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Topic: 3.11 – Eigen Value of a matrix

2) find the dominant eigen value 11-66

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \quad x_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$
$$A x_1 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$
$$= \begin{bmatrix} 1 + 0 + 0 \\ 3 + 0 + 0 \\ -1 + 0 + 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix} = 3 \begin{bmatrix} 0.333 \\ 1 \\ -0.333 \end{bmatrix}$$

$$A x_2 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.333 \\ 1 \\ -0.333 \end{bmatrix}$$
$$= \begin{bmatrix} 0.333 + 3 + 0.333 \\ 0.999 + 2 - 0.333 \\ -0.333 + 4 - 3.33 \end{bmatrix}$$
$$= \begin{bmatrix} 3.666 \\ 1.667 \\ 0.337 \end{bmatrix} = 3.666 \begin{bmatrix} 1 \\ 0.455 \\ 0.092 \end{bmatrix}$$



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$$A \times 2 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 1 \\ 0.455 \\ 0.092 \end{bmatrix}$$
$$= \begin{bmatrix} 1 + 1.365 - 0.092 \\ 3 + 0.91 + 0.368 \\ -1 + 1.82 + 0.92 \end{bmatrix} = \begin{bmatrix} 2.273 \\ 4.278 \\ 1.74 \end{bmatrix}$$

$$= 4.278 \begin{bmatrix} 0.531 \\ 1 \\ 0.407 \end{bmatrix}$$

$$A \times 3 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.531 \\ 1 \\ 0.407 \end{bmatrix}$$

$$= \begin{bmatrix} 0.531 + 3 - 0.407 \\ 1.593 + 2 + 1.628 \\ -0.531 + 4 + 4.07 \end{bmatrix} = \begin{bmatrix} 3.124 \\ 5.221 \\ 7.539 \end{bmatrix}$$

$$= 7.539 \begin{bmatrix} 0.414 \\ 0.693 \\ 1 \end{bmatrix}$$



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$$AX4 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.414 \\ 0.693 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.414 + 2.079 - 1 \\ 1.242 + 1.386 + 4 \\ -0.414 + 2.772 + 10 \end{bmatrix}$$

$$= \begin{bmatrix} 1.493 \\ 6.628 \\ 12.358 \end{bmatrix} = 12.358 \begin{bmatrix} 0.121 \\ 0.536 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.121 + 1.608 - 1 \\ 0.363 + 1.072 + 4 \\ -0.121 + 2.144 + 10 \end{bmatrix} = \begin{bmatrix} 0.729 \\ 5.435 \\ 12.023 \end{bmatrix}$$

$$= 12.023 \begin{bmatrix} 0.061 \\ 0.452 \\ 1 \end{bmatrix}$$

$$AX6 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.064 \\ 0.452 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.061 + 1.356 - 1 \\ 0.183 + 0.904 + 4 \\ -0.061 + 1.808 + 10 \end{bmatrix} = \begin{bmatrix} 0.417 \\ 5.087 \\ 11.747 \end{bmatrix}$$



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$$= 11.747 \begin{bmatrix} 0.035 \\ 0.433 \\ 1 \end{bmatrix}$$
$$AX_7 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.035 \\ 0.433 \\ 1 \end{bmatrix}$$
$$= \begin{bmatrix} 0.035 + 1.299 - 1 \\ 0.105 + 0.866 + 4 \\ -0.035 + 1.732 + 10 \end{bmatrix} = \begin{bmatrix} 0.334 \\ 4.971 \\ 11.697 \end{bmatrix}$$

$$= 11.697 \begin{bmatrix} 0.029 \\ 0.425 \\ 1 \end{bmatrix}$$
$$AX_8 = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.029 \\ 0.425 \\ 1 \end{bmatrix}$$
$$= \begin{bmatrix} 0.029 + 1.275 - 1 \\ 0.087 + 0.85 + 4 \\ -0.029 + 1.7 + 10 \end{bmatrix} = \begin{bmatrix} 0.304 \\ 4.937 \\ 11.671 \end{bmatrix}$$
$$= 11.671 \begin{bmatrix} 0.026 \\ 0.423 \\ 1 \end{bmatrix}$$



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$$\begin{aligned} Ax_9 &= \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.026 \\ 0.423 \\ 1 \end{bmatrix} \\ &= \begin{bmatrix} 0.026 + 1.269 - 1 \\ 0.078 + 0.846 + 4 \\ -0.026 + 1.692 + 10 \end{bmatrix} = \begin{bmatrix} 0.295 \\ 4.924 \\ 11.666 \end{bmatrix} \\ &= 11.666 \begin{bmatrix} 0.026 \\ 4.923 \\ 1 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} Ax_{10} &= \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix} \begin{bmatrix} 0.026 \\ 4.923 \\ 1 \end{bmatrix} \\ &= \begin{bmatrix} 0.026 + 1.269 - 1 \\ 0.078 + 0.846 + 4 \\ -0.026 + 1.692 + 10 \end{bmatrix} = \begin{bmatrix} 0.295 \\ 4.924 \\ 11.666 \end{bmatrix} = 11.666 \begin{bmatrix} 0.026 \\ 4.923 \\ 1 \end{bmatrix} \end{aligned}$$

Eigen value $\lambda = 11.666$

eigen vector $X = (0.026, 4.923, 1)$