3 Isomap

You can use external libraries for linear algebra operations but you are expected to write your own algorithms.

3.1 Exercise 1

- Write your own implementation of Isomap.
- Apply it to the Swiss Roll dataset ($n = 1000$) from Lab 1.
- Use a modified version of the Swiss Roll dataset, in which Gaussian noise from a Normal $\mathcal{N}(\mu = 0, \sigma = 0.5)$ is added to the x and y coordinates. Apply Isomap to this dataset and discuss the differences with the previous point.

3.2 Exercise 2

Undersample randomly from the `Dry_Bean_Dataset` in order to have $n = 1000$ datapoints. Follow the same pipeline of Exercise 1 of the previous lab by replacing PCA with Isomap. Discuss the differences with particular focus on the accuracy of the logistic regression.

Important note: in this case, you don't need to do the train-test split. Apply ISOMAP to the whole dataset first, and then do the train-test split and follow the rest of the pipeline.

Notes

- You can use the `sklearn.neighbors.NearestNeighbors` class.
- You are expected to write your own implementation of the Floyd-Warshall algorithm, as seen in class.
    * If you wish, you can implement Dijkstra's algorithm instead.
- Remember that your distance matrix must be symmetric!
- Suggestion: test you algorithm with $n = 100$ points at first.