 Vectors Vs  Vectors

$$\begin{bmatrix} d \times d \end{bmatrix} \cdot$$  Vector =  Vector

Both Magnitude and Direction changes

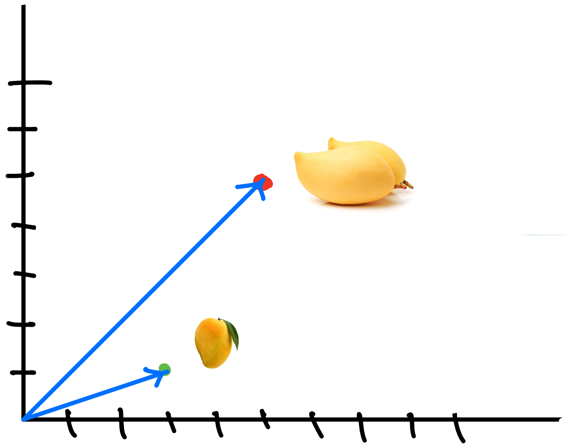
Ex :

Matrix $\Rightarrow \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$

 Vector $\Rightarrow \begin{bmatrix} 3 \\ 1 \end{bmatrix}$

 = np.dot(M, )

$$\begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 5 \\ 5 \end{bmatrix}$$



$$\begin{bmatrix} d \times d \end{bmatrix} \cdot$$  Vector $= \lambda$  Vector

(only magnitude changes)

Ex :

 Vector $\Rightarrow \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

 Vector ⇒ np.dot(M, )

$$\begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 4 \\ 2 \end{bmatrix}$$

Note that $M \cdot \vec{v} = \lambda \cdot \vec{v}$ where $\lambda = 2$

Q: How do we find 

Vector for any matrix

$\Rightarrow$ $M\vec{v} = \lambda\vec{v}$ can be rewritten as

$\Rightarrow$ $M\vec{v} - \lambda\vec{v} = 0$

$\Rightarrow$ $(M - \lambda I)\vec{v} = 0$

We know that $\vec{v} \neq 0$
Hence we can solve for
$\det(M - \lambda I) = 0$
and
find values of λ

$\Rightarrow$ Using λ's we can find $\vec{v}$

Ex:

$$M = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$$

Solving $\det(M - \lambda I) = 0$

i.e. $\begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix} - \lambda \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$\Rightarrow \det \begin{bmatrix} 1-\lambda & 2 \\ 3 & -4-\lambda \end{bmatrix}$

$\Rightarrow (1-\lambda)\cdot(-4-\lambda) - 2\cdot 3$

$\Rightarrow -4-\lambda + 4\lambda + \lambda^2 - 6$

$\Rightarrow \lambda^2 + 3\lambda - 10$

$\Rightarrow (\lambda-2)(\lambda+5) = 0$

Hence $\lambda_1 = 2$ and $\lambda_2 = 5$ (Eigen Values)

H.W

To Do: Now using λ find $\vec{v}$ (Eigen Vector)