

## 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 dendrogram and the datapoints in 2D, coloring now by cluster (cut the dendrogram 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.