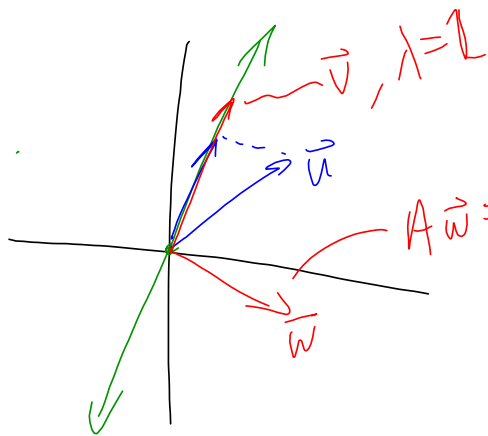


$$\underline{A\vec{x} = \lambda\vec{x}}$$

$$\vec{x} \neq 0$$

$\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ is an eigenvector with eigenvalue 1



$\begin{bmatrix} 2 \\ -1 \end{bmatrix}$ is an eigenvector with eigenvalue 0

$$P = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}, D = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$$

$$A = PDP^{-1} \quad P = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix} \Rightarrow P^{-1} = \frac{1}{5} \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \frac{1}{5} \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix} \quad (1, 2) \quad \begin{bmatrix} \frac{a^2}{a^2+b^2} & \frac{ab}{a^2+b^2} \\ \frac{ab}{a^2+b^2} & \frac{b^2}{a^2+b^2} \end{bmatrix}$$

$$= \frac{1}{5} \begin{bmatrix} 1 & 0 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix} = \frac{1}{5} \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} \frac{1}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{4}{5} \end{bmatrix}$$

$$A = \begin{pmatrix} 1 & 2 \\ 5 & 5 \\ 2 & 4 \\ 5 & 5 \end{pmatrix} \text{ null space of } A?$$

Can you find a nonzero vector in the null space?

$$A\vec{x} = \vec{0} \quad \frac{1}{5} \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\vec{x} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$

$$\text{rref}(A) = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix} \rightarrow 2 \times 3$$

$x_2 + 2x_3 = 0$
 $x_2 = -2t$

$$B_{\text{col}(A)} = \left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \right\}$$

$\dim(\text{col}(A)) = 2$

$A\vec{x} = \vec{0}$

$\text{rank}(A) + \text{nullity}(A) = n$
 $2 + ? = 3$

$x_1 - x_3 = 0$
 $x_1 = t$

$x_3 = t$
 $\vec{x} = t \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$

$(0,1), (1,2), (2,2), (3,4)$

$$\vec{x} = (A^T A)^{-1} A^T \vec{b}$$

$$A = \begin{bmatrix} 0 & 1 \\ 1 & 2 \\ 2 & 2 \\ 3 & 1 \end{bmatrix} \begin{matrix} m \\ b \end{matrix} = \begin{bmatrix} 1 \\ 2 \\ 2 \\ 4 \end{bmatrix} = \vec{b}$$

$y = mx + b$

$$\begin{cases} 0m + b = 1 \\ 1m + b = 2 \\ 2m + b = 2 \\ 3m + b = 4 \end{cases}$$

T 3right, 1down

$$T \begin{bmatrix} x_1 \\ x_2 \\ 1 \end{bmatrix} = \begin{bmatrix} x_1 + 3 \\ x_2 - 1 \\ 1 \end{bmatrix}$$
$$T \begin{bmatrix} 2 \\ 5 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \end{bmatrix}$$
$$\begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix} = [T]_h$$