< Programming Assignment #3 >

See announcement in our LMS (learning.hanyang.ac.kr)

- Due Date, submission e-mail address, etc

1. Environment

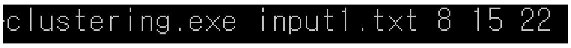
- OS: Windows, Mac OS, or Linux
- Languages: Java or Python (any version is ok)

2. Goal: Perform **clustering** on a given data set by using **DBSCAN**.

3. Requirements

The program must meet the following requirements:

- Execution file name: **clustering.py** (or clustering.exe, clustering.etc …)
  - Execute the program with four arguments: **input data file name, n, Eps and MinPts**
    - Three input data will be provided: ‘input1.txt’, ‘input2.txt’, ‘input3.txt
    - ***n***: number of clusters for the corresponding input data
    - ***Eps***: maximum radius of the neighborhood
    - ***MinPts***: minimum number of points in an Eps-neighborhood of a given point
    - We suggest that you use the following parameters (***n***, ***Eps***, ***MinPts***) for each input data
      - For ‘input1.txt’, ***n***=8, ***Eps***=15, ***MinPts***=22
      - For ‘input2.txt’, ***n***=5, ***Eps***=2, ***MinPts***=7
      - For ‘input3.txt’, ***n***=4, ***Eps***=5, ***MinPts***=5
  - Example:



```
clustering.exe input1.txt 8 15 22
```

    - Input data file name = ‘input1.txt’, *n* = 8, *Eps* = 15, *MinPts* = 22

- File format for an input data

[*object_id_1*]\t[*x_coordinate*]\t[*y_coordinate*]\n

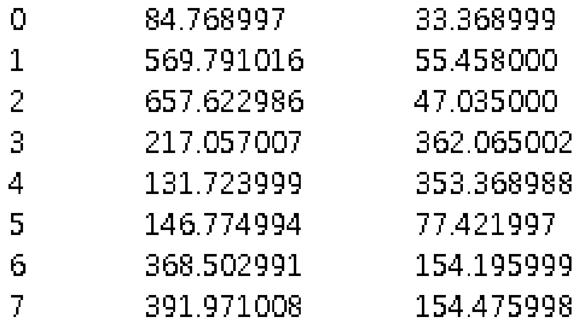
[*object_id_2*]\t[*x_coordinate*]\t[*y_coordinate*]\n

[*object_id_3*]\t[*x_coordinate*]\t[*y_coordinate*]\n

[*object_id_4*]\t[*x_coordinate*]\t[*y_coordinate*]\n

…

  - Row: information of an object
    - [*object_id_i*]: identifier of the *i*th object
    - [*x_coordinate*], [*y_coordinate*]: the location of the corresponding object in the 2-dimensional space
  - Example:



0	84.768997	33.368999
1	569.791016	55.458000
2	657.622986	47.035000
3	217.057007	362.065002
4	131.723999	353.368988
5	146.774994	77.421997
6	368.502991	154.195999
7	391.971008	154.475998

- Output files
  - You must print ***n*** output files for each input data
    - (Optional) If your algorithm finds *m* clusters for an input data and *m* is greater than *n* (*n* = the number of clusters given), you can remove (*m*-*n*) clusters based on the number of objects within each cluster. In order to remove (*m*-*n*) clusters, for example, you can select (*m*-*n*) clusters with the small sizes in ascending order
    - You can remove outlier. In other words, you don't need to include outlier in a specific cluster
  - **File format for the output of 'input#.txt'**
    - 'input#_cluster_0.txt'

      [*object_id*]\n

      [*object_id*]\n

      ...
    - 'input#_cluster_1.txt'

      [*object_id*]\n

      [*object_id*]\n

      ...
    - 'input#_cluster_*n-1*.txt'

