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 λ = vectors in $\mathrm{Nul}(A - \lambda I_n)$.

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 λ_i, such that $||\mathbf{w}_i|| = 1$.

Computing the largest eigenvalue λ_1 its eigenvector

Computing the other eigenvalues and eigenvectors