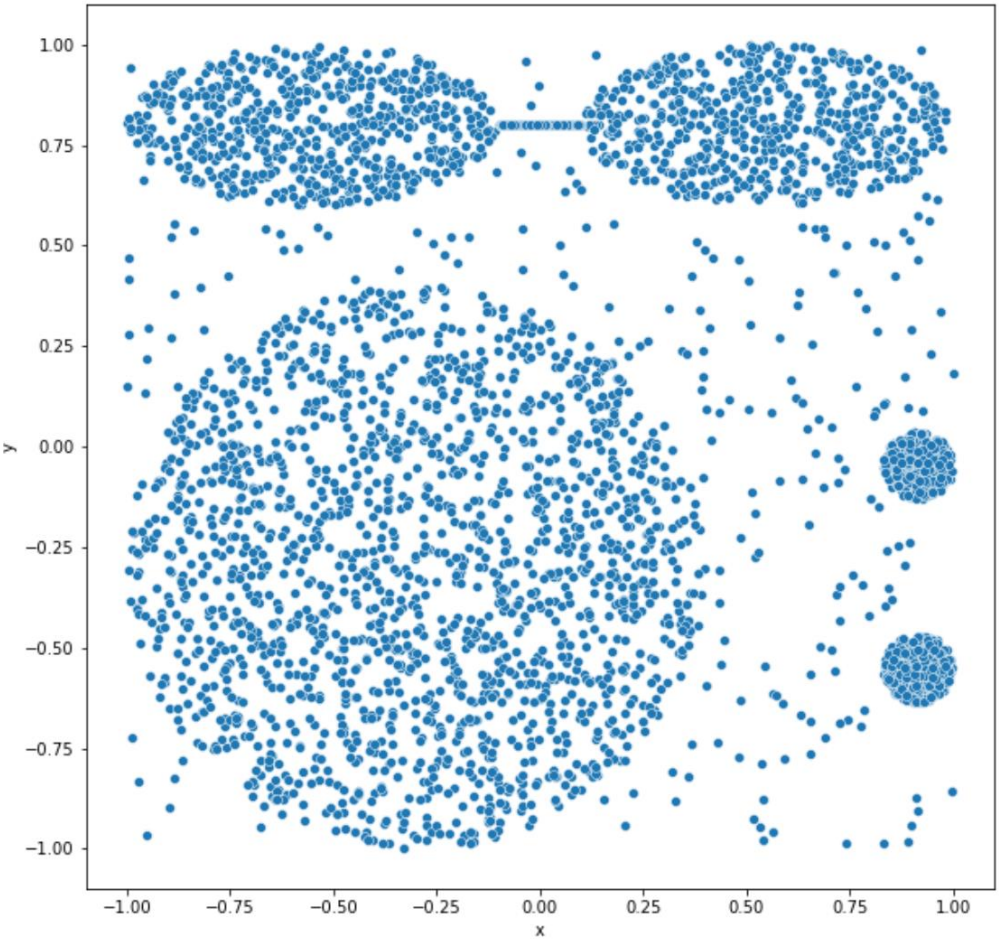
Homework Assignment 2

STAT430 Unsupervised Learning - Fall 2021

Due: Friday, September 10 on Compass

Question #1: [1.5 pt]

What type of cluster definition would be most useful in describing the five clusters represented in the plot shown below?