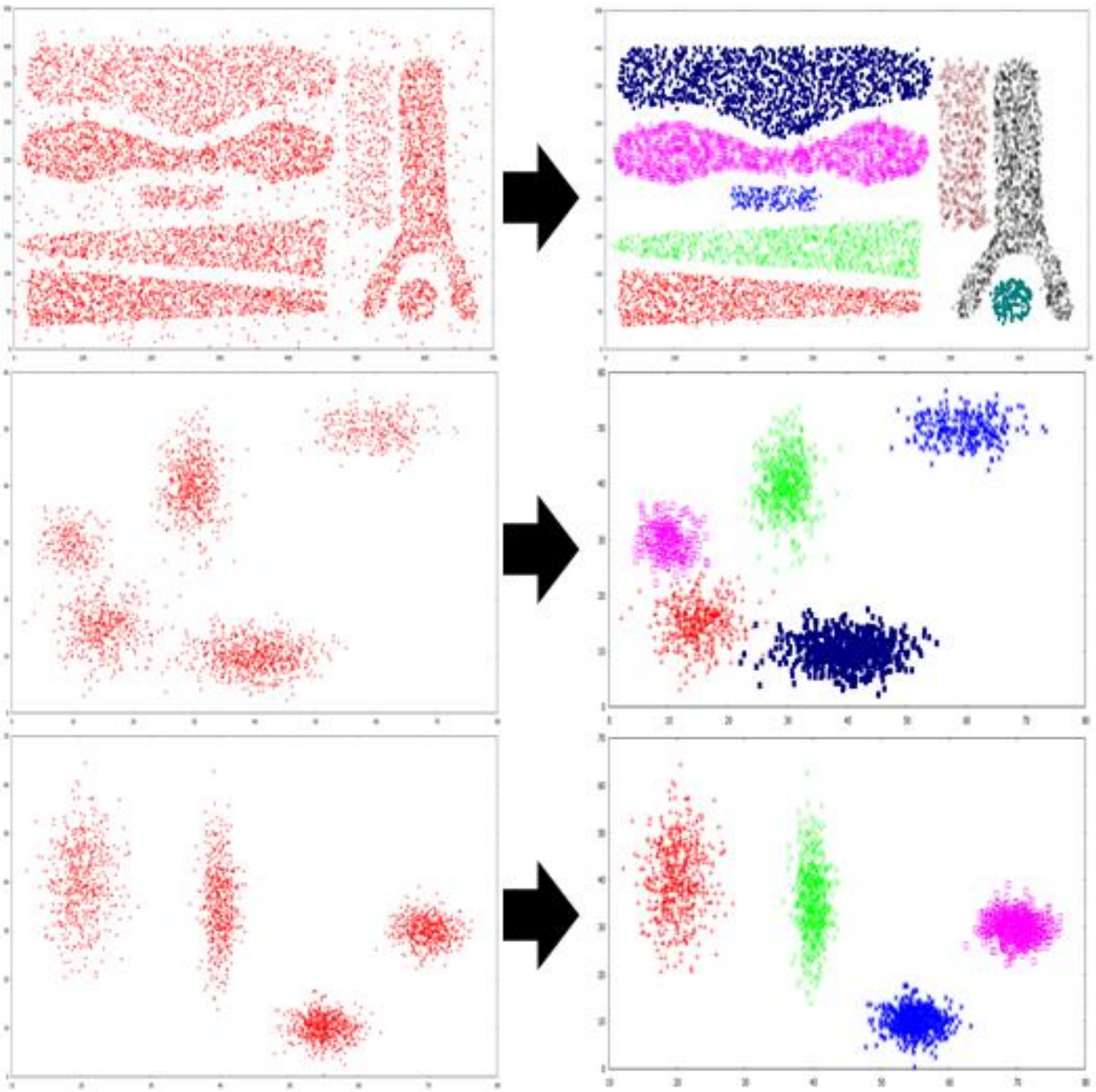
      [*object_id*]\n

      [*object_id*]\n

      ...
  - 'output#_cluster_*i*.txt' should contain all the ids belonging to cluster *i* that were obtained by using your algorithm
  - Supposed to follow the naming scheme for the output file as above

4. Rubric

- The following figure shows the clustering result for each input data



- Test method
  - (**just for your information**) For testing, we will use a measure similar to the Kendall's tau measure. Please refer to the following wikipedia page.

