2019 - 10 - 11

- product between matrix and vector

$$Mv$$

$$\boxed{\quad M \quad}\ \boxed{v} = \boxed{Mv}$$

$$Xw = [c_1, c_2, \dots, c_m]\begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_m \end{bmatrix} = w_1 c_1 + w_2 c_2 + \cdots + w_m c_m$$

$$\begin{bmatrix} \boxed{c_1} & \boxed{c_2} & \cdots & \boxed{c_m} \end{bmatrix}\begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_m \end{bmatrix} = w_1 \boxed{c_1} + w_2 \boxed{c_2} + \cdots + \boxed{w_m}\boxed{c_m}$$

Practice

prove Xw is equal to $w_1c_1 + w_2c_2 + w_3c_3$ (linear form)

$$X = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}, \quad w = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$$

① $Xw = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} = \begin{bmatrix} 2+6+12 \\ 8+15+29 \end{bmatrix} = \begin{bmatrix} 20 \\ 41 \end{bmatrix}$

$2\times3 \quad 3\times1 \Rightarrow 2\times1$

$\cancel{② \ w_1c_1 + w_2c_2 + w_3c_3 = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}\begin{bmatrix} 1 \\ 4 \end{bmatrix} + \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}\begin{bmatrix} 2 \\ 5 \end{bmatrix} + \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}\begin{bmatrix} 3 \\ 6 \end{bmatrix}}$

$\cancel{= [1, 4]\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} + [2, 5]\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} + [3, 6]\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}}$

② $w_1c_1 + w_2c_2 + w_3c_3 = 2 \cdot \begin{bmatrix} 1 \\ 4 \end{bmatrix} + 3\begin{bmatrix} 2 \\ 5 \end{bmatrix} + 4\begin{bmatrix} 3 \\ 6 \end{bmatrix}$

$= \begin{bmatrix} 2 \\ 8 \end{bmatrix} + \begin{bmatrix} 6 \\ 15 \end{bmatrix} + \begin{bmatrix} 12 \\ 24 \end{bmatrix} = \begin{bmatrix} 20 \\ 41 \end{bmatrix}$

Answer proved that both are same