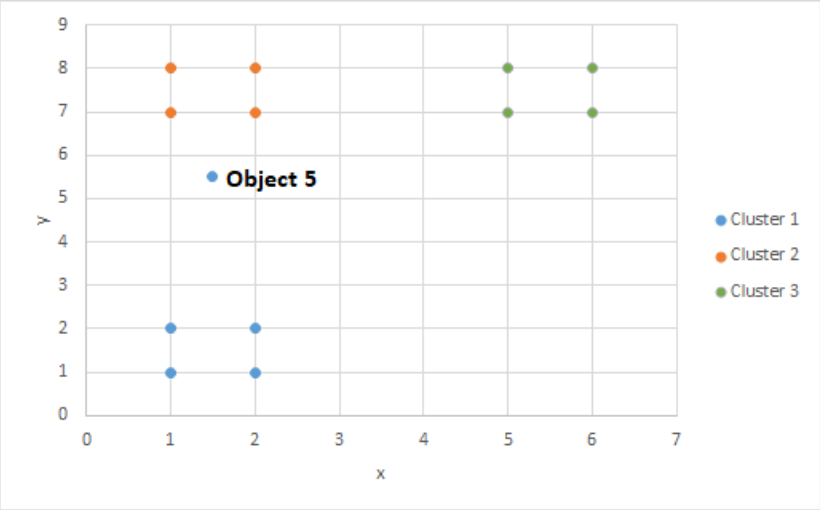
* Prototype based cluster definition would be most useful in describing the clusters as the two clusters at the top can be seen as prototype clusters since both are similar in shape, size and density. The same is true for the bottom right two clusters. These are very dense and are of equal shape.

* We can also consider them as Density based clusters since the five clusters are surrounded by a region of smaller density.

Question #2: [3 pt]

Calculate the silhouette score of object 5 using the information below. Then interpret what this silhouette score says about object 5 with respect to this clustering.

	Data			
		x	y	**Distance Object 5 is away from this object.**
Cluster 1	Object 1	1	1	4.53
	Object 2	2	2	3.54
	Object 3	1	2	3.54
	Object 4	2	1	4.53
	Object 5	1.5	5.5	--
Cluster 2	Object 6	1	7	1.58
	Object 7	1	8	2.55
	Object 8	2	7	1.58
	Object 9	2	8	2.55
Cluster 3	Object 10	5	7	3.81
	Object 11	5	8	4.30
	Object 12	6	7	4.74
	Object 13	6	8	5.15



a_5 = (4.53+3.54+3.54+4.53)/4
= 4.035

b_5_orng = (1.58+2.55+1.58+2.55)/4
= 2.065

b_5_grn = (3.81+4.30+4.74+5.15)/4
= 4.5

Hence, b_5 = 2.065

Silhouette_5 = (2.065-4.035)/4.035
= -0.48823

* Silhouette score of object 5 is -0.48823. The object 5 is actually closer to cluster_2 (orange) than cluster_1 (blue).

Question #3: [2 pt]

Suppose we have a dataset comprised of three objects (*object 1, object 2, and object 3*). Each object has two dimensions (ie. x and y dimensions). Suppose we come up with a clustering that assigns *objects 1 and 2* to cluster 1 and *object 3* to cluster 2 (see below). Come up with an example of (x,y) values for *objects 1, 2, and 3* below such that *object 2* has a silhouette score of exactly 0. *(Ie: fill in the blanks below).*

Clustering:

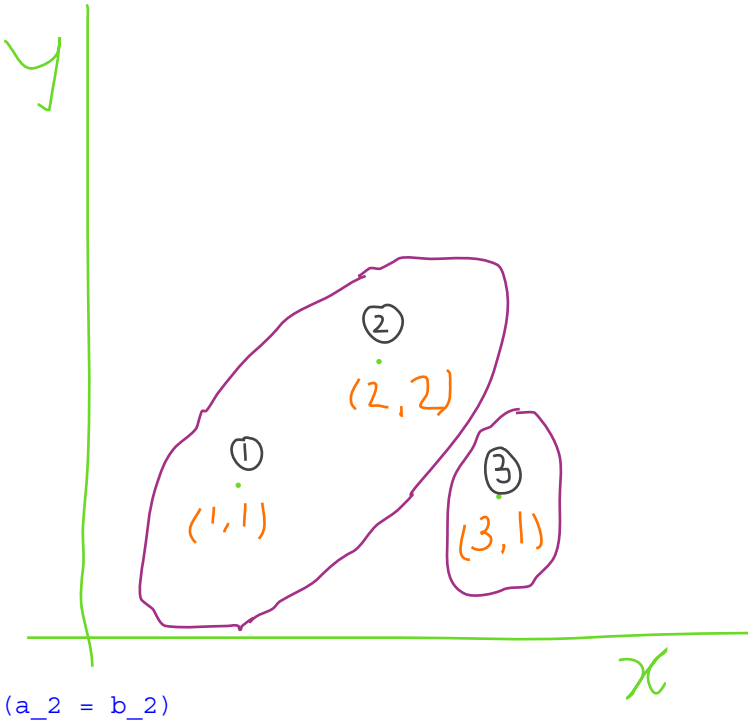
Cluster 1:

