Com S 574	Spring Semester 2021
Machine Learning	
Homework 5	
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1 no question

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} 0.5 & 0.1 & 0.3 \\ -1 & -20 & 1.5 \end{bmatrix}$$

$$A \circ B = \begin{bmatrix} 1 \times 0.5 & 2 \times 0.1 & 3 \times 0.3 \\ 3 \times -1 & 2 \times -20 & 1 \times 1.5 \end{bmatrix}$$

$$A \circ B = \begin{bmatrix} 0.5 & 0.2 & 0.9 \\ -3 & -40 & 1.5 \end{bmatrix}$$

2 no Question

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

$$B^T = \begin{bmatrix} 0.5 & -1 \\ 0.1 & -20 \\ 0.3 & 1.5 \end{bmatrix}$$

$$AB^T = \begin{bmatrix} 1.6 & -36.5 \\ 2 & -41.5 \end{bmatrix}$$

$$B = \begin{bmatrix} 0.5 & 0.1 & 0.3 \\ -1 & -20 & 1.5 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 1 & 3 \\ 2 & 2 \\ 3 & 1 \end{bmatrix}$$

$$BA^T = \begin{bmatrix} 1.6 & 2 \\ -36.5 & -41.5 \end{bmatrix}$$

3 no Question

Product of A and B is not possible as in matrix multiplication number of rows of 1st matrix must be equal to the number of columns of the second one.

4 no Question

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

$$B^T = \begin{bmatrix} 0.5 & -1 \\ 0.1 & -20 \\ 0.3 & 1.5 \end{bmatrix}$$

$$AB^T = \begin{bmatrix} 1.6 & -36.5 \\ 2 & -41.5 \end{bmatrix}$$

$$f(x) = x + 1$$
$$f(AB^T) = AB^T + 1$$

$$= \begin{bmatrix} 2.6 & -35.5 \\ 3 & -40.5 \end{bmatrix}$$

5 no Question

We can get it in the following way:

$\frac{\partial E}{\partial \tilde{y}} = 2(\tilde{y} - y)$

$\frac{\partial W^T X}{\partial \tilde{w}_i} = x$ (one sample)

$\frac{\partial \tilde{y}}{\partial W^T X} = 1$

$\frac{\partial E}{\partial w_i} = 2(\tilde{y} - y) * x$

6 no Question

Given,

$x = \begin{bmatrix} x_0, x_1, x_2, x_3 \end{bmatrix}$

$$= \begin{bmatrix} 1, 0, 1, 0 \end{bmatrix}$$

$$w = \begin{bmatrix} w_0 \\ w_1 \\ w_2 \\ w_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 6 \\ 1 \end{bmatrix}$$

Prediction -

$$\hat{y} = \phi(W^T X)$$
$$= \phi(W_0 X_0 + W_1 X_1 + W_2 X_2 + W_3 X_3))$$
$$= \phi(11)$$
$$= 11^2 = 121$$

7 no Question

$$\frac{\partial E}{\partial X_1} = \frac{\partial}{\partial X_1}(\hat{y} - y)$$
$$= \frac{\partial}{\partial X_1}(W_0 X_0 + W_1 X_1 + W_2 X_2 + W_3 X_3)^2 \text{ - } \frac{\partial}{\partial X_1}(y)$$
$$= 2 \times (W_0 X_0 + W_1 X_1 + W_2 X_2 + W_3 X_3) \times W_1$$
$$= 2 \times (11) \times 4 - 0$$
$$= 88$$

$$\frac{\partial E}{\partial W_1} = \frac{\partial}{\partial W_1}(\hat{y} - y)$$
$$= 2 \times (W_0 X_0 + W_1 X_1 + W_2 X_2 + W_3 X_3) \times X_1$$
$$= 0$$

8 no Question

$$\frac{\partial E}{\partial X} = \begin{bmatrix} \frac{\partial E}{\partial X_0} \\ \frac{\partial E}{\partial X_1} \\ \frac{\partial E}{\partial X_2} \\ \frac{\partial E}{\partial X_3} \end{bmatrix} = \begin{bmatrix} 22 \times 5 \\ 22 \times 4 \\ 22 \times 6 \\ 22 \times 1 \end{bmatrix} = \begin{bmatrix} 110 \\ 88 \\ 132 \\ 22 \end{bmatrix}$$

$$\frac{\partial E}{\partial W} = \begin{bmatrix} \frac{\partial E}{\partial W_0} \\ \frac{\partial E}{\partial W_1} \\ \frac{\partial E}{\partial W_2} \\ \frac{\partial E}{\partial W_3} \end{bmatrix} = \begin{bmatrix} 22 \times 1 \\ 22 \times 0 \\ 22 \times 1 \\ 22 \times 0 \end{bmatrix} = \begin{bmatrix} 22 \\ 0 \\ 22 \\ 0 \end{bmatrix}$$