MTMA33 – A Reminder About Matrices

Many programming tasks will require the manipulation of arrays or matrices. With that in mind, this is a short reminder (hopefully) about basic matrix manipulation via some simple examples.

Addition: simply addition of corresponding elements: $\begin{bmatrix}1 & 3\\4 & 2\end{bmatrix} + \begin{bmatrix}7 & 6\\9 & 8\end{bmatrix} = \begin{bmatrix}8 & 9\\13 & 10\end{bmatrix}$

Subtraction: similar to addition: $\begin{bmatrix}7 & 6\\9 & 8\end{bmatrix} - \begin{bmatrix}1 & 3\\4 & 2\end{bmatrix} = \begin{bmatrix}6 & 3\\5 & 6\end{bmatrix}$

Multiplication: More complicated, if doing *AB* (*A* times *B*), the number of columns of *A* must be equal to the number of rows of *B*, the result will have the same number of rows as *A* and columns as *B*. It is important to be aware than *AB* is different to *BA* (not commutative).

Examples:

$$\begin{bmatrix}2 & 3 & 1\end{bmatrix}\begin{bmatrix}4\\5\\6\end{bmatrix} = (4 \times 2) + (5 \times 3) + (6 \times 1) = [29]$$

$$\begin{bmatrix}1 & 4 & 2\\2 & -5 & 1\\3 & 3 & -1\end{bmatrix}\begin{bmatrix}1\\0\\-1\end{bmatrix} = \begin{bmatrix}(1 \times 1) + (4 \times 0) + (2 \times -1)\\(2 \times 1) + (-5 \times 0) + (1 \times -1)\\(3 \times 1) + (3 \times 0) + (-1 \times -1)\end{bmatrix} = \begin{bmatrix}-1\\1\\4\end{bmatrix}$$

$$\begin{bmatrix}1 & 0\\2 & -1\end{bmatrix} \times \begin{bmatrix}1 & 4\\2 & 3\end{bmatrix} = \begin{bmatrix}(1 \times 1) + (0 \times 2) & (1 \times 4) + (0 \times 3)\\(2 \times 1) + (-1 \times 2) & (2 \times 4) + (-1 \times 3)\end{bmatrix} = \begin{bmatrix}1 & 4\\0 & 5\end{bmatrix}$$

Note there is a difference between matrix maths and element wise maths.

So if $A = \begin{bmatrix}1 & 0\\2 & -1\end{bmatrix}$ & $B = \begin{bmatrix}1 & 4\\2 & 3\end{bmatrix}$;

*A*B in matrix maths is* $\begin{bmatrix}1 & 4\\0 & 5\end{bmatrix}$ but in element wise maths is $\begin{bmatrix}1 & 0\\4 & -3\end{bmatrix}$

Transpose: This is essentially a reflection through the main diagonal... writing the rows as columns and columns as rows... this can be very handy in programs.

$$A = \begin{bmatrix}1 & 0\\2 & -1\end{bmatrix} \quad hence\ np.transpose(A) = \begin{bmatrix}1 & 2\\0 & -1\end{bmatrix}$$