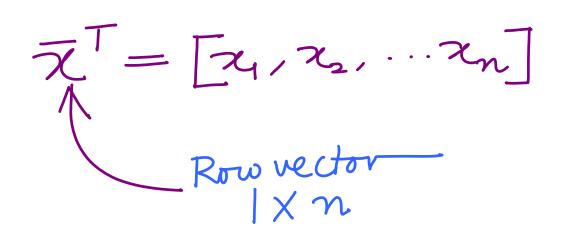
X

MATHEMATICAL

PRELIMINARIES:



$$\overline{\chi} \overline{\chi} = [\underline{\chi}_{1} \chi_{2} ... \chi_{n}] [\underline{\chi}_{1}]$$

$$= \chi_{1}^{2} + \chi_{2}^{2} + ... + \chi_{n}^{2}$$

$$= \|\underline{\chi}\|_{2}^{2}$$

$$\underline{\xi}_{norm} = \text{Default}$$

 $||z|| = \sqrt{x_1^2 + x_2^2 + \dots + x_n^2}$ length of vector COMPLEX VECTORS $\chi_1, \chi_2, \ldots, \chi_n \in \mathbb{C}$ Complex Numbers. ⇒ 元 e £ n dimensional. Complex vectors.

$$\overline{\chi}^{H} = \begin{bmatrix} \chi_{1}^{+} \chi_{2}^{+} & \dots & \chi_{n}^{+} \end{bmatrix}$$

$$\begin{array}{c}
\text{Row vector} \\
+ \text{ complex conjugate} \\
\text{of elements}
\end{array}$$

$$\overline{\chi}^{H} \overline{\chi} = \begin{bmatrix} \chi_{1}^{+} \chi_{2}^{+} & \dots & \chi_{n}^{+} \end{bmatrix} \begin{bmatrix} \chi_{1} \\ \chi_{2} \\ \dots & \chi_{n} \end{bmatrix}$$

$$= |\chi_{1}|^{2} + |\chi_{2}|^{2} + \dots \\
+ |\chi_{n}|^{2}$$

$$= |\chi||_{2}$$

|| Tell = | Ze| + 1 + | Ze| + 1 + | Ze| = | General Definition |

For real & complex vectors.

 $\tilde{\chi} = \frac{\tilde{\chi}}{\|\tilde{\chi}\|}$ $\tilde{\chi} = \frac{\tilde{\chi}}{\|\tilde{\chi}\|}$ $2^{1}.2^{1}.2^{1}.2^{1}$ $= \frac{2^{1}.2^{1}.2^{1}}{||2||^{2}} = 1$

$$\Rightarrow \frac{\|\tilde{\chi}\|^2 - 1}{\|\tilde{\chi}\| - 1}$$

$$\Rightarrow \frac{\|\tilde{\chi}\|^2 - 1}{\|\tilde{\chi}\| - 1}$$

$$e_{x}: \tilde{\chi} = T_1T_1$$

$$||\overline{x}|| = \sqrt{1 + 1 + \dots + 1}$$

$$= \sqrt{n} \quad \text{witNm}$$

$$||\overline{x}||^2 = n$$

$$||\overline{x}||^2 = \frac{1}{||\overline{x}||} = \frac{1}{||\overline{x}||}$$

MATRICES:

$$A = m \times n \quad matrix$$

$$\Rightarrow \quad m \quad rows$$

$$n \quad when ns$$

$$A = \begin{cases} a_{11} & a_{12} & a_{1n} \\ a_{21} & a_{21} & a_{2n} \\ \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & a_{mn} \end{cases}$$

$$mrows$$

$$n \quad when s$$

 $\overline{W}_1,\overline{W}_2,\ldots,\overline{W}_m$ 1/ m Vectors. mear Independence (LI) Linearly independent if there do NOT exist C1, C2, there do NOT all zero) such that $C_1W_1 + C_2W_2 + \cdots + C_mW_m =$ Linear Combination

Linear Dependence:

Linearly dependent if there exist $c_1, c_2, ..., c_m$ NoT all zero, such that

$$\overline{W}_{1} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \overline{W}_{2} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

$$\overline{W}_{1}, \overline{W}_{2} \text{ are linearly independent}$$

$$\Rightarrow \text{ There do NOT expet}$$

$$C_{1}, C_{2} \text{ (NOT both Zero)}$$

$$\text{such that}$$

$$C_{1}\overline{W}_{1} + C_{2}\overline{W}_{2} = 0$$

$$A = \begin{bmatrix} \overline{a}_{1}, \overline{a}_{2}, \dots, \overline{a}_{m} \end{bmatrix}$$

$$= \begin{bmatrix} \overline{a}_{1} & \overline{a}_{2}, \dots, \overline{a}_{m} \end{bmatrix}$$

Column rank of A = maximum number of linearty independent columns of A Row rank of A = maximum number finearly independent

Rowrank(A) = column rank(A) = rank(A) Tank (A) < min & m. n. 3

rows. # columns

rank < minimum of rows

Number of rows

Lulumns of

the matrix.