Object 1: (x1 = 1, y1 = 1)

Object 2: (x2 = 2, y2 = 2)

Cluster 2:

Object 3: (x3 = 3, y3 = 1)



b_2_1 = 1.414
b_2_3 = 1.414

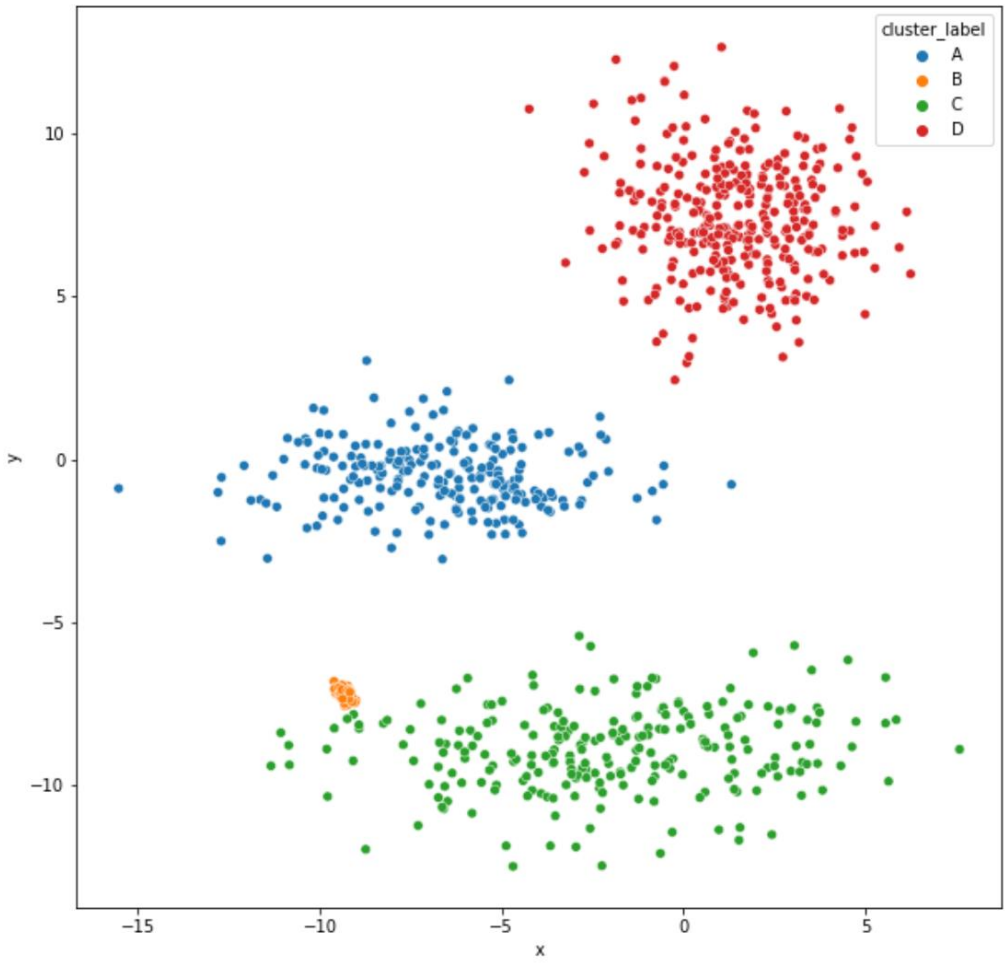
Hence b_2 = 1.414

Now, a_2 = 1.414

Hence Silhouette score of object 2 is zero. (a_2 = b_2)

Question 4: [4 pt]

The silhouette plot below was created from the following clustering and dataset shown in the scatterplot below. Match the cluster labels (A-D) shown in the scatterplot to the corresponding cluster labels (0-3) in the silhouette plot. Explanations are not required, but may help with partial credit if you get something wrong.

