

$$X = \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}$$

$$= -3 \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix} = -3 \times$$

↓



Latent

characteristic vector.

characteristic root

This makes sense if $\frac{\det(A - \lambda I) = 0}{\text{characteristic eq}^n}.$

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$$\det (A - \lambda I) \rightarrow \text{characteristic poly.}$$

$$\Rightarrow \begin{bmatrix} -2-\lambda & 2 & -3 \\ 2 & 1-\lambda & -6 \\ -1 & -2 & -\lambda \end{bmatrix}$$

$$\det(A - \lambda I) = (-2 - \lambda) [-\lambda(1 - \lambda) - 12] - 2[-2\lambda - 6] - 3[-4 + 1 - \lambda]$$

$$= (-2 - \lambda) [-\lambda + \lambda^2 - 12] + 4\lambda + 12 + 9 + 3\lambda$$

$$= (-2-\lambda) \begin{vmatrix} -\lambda+1 & -1 \\ 1 & 1 \end{vmatrix} - (-1) \begin{vmatrix} 1 & 1 \\ 1 & 1 \end{vmatrix} + (-1) \begin{vmatrix} 1 & 1 \\ 1 & 1 \end{vmatrix}$$

$$= 2\lambda - 2\lambda^2 + 24 + \lambda^2 - \lambda^3 + 12\lambda + 7\lambda + 21$$

$$= -\lambda^3 - \lambda^2 + 21\lambda + 45 \rightarrow \text{char. poly.}$$

$$-\lambda^3 - \lambda^2 + 21\lambda + 45 = 0 \quad \text{char. eqn.}$$

$$\lambda^3 + \lambda^2 - 21\lambda - 45 = 0$$

$$45 = \pm 3, \pm 5$$

$$(\lambda + 3) [\lambda^2 - 2\lambda - 15] = 0$$

$$(\lambda + 3) (\lambda^2 + 3\lambda - 5\lambda - 15) = 0$$

$$(\lambda + 3) (\lambda + 3) (\lambda - 5) = 0$$

$$\lambda = -3, -3, 5$$

$$\lambda_1 \quad \lambda_2 \quad \lambda_3$$

$$\lambda_1 + \lambda_2 + \lambda_3 = -1$$

$$\lambda_1 \lambda_2 \lambda_3 = 45$$

Properties of eigen values:

1) Sum of eigen values = Trace A

2) Product of " " = Det A

3) A & A^T have same eigen values.

4) If $\lambda_1, \lambda_2, \dots, \lambda_n$ are eigen values of A, $A \rightarrow \lambda_1^m, \lambda_2^m, \dots, \lambda_n^m$

5) " " " " $kA \rightarrow k\lambda_1, k\lambda_2, \dots, k\lambda_n$

6) " " " " $A^{-1} \rightarrow \frac{1}{\lambda_1}, \frac{1}{\lambda_2}, \dots, \frac{1}{\lambda_n}$

7) If 0 is an eigen value then $\det A = 0$

eg:

$$A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

Result: Eigen values of diagonal / upper tri. / lower tri.

matrices are nothing but the diagonal elements itself.

result: eigenvalue λ $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
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