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Chapter 2 - Linear Algebra with NumPy

2.1 Data and Matrix

- Data Type

i) Scalar ii) Vector iii) matrix iv) tensor.

i) Scalar

$$x \in R$$

ii) Vector

<n-dimensional vector>

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}, \quad x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_N \end{bmatrix}, \quad x \in R^N$$

$$x_1 = \begin{bmatrix} 5.1 \\ 3.5 \\ 1.4 \\ 0.2 \end{bmatrix} \quad x_2 = \begin{bmatrix} 4.9 \\ 3.0 \\ 1.4 \\ 0.2 \end{bmatrix}$$

iii) Matrix

$$X = \begin{bmatrix} x_{1,1} & x_{1,2} & x_{1,3} & x_{1,4} \\ x_{2,1} & x_{2,2} & x_{2,3} & x_{2,4} \\ x_{3,1} & x_{3,2} & x_{3,3} & x_{3,4} \\ x_{4,1} & x_{4,2} & x_{4,3} & x_{4,4} \\ x_{5,1} & x_{5,2} & x_{5,3} & x_{5,4} \end{bmatrix}$$

$$X \in R^{5 \times 4}$$

iv) tensor : Several Matrixes

- Transpose : Convert row and column

$$x \rightarrow x^T \quad \text{or} \quad x \rightarrow x'$$

$$X = \begin{bmatrix} x_{11} & x_{12} & x_{13} & x_{14} \\ x_{21} & x_{22} & x_{23} & x_{24} \\ x_{31} & x_{32} & x_{33} & x_{34} \\ x_{41} & x_{42} & x_{43} & x_{44} \\ x_{51} & x_{52} & x_{53} & x_{54} \\ x_{61} & x_{62} & x_{63} & x_{64} \end{bmatrix} \rightarrow X^T = \begin{bmatrix} x_{11} & x_{21} & x_{31} & x_{41} & x_{51} & x_{61} \\ x_{12} & x_{22} & x_{32} & x_{42} & x_{52} & x_{62} \\ x_{13} & x_{23} & x_{33} & x_{43} & x_{52} & x_{63} \\ x_{14} & x_{24} & x_{34} & x_{44} & x_{54} & x_{64} \end{bmatrix}$$