**MLSP HW2**

ISOMAP & t-SNE

Due date: 2024/05/07 23:55

**Requirements:**

- The code should be written in Python.
- Zip code (.py/.ipynb) and reports (PDF) and name the zipped file as "HW1_YOURSTUDENTID.zip" and submit it to the E3 system.
- We will deduct a late penalty of 20% per additional late day.
- Note that you cannot use any well-developed library. e.g., `sklearn.manifold.Isomap` and `sklearn.manifold.TSNE` in Python.

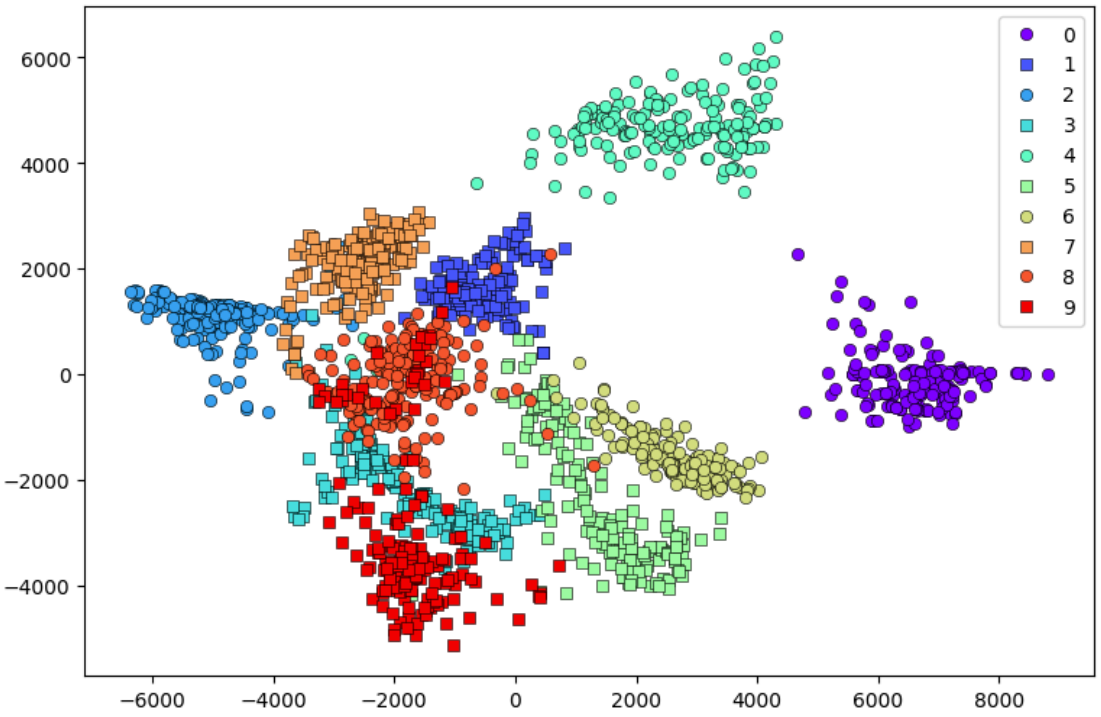
**In this assignment, we will investigate:**

1. The concept of Isometric Mapping (ISOMAP).
2. The concept of t-distributed Stochastic Neighbor Embedding (t-SNE).

**We already provide the example.ipynb to:**

1. *By using the MNIST dataset, implement ISOMAP by* **filling the TODO** *(calling ISOMAP packages is not allowed). Plot the original data distribution and the result of ISOMAP, and describe the concept of ISOMAP.*

   *Example of distribution result for reference only*




2. By using the MNIST dataset, implement t-SNE by **filling the TODO** (calling t-SNE packages is not allowed). Plot the original data distribution and the result of t-SNE, and describe the concept of t-SNE.

**Note:**

The report should contain two parts:

1. Explain each step of your implementation in detail.
2. Result of problems 1 and 2. (contain original data distribution and dimensional reduction result)

References:


- Van der Maaten, Laurens, and Geoffrey Hinton. "Visualizing data using t-SNE." Journal of machine learning research 9.11 (2008). Paper Link
- Isomap Website Link


Note:

Although you can easily find the implementation code on the web, we encourage you to implement these two nonlinear dimensional reduction methods on your own.