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Matrix Multiplication

General Case

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Intro to ECSE

Multiply matrices **A** and **B**

In order for matrix multiplication to be possible:
number of columns in matrix A = number of rows in matrix B

\# of rows

Let the size (or order or dimension) of matrix A = N x M

\# of columns

Let the size (or order or dimension) of matrix B = M x K → # of columns

\# of rows

Size of the resulting matrix Z = A.B will be N x K

columns

rows

$$A = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1M} \\ A_{21} & A_{22} & \cdots & A_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ A_{N1} & A_{N2} & \cdots & A_{NM} \end{bmatrix}_{\underline{\underline{N}} \times M}$$

$$B = \begin{bmatrix} B_{11} & B_{12} & \cdots & B_{1K} \\ B_{21} & B_{22} & \cdots & B_{2K} \\ \vdots & \vdots & \ddots & \vdots \\ B_{M1} & B_{M2} & \cdots & B_{MK} \end{bmatrix}_{M \times \underline{\underline{K}}}$$

$$A \cdot B = \begin{bmatrix} \sum_{i=1}^{M} A_{1i} B_{i1} & \sum_{i=1}^{M} A_{1i} B_{i2} & \cdots & \sum_{i=1}^{M} A_{1i} B_{iK} \\ \sum_{i=1}^{M} A_{2i} B_{i1} & \sum_{i=1}^{M} A_{2i} B_{i2} & \cdots & \sum_{i=1}^{M} A_{2i} B_{iK} \\ \vdots & \vdots & \ddots & \vdots \\ \sum_{i=1}^{M} A_{Ni} B_{i1} & \sum_{i=1}^{M} A_{Ni} B_{i2} & \cdots & \sum_{i=1}^{M} A_{Ni} B_{iK} \end{bmatrix}_{N \times K}$$