جامـــــعة المـــستـقبـل
AL MUSTAQBAL UNIVERSITY

كلية العلـــوم
قـســــــــم علوم الذكاء الاصطناعي

المحاضرة الاولى

المادة : mathematics

المرحلة : الاولى

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MATRICES المصفوفات

MATRICES

A matrix is a rectangular arrangement of numbers organized into rows and columns. Mathematically, it can be represented as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

Where each $\boldsymbol{a_{ij}}$ represents an element in row i and column j

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Matrices Algebra

1- Matrices addition and subtraction

Addition and subtraction of matrices can be performed for matrices of the same order, meaning they have the same number of rows and the same number of columns. If (A) and (B) are matrices of the same order, then their sum is defined as the matrix (C), which has the same order, and each element of (C) is equal to the sum of the corresponding elements in (A) and (B).

EXAMPLE:

$$A = \begin{pmatrix} 1 & -2 & 1 \\ 3 & 0 & 5 \end{pmatrix} \quad , \quad B = \begin{pmatrix} 3 & 6 & 5 \\ 2 & 2 & -1 \end{pmatrix}$$

$$\therefore C = A + B = \begin{pmatrix} 1+3 & -2+6 & 1+5 \\ 3+2 & 0+2 & 5-1 \end{pmatrix} = \begin{pmatrix} 4 & 4 & 6 \\ 5 & 2 & 4 \end{pmatrix}$$

$$D = A - B = \begin{pmatrix} 1-3 & -2-6 & 1-5 \\ 3-2 & 0-2 & 5+1 \end{pmatrix} = \begin{pmatrix} -2 & -8 & -4 \\ 1 & -2 & 6 \end{pmatrix}$$

❖ From the definition, it can be proven that the sum of matrices has the following properties:

$$A + B = B + A$$
$$A + (B + C) = (A + B) + C = A + B + C$$

2- Matrix Multiplication:

Matrix multiplication is defined for two matrices A and B when the number of columns in A is equal to the number of rows in B. The resulting matrix C=A*B will have dimensions determined by the number of rows in A and the number of columns in B.

The elements of the resulting matrix C are calculated as follows:

$$c_{ij} = \sum_{k=1} a_{ik} * b_{kj}$$

Where:

- c_{ij} is the element in the i^{th} row and j^{th} column of matrix C.
- a_{ik} is the element in the i^{th} row and k^{th} column of matrix A.
- b_{kj} is the element in the k^{th} row and j^{th} column of matrix B.
- n is the shared dimension (number of columns in A or rows in B).

Example:

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

then the product C=A⋅B is calculated as:

$$C = \begin{bmatrix} (1*5+2*7) & (1*6+2*8) \\ (3*5+4*7) & (3*6+4*8) \end{bmatrix}$$

$$C = \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$$

❖ Scalar Multiplication.

$$A = \begin{pmatrix} 1 & 3 & 2 \\ 2 & -1 & 0 \end{pmatrix} \qquad \therefore mA = \begin{pmatrix} m & 3m & 2m \\ 2m & -m & 0 \end{pmatrix}$$

EX: IF A matrix , m=3 find the Scalar Multiplication C=3*A:

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

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

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$$C = \begin{bmatrix} 3 & 6 \\ 9 & 9 \\ -3 & 12 \end{bmatrix}$$

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