    (http://en.wikipedia.org/wiki/Kendall_tau_rank_correlation_coefficient)

    - Example
      - Correct answer: [*object_id_1*] and [*object_id_2*] are contained in different clusters
      - Your answer
        - [*object_id_1*] and [*object_id_2*] are contained in the same cluster → *INCORRECT*
        - [*object_id_1*] and [*object_id_2*] are contained in different clusters → *CORRECT*
    - The final score will be computed as follows:

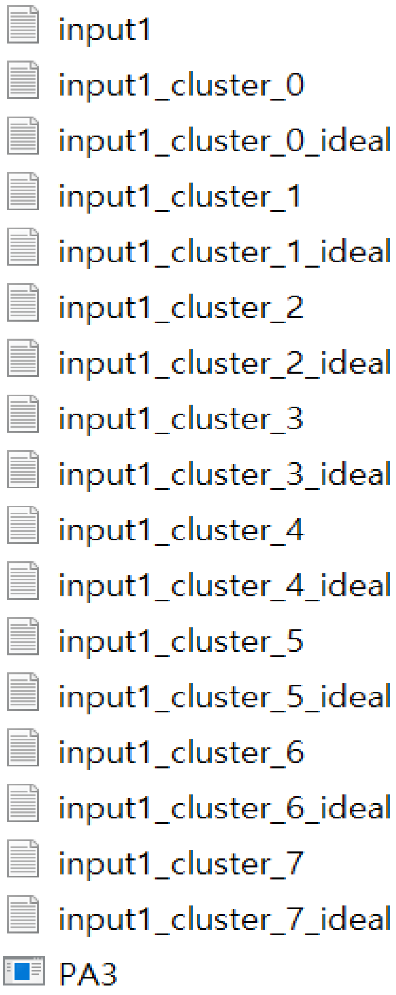
$$\frac{\boldsymbol{The\ number\ of\ correct\ pairs}}{\boldsymbol{The\ number\ of\ all\ possible\ pairs}}$$

5. Submission

- Please submit a single .zip file to TA's email address
  - ■ Guileline
    - The file format of report must be *.pdf. or *.doc or *.hwp
    - Content
      - ✓ Instructions for compiling and running your source codes on other person's computer (e.g. screenshot) (*Important!!*)
      - ✓ Java or Python version, and any other specification that our TA must know for running your code
  - ■ Program files
    - An executable file (.exe or .py)
      - ✓ For JAVA users, if you have a problem in making or sending .exe file, you can submit .jar or .java instead, or share a google drive link (please open the permission to anyone who has the link)
    - All source files
      - ✓ For JAVA users, include MakeFile if you use Linux

6. Testing program

- Please put the following files in a same directory: Testing program, your output files, given input files, attached answer files(~ideal.txt)



input1
input1_cluster_0
input1_cluster_0_ideal
input1_cluster_1
input1_cluster_1_ideal
input1_cluster_2
input1_cluster_2_ideal
input1_cluster_3
input1_cluster_3_ideal
input1_cluster_4
input1_cluster_4_ideal
input1_cluster_5
input1_cluster_5_ideal
input1_cluster_6
input1_cluster_6_ideal
input1_cluster_7
input1_cluster_7_ideal
PA3

- Execute the testing program with one argument (input file name)

```
C:\Users\user\Desktop\PA3>PA3.exe input1
```

- Check your score for the input file
  - If you implement your DBSCAN algorithm successfully and use the given parameters mentioned above, you will be able to get the similar scores with the following score for each input data
    - For ‘input1.txt’, Score=99
    - For ‘input2.txt’, Score=95
    - For ‘input3.txt’, Score=99
  - The test program was build with program 'mono'. So, even if you are using mac or linux instead of window, you can run dt_test.exe using C# mono.

7. Penalty

- Late submission
  - 1 week delay: 20%
  - 2 weeks delay: 50%
  - Delay more than 2 weeks: 100%
- Requirements unsatisfied
  - Penalty up to 100% will be given depending on how the requirements are well-satisfied