Non-square matrix multiplication

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Practice Assignment • 20 min

English

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1. In the previous lecture we saw the Einstein summation convention, in which we sum over any indices which are repeated. In traditional notation we might write, for example, $\sum_{j=1}^{3} A_{ij}v_j = A_{i1}v_1 + A_{i2}v_2 + A_{i3}v_3$. With the Einstein summation convention we can avoid the big sigma and write this as $A_{ij}v_j$. We know that we sum over j because it appears twice.

1 / 1 point

We saw that thinking about this type of notation helps us to multiply non-square matrices together. For example, consider the matrices

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 0 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix},$$

and remember that in the A_{ij} notation the first index i represents the row number and the second index j represents the column number. For example, $A_{12} = 2$.

Let's define the matrix $C = AB$. Then in Einstein summation convention notation $C_{mn} = A_{mj}B_{jn}$.

Using the Einstein summation convention, calculate $C_{21} = A_{2j}B_{j1}$.

- ○ $C_{21} = 3$
- ○ $C_{21} = 4$
- ◉ $C_{21} = 5$
- ○ $C_{21} = 6$