

Exercise Sheet 10

Exercise 1

What is the mathematical connection between PCA and classical MDS? When do you get a different result from both methods and when the same result?

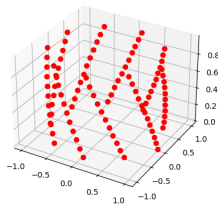
Exercise 2

Let $A \in \mathbb{R}^{d \times d}$ be a symmetric matrix. Prove that the solution to the following optimization problem is given by the eigenvector to the largest eigenvalue

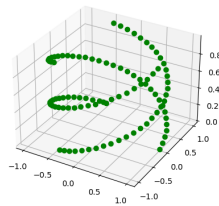
$$\begin{aligned} \max_{x \in \mathbb{R}^d} \quad & x^\top A x \\ \text{st} \quad & \|x\|_2 = 1 \end{aligned}$$

Exercise 3

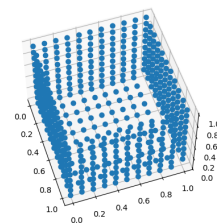
Project datasets `box.npy`, `spring_1.npy` and `spring_2.npy`, into two dimensions using metric MDS, and compare the projections to PCA.



(a) `spring_1.png`



(b) `spring_2.png`



(c) `box.npy`

Please turn in your solutions by Wednesday, July 5th.