ECE180 HW7

~~Solve~~

Setup

$x_1 = [1, 2, 0]$, $y_1 = -1$

$x_2 = [1, 4, 4]$, $y_2 = 1$

$\hat{y} = w^T x$

$L = \max(0, 1 - y \cdot \hat{y})$

$\frac{\partial L}{\partial \hat{y}} = 0$ if $1 - y \cdot \hat{y} < 0$

$-y$ else

$\frac{\partial \hat{y}}{\partial w} = x$

$\boxed{\frac{\partial L}{\partial w} = -y \cdot x}$ if $1 - y \cdot \hat{y} > 0$

0 else

Step 1:

$w_0 = [0, 0, 0]^T$

$\hat{y} = w^T x = 0$

$L = \max(0, 1 - 0(-1)) = 1$

$\frac{\partial L}{\partial w} = -y \cdot x = 1 \cdot \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}^T = [1, 2, 0]$

$s_{dw} = .1 \left(\frac{\partial L}{\partial w}\right) = \begin{bmatrix} .1 \\ .4 \\ 0 \end{bmatrix}^T$

$\frac{1}{\sqrt{s_{dw} + .1}} dw = \frac{[1, 2, 0]}{\sqrt{[.2, .5, .1]}}$ (this is piecewise)

$w_1 = \begin{bmatrix} -1/\sqrt{.2} \\ -2/\sqrt{.5} \\ 0 \end{bmatrix}^T = \begin{bmatrix} -2.236 \\ -2.828 \\ 0 \end{bmatrix}^T$

Step 2:

$\hat{y} = w^T x = -13.549$

$L = 14.549$

$\frac{\partial L}{\partial w} = \begin{bmatrix} -1 \\ -4 \\ -4 \end{bmatrix}$

$s_{dw} = .9 \begin{bmatrix} .1 \\ .4 \\ 0 \end{bmatrix}^T + .1 \left(\begin{bmatrix} -1 \\ -4 \\ -4 \end{bmatrix}^2 \right)^T$

$= \begin{bmatrix} .19 \\ 1.96 \\ 1.6 \end{bmatrix}^T$

$a = \frac{1}{\sqrt{s_{dw} + .1}} dw = \frac{-[-1 \ -4 \ -4]}{\sqrt{[.29, 2.06, 1.7]}}$

$a = [1/\sqrt{.29}, 4/\sqrt{2.06}, 4/\sqrt{1.7}]$

$w_2 = [w_0] + a$

$w_2 = \begin{bmatrix} .37 \\ .04 \\ 3.06 \end{bmatrix}^T$