# Assignment_06

Wednesday, October 6, 2021 6:26 PM

Assignmen...

# Homework Assignment 6 [30 points]

STAT430 Unsupervised Learning - Fall 2021

*Due: Friday, October 8 on Compass at 11:59pm CST.*

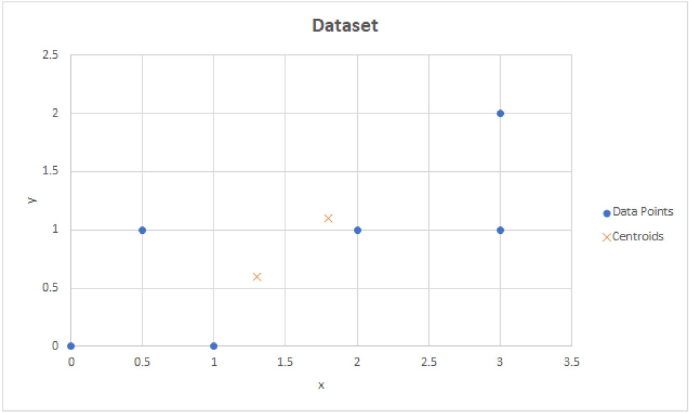
| Problem | Points |
|---|---|
| 1 | 0.5 |
| 2.1 | 0.25 |
| 2.2 | 2 |
| 2.3 | 1.5 |
| 2.4 | 1 |
| 3.1 | 1 |
| 3.2 | 3 |
| 4 | 0.5 |
| 5.1 | 0.75 |
| 5.2 | 0.75 |
| 5.3 | 0.75 |
| 5.4 | 0.75 |
| 5.5 | 1 |
| 6.1 | 1.5 |
| 6.2 | 2 |
| 6.3 | 0.5 |
| 6.4 | 1 |
| 6.5 | 1.5 |
| 6.6 | 0.75 |
| 6.7 | 0.5 |
| 6.8 | 1 |
| 6.9 | 0.75 |
| 6.1 | 1 |
| 6.11 | 1 |
| 6.12 | 1.5 |
| 6.13 | 0.5 |
| 7 | 2.5 |

**Questions #1-#6**: Answer the questions in the jupyter notebook.

**Question #7:**

We would like to cluster the dataset below using Fuzzy c-Means using $c = 2$ clusters and $p = 3$. The *current* centroids for the two cluster are (1.3, 0.6) and (1.8, 1.1). In the second table below, we have provided the squared distance that each object is to each of the *current* centroids. Determine what the *new* centroids will be in the next iteration of the algorithm. Show your work.

| | Dataset | |
|---|---|---|
| | x | y |
| Object 1 | 0 | 0 |
| Object 2 | 1 | 0 |
| Object 3 | 0.5 | 1 |
| Object 4 | 3 | 1 |
| Object 5 | 3 | 2 |
| Object 6 | 2 | 1 |




| | Additional Information | |
|---|---|---|
| | Squared Distance to Centroid 1 (1.3, 0.6) | Squared Distance to Centroid 12 (1.8, 1.1) |
| Object 1 | 2.05 | 4.45 |
| Object 2 | 0.45 | 1.85 |
| Object 3 | 0.8 | 1.7 |
| Object 4 | 3.05 | 1.45 |
| Object 5 | 4.85 | 2.25 |
| Object 6 | 0.65 | 0.05 |

$$w_{ik} = \frac{\left(\frac{1}{dist.(x_i, c_k)^2}\right)^{\frac{1}{p-1}}}{\sum_{j=1}^{k}\left(\frac{1}{dist.(x_i, c_j)^2}\right)^{\frac{1}{p-1}}}$$

| Object | Cluster 1 Membership Scores | Cluster 2 Membership Scores | x | y | Centroid 1 W1*x | W1*y | Centroid 2 W2*x | W2*y |
|---|---|---|---|---|---|---|---|---|
| Object 1 | 0.404311526 | 0.595688474 | 0 | 0 | 0 | 0 | 0 | 0 |
| Object 2 | 0.330295985 | 0.669704015 | 1 | 0 | 0.33 | 0 | 0.67 | 0 |
| Object 3 | 0.406878199 | 0.593121801 | 0.5 | 1 | 0.203 | 0.407 | 0.297 | 0.593 |
| Object 4 | 0.591891197 | 0.408108803 | 3 | 1 | 1.776 | 0.592 | 1.224 | 0.408 |
| Object 5 | 0.594843334 | 0.405156666 | 3 | 2 | 1.785 | 1.19 | 1.215 | 0.81 |
| Object 6 | 0.782870727 | 0.217129273 | 2 | 1 | 1.566 | 0.783 | 0.434 | 0.217 |
| **Sum** | **3.111090968** | **2.888909032** | | | **5.66** | **2.971** | **3.84** | **2.029** |
| | | | | | **C1** | | **C2** | |
| | | | | | 1.819 | 0.955 | 1.329 | 0.702 |