

Exercise Class Numerical Linear Algebra
Eigenvalues and Eigenvectors

Exercise 1: Write a script that reads a matrix $A \in \mathbb{R}^{n \times n}$ and computes the largest eigenvalue and its correspondent eigenvector using the power method.

Exercise 2: Write a script that reads a matrix $A \in \mathbb{R}^{n \times n}$ and computes the smallest eigenvalue and its correspondent eigenvector using the inverse iteration.

Exercise 3: Write a script that reads a matrix $A \in \mathbb{R}^{n \times n}$ and computes the closest eigenvalue to $\mu \in \mathbb{R}$ and its correspondent eigenvector using the shifted inverse iteration.

Exercise 4:(optional) Write a script that reads a matrix $A \in \mathbb{R}^{n \times n}$ and computes all the eigenvalues of the matrix by means of the QR method. How can we approximate all the eigenvectors?

$$A = \begin{pmatrix} 4 & -5 \\ 2 & 3 \end{pmatrix}, A = \begin{pmatrix} 0 & 11 & -5 \\ -2 & 17 & -7 \\ -4 & 26 & -10 \end{pmatrix},$$

$$A = \begin{pmatrix} 1 & 0.5 & -0.5 & 0.2 \\ 0.5 & 12 & 0.8 & 1 \\ -0.5 & 0.8 & -16 & 1 \\ 0.2 & 1 & 1 & -4 \end{pmatrix}, A = \begin{pmatrix} 2 & 0 & 0.5 & -1 \\ 0.5 & 7 & 6.5 & 21 \\ -2 & 1 & 12 & -0.5 \\ 0 & -0.5 & 0 & 18 \end{pmatrix}.$$