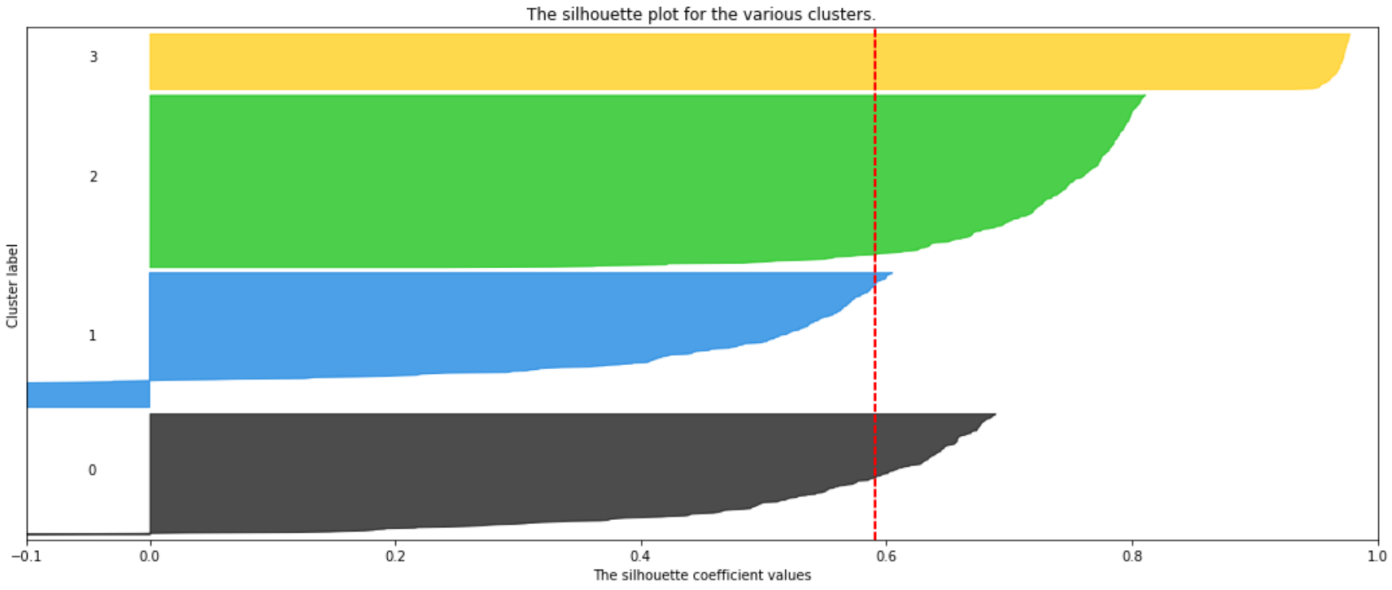


C-1
> Some of the objects are very close to cluster B than C giving negative Silhouette for some objects

B-3
> All objects are tightly packed and closer to its centroid, giving Silhouette of ~1 for all objects

D-2
Has very similar looking plot with A. There are fewer objects away from its centroid and closer to other cluster compared to cluster A.

A-0
> Objects are scattered and away from centroid



Question #5:

1. Download the Assignment_02.zip file from Compass.
2. Edit the Jupyter notebook (.ipynb) file to complete/answer questions for question 5.
3. Submit your completed Jupyter notebook (.ipynb) file as well as any other files you used to answer Question 1-4 to compass.