Assignment 3 - Logistic Regression and Gradient-Based Learning
Fall 2023

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1 Theory

1. For the function $J = (x_1w_1 - 5x_2w_2 - 2)^2$, where $w = [w_1, w_2]$ are our weights to learn:

   (a) What are the partial gradients, $\frac{\partial J}{\partial w_1}$ and $\frac{\partial J}{\partial w_2}$? Show work to support your answer (6pts).

   i. $\frac{\partial J}{\partial w_1} = 2(x_1w_1 - 5x_2w_2 - 2)(x_1 - 0 - 0)$

   $= 2x_1^2w_1 - 10x_2w_2 - 4$

   ii. $\frac{\partial J}{\partial w_2} = 2(x_1w_1 - 5x_2w_2 - 2)(0 - 5x_2 - 0)$

   $= -10x_1x_2w_1 + 50x_2^2w_2 + 20x_2$

   (b) What are the values of the partial gradients, given current values of $w = [0, 0], x = [1, 1]$ (4pts)?

   i. $\frac{\partial J}{\partial w_1} = 2(1)^2(0) - 5(1)(0) - 2 = -2$

   ii. $\frac{\partial J}{\partial w_2} = -10(1)(1)(0) + 50(1)^2(0) + 20(1) = 20$

2 Logistic Regression

See code and output from `hw3_problem2.py`

- $Precision = 0.894$
- $Recall = 0.898$
- $F_1 = 0.896$
- $Accuracy = 0.922$