Lecture 3

→ Matrix Multiplication (4 ways)

→ Inverse of A AB & A^T

→ Gauss-Jordan / find A^{-1}

→ First way: {Normal Element by Element}

→ Second way {Combination of Rows}

→ Third way {Combination of Columns}

→ Forth way

$$AB = \sum (\text{col's of } A) \times (\text{rows of } B)$$

Example

$$\begin{bmatrix} 2 & 7 \\ 3 & 8 \\ 4 & 9 \end{bmatrix} \begin{bmatrix} 1 & 6 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} \begin{bmatrix} 1 & 6 \end{bmatrix} + \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix} \begin{bmatrix} 0 & 0 \end{bmatrix}$$

Block Multiplication

$$\left[\begin{array}{c|c} A_1 & A_2 \\ \hline A_3 & A_4 \end{array}\right] \left[\begin{array}{c|c} B_1 & B_2 \\ \hline B_3 & B_4 \end{array}\right] = \left[\begin{array}{c|c} A_1B_1 + A_2B_3 & \\ \hline & \end{array}\right]$$

Matrices

Inverses {Square Matrix}

Consider a Square matrix A, If you can find some vectore x such that

$$Ax = 0 \quad \{x \text{ is not zero vector}\}$$

then A is non invertible

Proof

Consider A is invertible & we find a non zero x.

then, $Ax = 0$

$$\Rightarrow A^{-1}Ax = A^{-1}0$$

$$\Rightarrow x = 0$$

which is not true hence A is no invertible

$$A^{-1}A = I = AA^{-1}$$

True but hard to proof

Gauss Jordan

Example

$$\underbrace{\begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}}_{A} \begin{bmatrix} a & c \\ b & d \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\Rightarrow \left[\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 2 & 7 & 0 & 1 \end{array}\right] \rightarrow \left[\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 0 & 1 & -2 & 1 \end{array}\right]$$

$$\left[\begin{array}{cc|cc} 1 & 0 & 7 & -3 \\ 0 & 1 & -2 & 1 \end{array}\right]$$

A^{-1}