جامـــــعـة المـــــسـتـقـبـل
AL MUSTAQBAL UNIVERSITY

كلية العلـــــوم
قـســـــــــــم علوم الذكاء الاصطناعي

المحاضرة الثالثة

mathematics : المادة
المرحلة : الاولى

اسم الاستاذ: م.د. رياض حامد سلمان

MATRICES المصفوفات

Determinant, Symmetric Matrix, and Transpose of a Matrix:

Determinant (المحدد)

The determinant is a scalar value calculated from a square matrix (number of rows equals the number of columns). It is useful in determining whether a matrix:

- Has an inverse (if the determinant is **non-zero**, the matrix has an inverse).
- Represents certain transformations in geometry (e.g., area scaling).

Properties:

- If **det(A) = 0**, the matrix **A** does not have an inverse.
- Determinants are only defined for square matrices.

Example1: Given the 2×2 matrix:

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$$

The determinant is calculated as:

$$\det(A) = (2)(4) - (3)(1) = 8 - 3 = 5$$

Example2: Given the 3×3 matrix:

$$B = \begin{bmatrix} 1 & 1 & 3 \\ 2 & 0 & -1 \\ 1 & 4 & 2 \end{bmatrix}$$

The determinant is calculated as:

$$det\ (B) = (1*0*2) + (1*-1*1) + (3*2*4) - (3*0*1) - (1*2*2) - (1*-1*4) = 0 + (-1) + 24 - 3 - 4 + 4 = 20$$

Transpose (نقل المصفوفة)

The **transpose** of a matrix involves switching its rows with its columns. If A is a matrix, the transpose is denoted as A^T.

Steps to Find Transpose:

- The element in row i, column j of A becomes the element in row j, column i of A^T.

Example 1: Given the matrix:

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

The transpose is:

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

Example 2: Given the matrix:

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

The transpose is:

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

Symmetric Matrix (المصفوفة المتناظرة)

A **symmetric matrix** is a square matrix that is equal to its transpose, i.e.,

$$A = A^T$$

Example:

Given the matrix:

$$A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$$

The transpose of A is:

$$A^T = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$$

Since $A = A^T$, the matrix is symmetric.