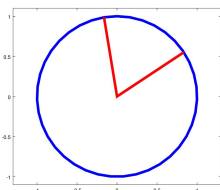# Spectral norm and spectral radius

Example 1 – a general matrix with 2 different real eigenvalues
image of the unit circle is an elipse

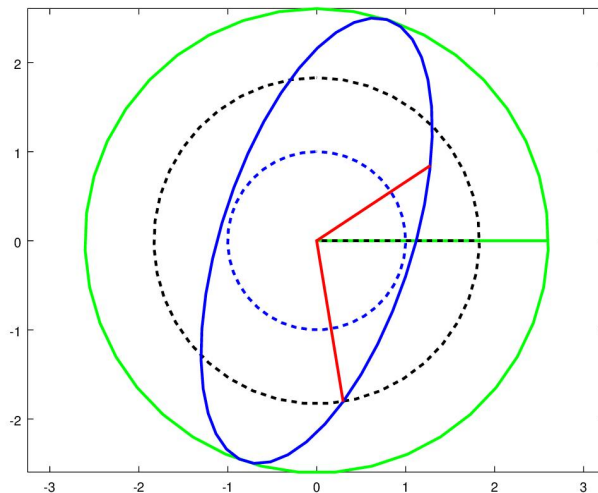$$A = \begin{bmatrix} 1.2 & 0.5 \\ 2 & -1.5 \end{bmatrix}$$

A

$\rightarrow$

$\lambda_1 = 1.53$
$\lambda_2 = -1.83$

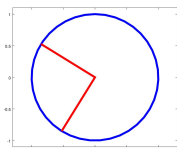$\rho(A) = 1.83,\ \|A\|_2 = 2.605$

Left: Unit circle (blue) and unit eigenvectors (red).

Right: Image of the unit circle and of the eigenvectors (blue and red, respectively).
Black dashed circle has radius $\rho(A)$. Green circle has radius $\|A\|_2$.
Unit circle is blue dashed.

Example 2 – symmetric matrix
eigenvalues are always real, eigenvectors are orthogonal and parallel to axes of the elipse

$$A = \begin{bmatrix} 3 & -1 \\ -1 & 2 \end{bmatrix}$$

A

$\rightarrow$

$\lambda_1 = 1.382$
$\lambda_2 = 3.618$

$\rho(A) = \|A\|_2 = 3.618$