HCMC University of Technology and Education

Faculty of Electrical & Electronic Engineering

IMAGE PROCESSING

Chapter 2:

Fundamentals

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Matrix transforms

Symmetric matrix

In linear algebra, a **symmetric matrix** is a square matrix that is equal to its transpose. Formally, matrix *A* is symmetric if

$$A = A^T$$

$A = (a_{ij})$, then $a_{ij} = a_{ji}$

The following 3 × 3 matrix is symmetric:

$$A = A^T = \begin{bmatrix} 1 & 7 & 3 \\ 7 & 4 & -5 \\ 3 & -5 & 6 \end{bmatrix}$$

Transpose matrix

- write the rows of **A** as the columns of $\mathbf{A}^T$
- write the columns of **A** as the rows of $\mathbf{A}^T$

$$[A^T]_{ij} = [A]ji$$

The following 3 × 2 matrix is transpose:

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}^T = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{bmatrix}$$

Orthogonal matrix

In linear algebra, an **orthogonal matrix or real orthogonal matrix** is a square matrix with real entries whose columns and rows are orthogonal unit vectors.

$$AA^T = A^T A = I$$

I is the identity matrix, in which the diagonal values are 1

The following 3 × 3 matrix is orthogonal:

$$AA^T = A^T A = I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Matrix multiplication

the product **AB** is defined to be the product of column in **B** and row in **A**

$$A = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & k \end{bmatrix}; B = \begin{bmatrix} \alpha & \beta & \gamma \\ \lambda & \mu & \phi \\ \sigma & \omega & \theta \end{bmatrix}$$

Calculate the AB matrix:

$$AB = ?$$

Matrix addition

Calculate the (A+B) matrix:

$$A = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & k \end{bmatrix}; B = \begin{bmatrix} \alpha & \beta & \gamma \\ \lambda & \mu & \phi \\ \sigma & \omega & \theta \end{bmatrix}$$

$$A + B = ?$$

Similarly, calculate the (A-B) matrix=?

Calculate the axA matrix=?, with a=number.

The End