Homework 2

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Problem 1

$\eta = 0.5 Firstly, (-1) pretty bad \phi(x) = [1,0,1,0,0,0], y = -1, w = [0,0,0,0,0,0]$ $1 - w.\phi(x) * y = 1 - [0,0,0,0,0,0].[1,0,1,0,0,0] * 1 = 1 > 0$ $\nabla Loss(x,y,w) = -\phi(x) * y = -[1,0,1,0,0,0] * (-1) = [1,0,1,0,0,0]$ w ¡ -[0,0,0,0,0,0] -0.5[1,0,1,0,0,0] ¡ -[-0.5,0,-0.5,0,0,0] Secondly, (+1) pretty good $\phi(x) = [0,1,0,1,0,0], y = 1, w = [-0.5,0,-0.5,0,0,0]$ $1 - w.\phi(x) * y = 1 - [-0.5,0,-0.5,0,0,0].[0,1,0,1,0,0] * 1 = 1 > 0$ $\nabla Loss(x,y,w) = -\phi(x) * y = -[0,1,0,1,0,0] * 1 = [0,-1,0,-1,0,0]$ w ¡-[-0.5,0,-0.5,0,0,0]-0.5*[0,-1,0,-1,0,0] ¡ -[-0.5,0.5,-0.5,0.5,0,0] Thirdly, (-1) not good $\phi(x) = [0,1,0,0,1,0], y = -1, w = [-0.5,0.5,-0.5,0.5,0,0]$ $1 - w.\phi(x) * y = 1 - [-0.5,0.5,-0.5,0.5,0,0].[0,1,0,1,0,0] * -1 = 1.5 > 0$ $\nabla Loss(x,y,w) = -\phi(x) * y = [0,1,0,0,1,0]$ w ¡ -[-0.5,0.5,-0.5,0.5,0,0] -0.5[0,1,0,0,1,0] ¡ -[-0.5,0,-0.5,0.5,-0.5,0] Finally, (+1) pretty scenery $\phi(x) = [1,0,0,0,0,1], y = 1, w = [-0.5,0,-0.5,0.5,-0.5,0]$ $1 - w.\phi(x) * y = 1 - [-0.5,0,-0.5,0.5,-0.5,0].[1,0,0,0,0,1] * 1 = 1.5 > 0$ $\nabla Loss(x,y,w) = -\phi(x) * y = [-1,0,0,0,0,-1]$ w ¡ -[-0.5,0,-0.5,0.5,-0.5,0] -0.5[-1,0,0,0,0,-1] ¡ -[0,0,-0.5,0.5,-0.5,0.5]

Problem 2

1. (-1) 'bad'
2. (+1) 'good'
3. (+1) 'not bad'
4. (-1) 'not good'
5. Proof: to classify 'bad' and 'good' correctly, they must have opposite signs. If 'not' has a positive weight then 'not good' is classified wrong. If 'not' has a negative weight, then 'not bad' is classified wrong. A single redemption feature would be indicative of the phrase "bad". The following weight vector then correctly classifies all the examples: $w = 'bad' : -1, 'good' : 1, 'not' : 2, 'notgood' : -4$

Problem 3

$$Loss(x,y,w) = (\sigma(w * \phi(x)) - y)^2 \tag{1}$$

Problem 4

$$\nabla Loss(x,y,w) = \phi(x) 2(p-y)p(1-p), p = \sigma(w * \phi(x)) \tag{2}$$

Problem 5

In order to minimize the magnitude of gradient, we need to make p tend to 1 or 0 by taking