Linear Algebra

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1 Basics

The size of a matrix is given by (no. of rows x no of colums)

Unless otherwise stated, a vector means a column vector. (k,1) and say it is in R^k.

1.1 product of matrix with vector

If the column vectors of a (n, m) matrix A, are $\vec{v_1}, \vec{v_2}, \cdots, \vec{v_m}$, and $\vec{x}$ is a vector in R^m with components $x_1, x_2, \cdots, x_m$, then the product is defined as (in terms of the columns of the matrix)

$$\begin{bmatrix} \vec{v_1} & \vec{v_2} & \cdots & \vec{v_m} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_m \end{bmatrix} = x_1\vec{v_1} + x_2\vec{v_2} + \cdots + x_m\vec{v_m} \tag{1}$$

The same product of matrix A and vecotr x but in terms of row vectors $\vec{w_1}, \vec{w_2}, \cdots, \vec{w_n}$ is given in terms of rows of matrix A is:

$$\begin{bmatrix} \vec{w_1} \\ \vdots \\ \vec{w_n} \end{bmatrix} \vec{x} = \begin{bmatrix} \vec{w_1} \cdot \vec{x} \\ \vdots \\ \vec{w_n} \cdot \vec{x} \end{bmatrix} \tag{2}$$