9 Hierarchical and Spectral Clustering

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

9.1 Exercise 1

Use the `iris` dataset available at `https://archive-beta.ics.uci.edu/dataset/53/iris`.

- Apply **your own** PCA function to the dataset. Plot the data in two dimensions, coloring by class.
- Perform hierarchical clustering with single linkage and ward's linkage using `scipy` functions (see `https://docs.scipy.org/doc/scipy/reference/cluster.hierarchy.html`).
- Plot the dendogram and the datapoints in 2D, coloring now by cluster (cut the dendogram to have the same number of clusters of the ground truth).
- Implement your own version of spectral clustering.
- Apply it to the dataset, setting k to be the same of the ground truth (build the graph with k-NN having $k = 5$). Plot the datapoints in 2D, coloring by cluster.

Notes

We use PCA only to plot the data in 2 dimensions. You will have to use the original dataset to compute the clusters, and then use the obtained results to color the PCA projections.