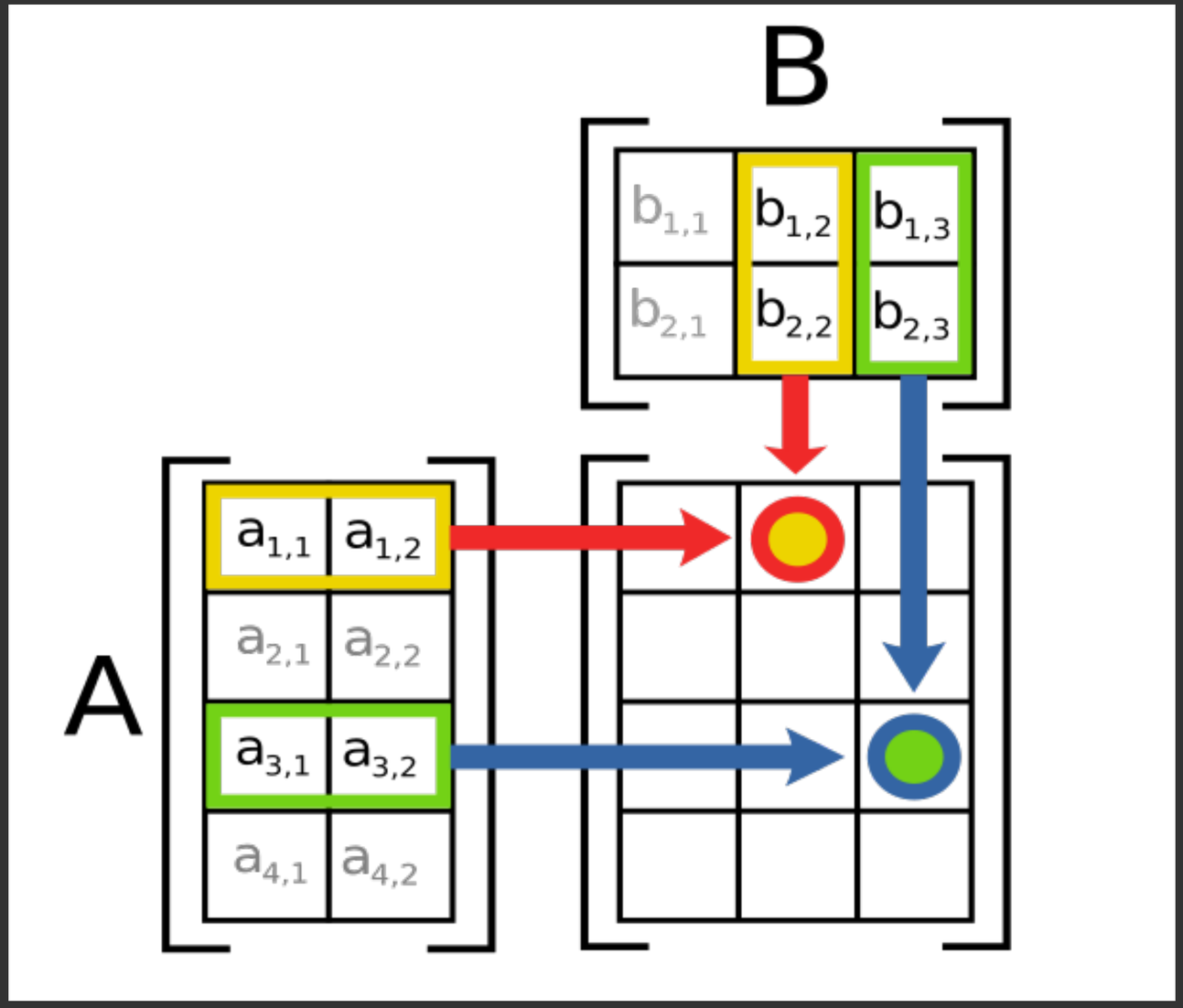
matrix arithmetic: matrix multiplication



[source: https://commons.wikimedia.org/wiki/File:Matrix_multiplication_diagram_2.svg]

matrix arithmetic: matrix multiplication

example

Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$. What is AB?

Compute each element of resulting matrix $C = A \times B$ by summing products of rows of A and columns of B:

$C = \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix}$ where

$$c_{11} = 1 \cdot 5 + 2 \cdot 7 = 5 + 14 = 19$$
$$c_{12} = 1 \cdot 6 + 2 \cdot 8 = 6 + 16 = 22$$
$$c_{21} = 3 \cdot 5 + 4 \cdot 7 = 15 + 28 = 43$$
$$c_{22} = 3 \cdot 6 + 4 \cdot 8 = 18 + 32 = 50$$

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