Sid

Matrix : rows x columns $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \\ j & k & l \end{bmatrix}$ 4 x 3 matrix

Vector : Matrix w/ 1 column
- Subset of matrix

$\begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix}$ 4 x 1 matrix

A_{ij} : element at i^{th} row & j^{th} column

V_i : element in i^{th} row of n-dimensional vector

Addition

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} a+w & b+x \\ c+y & d+z \end{bmatrix}$$

Subtraction

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} - \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} a-w & b-x \\ c-y & d-z \end{bmatrix}$$

Scalar Multiplication

$$x \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} a \cdot x & b \cdot x \\ c \cdot x & d \cdot x \end{bmatrix}$$

Matrix - Vector Multiplication
- result is a vector
- # of columns of matrix = # of rows of vector

$$\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} ax + by \\ cx + dy \\ ex + fy \end{bmatrix} \quad (3 \times 2) \cdot (2 \cdot 1) = (3 \cdot 1)$$

Matrix - Matrix Multiplication

$$\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix} \times \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \\ ew + fy & ex + fz \end{bmatrix}$$

$$(m \times n) \cdot (n \times o) = (m \times o)$$

$$(3 \times 2) \cdot (2 \times 2) = (3 \times 2)$$

col of first matrix = rows of second matrix

Properties

$$A \cdot B \neq B \cdot A$$

$$(A \cdot B) \cdot C = A \cdot (B \cdot C)$$

identity matrix : multiplied by any matrix w/ same dim. = original matrix

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Inverse (A^{-1}) - pinv(A)

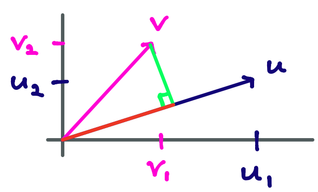
$A \cdot A^{-1} = I$ (identity matrix)

Transpose - A' or transpose (A)

$$A_{ij} = A'_{ji} \qquad A = \begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix}, \quad A' \begin{bmatrix} a & c & e \\ b & d & f \end{bmatrix}$$

Vector Inner Product

$$\vec{u} = \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \qquad \vec{v} = \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$$



$$\|\vec{u}\| = \sqrt{u_1^2 + u_2^2}$$

$$u^T v = p \cdot \|\vec{u}\|$$

$$= u_1 v_1 + u_2 v_2$$

$$\begin{bmatrix} u_1 & u_2 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$$