

**Recall:** The standard way of computing eigenvalues and eigenvectors of an  $n \times n$  matrix  $A$ :

- 1) Compute the characteristic polynomial  $P(\lambda) = \det(A - \lambda I_n)$ .
- 2) Eigenvalues of  $A$  = roots of  $P(\lambda)$ .
- 3) Eigenvectors corresponding to an eigenvalue  $\lambda$  = vectors in  $\text{Nul}(A - \lambda I_n)$ .

**Problems:**

- For large matrices computations of  $P(\lambda)$  are slow.
- Even if we know  $P(\lambda)$ , it is difficult to compute its roots.

**More efficient way:** The power method.

**Assumptions:**

- $A$  is an  $n \times n$  matrix with eigenvalues  $\lambda_1, \dots, \lambda_n$  such that

$$|\lambda_1| > |\lambda_2| > \dots > |\lambda_n|$$

- For  $i = 1, \dots, n$ , by  $\mathbf{w}_i$  we will denote an eigenvector corresponding to the eigenvalue  $\lambda_i$ , such that  $\|\mathbf{w}_i\| = 1$ .

## Computing the largest eigenvalue $\lambda_1$ its eigenvector

## Computing the other eigenvalues and eigenvectors