

Vector Geometry

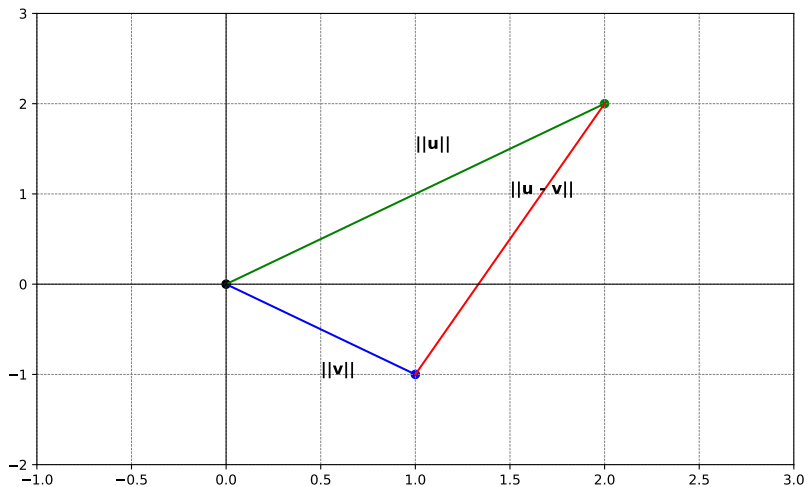
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Learning Objectives

- ▶ Discuss the computational, geometric, and algebraic views of vectors.
- ▶ Recall the notion of the inner product and use it for vector geometry, covering the concepts of, length, distance, orthogonality, and angle.
- ▶ Introduce k -Nearest Neighbors (k -NN), a supervised, nonparametric classifier.
- ▶ Discuss the curse of dimensionality, the reason behind the ineffectiveness of k -NN in high dimensions, and a potential solution for it

Vector Geometry



Computational View of Vectors

- ▶ A list of real numbers with only one column is called a **column vector**, or simply a **vector**.
- ▶ The set of real numbers of dimension d is denoted as \mathbb{R}^d .
- ▶ These are vectors in \mathbb{R}^2

$$\mathbf{a} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} 0.2 \\ 0.3 \end{bmatrix}, \quad \mathbf{c} = \begin{bmatrix} w_1 \\ w \end{bmatrix}$$

- ▶ These are vectors in \mathbb{R}^3

$$\mathbf{a} = \begin{bmatrix} 4 \\ -2 \\ 7 \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} 1.1 \\ 0.0 \\ -1.3 \end{bmatrix}, \quad \mathbf{c} = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix}$$