(PTIA0301) Elementary Linear Algebra

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Eigenvalue, Eigenvector I

- Definition: Let V be a vector space over $\mathbb{R}$. Let $\varphi : V \to V$ be a linear mapping. If for a nonzero vector $\mathbf{a} \in V$ and a scalar $\lambda \in \mathbb{R}$, the equation $\varphi(\mathbf{a}) = \lambda \mathbf{a}$ holds, we say that $\mathbf{a}$ is an eigenvector of φ, and λ is the eigenvalue of φ corresponding to $\mathbf{a}$.
- Definition: Let $L_\lambda = \{\mathbf{a} \in V : \varphi(\mathbf{a}) = \lambda \mathbf{a}\}$ be the set of eigenvectors corresponding to λ, along with the zero vector. The set L_λ forms a subspace, and it is called the eigenspace corresponding to λ.
- Definition: (Determination of Eigenvalues) The characteristic polynomial of a matrix $A \in \mathcal{M}_{n \times n}$ is defined as the n^{th}-degree polynomial

$$f(x) = |A - xE_n| = \begin{vmatrix} a_{11} - x & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} - x & \dots & a_{2n} \\ \vdots & \vdots & \dots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} - x \end{vmatrix}.$$

The End

Thank you for your attention!