Operations on Matrices

Michael Brodskiy
Professor: Lynn Knight

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- Matrix – An ordered array of numbers

  1. Dimensions (size) – Expressed as row by column (r x c)
  2. Addition – Let $A = [a_{ij}]$ and $B = [b_{ij}]$, then $A + B = [a_{ij} + b_{ij}]$, assuming the matrix dimensions are equal
  3. Scalar Multiplication – Let c be a constant and $A = [a_{ij}]$. Then $cA = [ca_{ij}]$
  4. Zero Matrix – Ex. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$
  5. Equality – Let $A = [a_{ij}]$ and $B = [b_{ij}]$. $A = B$ iff $a_{ij} = b_{ij}$
  6. Matrix Multiplication

     (a) Dot Product – Given two matrices, $A = \begin{bmatrix} a_1 & a_2 & \dots & a_n \end{bmatrix}$ and $B = \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix}$, the product is $a_1b_1 + a_2b_2 + \cdots + a_nb_n$. This can only be done if the dimensions of A are m x n and the dimensions of B are n x m.

- Diagonal Matrix: $A = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ 0 & a_{22} & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & a_{nn} \end{bmatrix}$. Must be a square matrix.

- Traces of a matrix are the sums of the main diagonal components