Maths Worksheet 1: Working with Matrices

This worksheet covers matrix addition, subtraction, and multiplication. These are key skills for building neural networks. If you would like feedback on this work, feel free to submit it to: gabriella.miles@bristol.ac.uk once you have completed it.

Worked Example 1: Matrix Addition

You are given $A = \begin{bmatrix} 6 & 7 \\ 3 & 2 \end{bmatrix}$, and $B = \begin{bmatrix} 1 & 6 \\ 5 & 4 \end{bmatrix}$. Calculate $A + B$:

$$A + B = \begin{bmatrix} 6 & 7 \\ 3 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 6 \\ 5 & 4 \end{bmatrix} \tag{1}$$

For addition, we simply add each element of the matrix to get:

$$A + B = \begin{bmatrix} 6+1 & 7+6 \\ 3+5 & 2+4 \end{bmatrix} = \begin{bmatrix} 7 & 13 \\ 8 & 6 \end{bmatrix} \tag{2}$$

Here are some questions that you can practice:

1.
$$\begin{bmatrix} 5 & -2 \\ 4 & -3 \end{bmatrix} + \begin{bmatrix} -11 & 7 \\ 2 & 1 \end{bmatrix} \tag{3}$$

2.
$$\begin{bmatrix} 2.4 & 9.1 \\ 5.6 & -3.4 \end{bmatrix} + \begin{bmatrix} 9.1 & -7.4 \\ 2.7 & 1.1 \end{bmatrix} \tag{4}$$

3.
$$\begin{bmatrix} 14 & 7 \\ -12 & 9 \end{bmatrix} + \begin{bmatrix} 8 & 6 \\ 5 & 13 \end{bmatrix} \tag{5}$$

4.
$$\begin{bmatrix} 5x & -2y \\ 4z & -3x \end{bmatrix} + \begin{bmatrix} -11x & 7y \\ 2z & x \end{bmatrix} \tag{6}$$

Worked Example 2: Matrix Subtraction

This is very similar to our addition problem, let's use the same matrices:

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

To calculate $A - B$:

$$A - B = \begin{bmatrix} 6 & 7 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} 1 & 6 \\ 5 & 4 \end{bmatrix} \tag{7}$$

We then subtract each element of the matrix, to get:

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

Here are some questions that you can practice:

1. $$\begin{bmatrix} 5 & -2 \\ 4 & -3 \end{bmatrix} - \begin{bmatrix} -11 & 7 \\ 2 & 1 \end{bmatrix} \tag{9}$$

2. $$\begin{bmatrix} 2.4 & 9.1 \\ 5.6 & -3.4 \end{bmatrix} - \begin{bmatrix} 9.1 & -7.4 \\ 2.7 & 1.1 \end{bmatrix} \tag{10}$$

3. $$\begin{bmatrix} 14 & 7 \\ -12 & 9 \end{bmatrix} - \begin{bmatrix} 8 & 6 \\ 5 & 13 \end{bmatrix} \tag{11}$$

4. $$\begin{bmatrix} 5x & -2y \\ 4z & -3x \end{bmatrix} - \begin{bmatrix} -11x & 7y \\ 2z & x \end{bmatrix} \tag{12}$$

Worked Example 3: Matrix Multiplication

Multiplication is a little bit more complicated than addition or subtraction. Let's use some general matrices to get an idea of what I mean:

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \times \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae+bg & af+bh \\ ce+dg & cg+dh \end{bmatrix} \tag{13}$$

So carrying out the calculation with the matrices A and B used previously, we get:

$$A \times B = \begin{bmatrix} 6 & 7 \\ 3 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 6 \\ 5 & 4 \end{bmatrix} \tag{14}$$

$$A \times B = \begin{bmatrix} 6\times 1+7\times 5 & 6\times 6+7\times 4 \\ 3\times 1+2\times 5 & 3\times 6+2\times 4 \end{bmatrix} = \begin{bmatrix} 41 & 64 \\ 13 & 26 \end{bmatrix} \tag{15}$$

Here are some questions that you can practice:

1. $$\begin{bmatrix} 5 & -2 \\ 4 & -3 \end{bmatrix} \times \begin{bmatrix} -11 & 7 \\ 2 & 1 \end{bmatrix} \tag{16}$$

2. $$\begin{bmatrix} 2.4 & 9.1 \\ 5.6 & -3.4 \end{bmatrix} \times \begin{bmatrix} 9.1 & -7.4 \\ 2.7 & 1.1 \end{bmatrix} \tag{17}$$

3. $$\begin{bmatrix} 14 & 7 \\ -12 & 9 \end{bmatrix} \times \begin{bmatrix} 8 & 6 \\ 5 & 13 \end{bmatrix} \tag{18}$$

4. $$\begin{bmatrix} 5x & -2y \\ 4z & -3x \end{bmatrix} \times \begin{bmatrix} -11x & 7y \\ 2z & x \end{bmatrix} \tag{19}$$