Quiz 2
Week 2
CS 280: Fall 2020
Instructor: Xuming He

Name:
On your left:
On your right:

Instructions:
Please answer the questions below. Show all your work. This is an open-book test. NO discussion/collaboration is allowed.

Problem 1. (10 points)
Consider the perceptron algorithm and let us re-write the weight updates as follows

$$\begin{aligned}
\text{Initialization:} \quad & \mathbf{w}_1^+ = \mathbf{w}_1^- = 0 \\
\text{Mistakes on positive:} \quad & \mathbf{w}_{t+1}^+ = \mathbf{w}_t^+ + \mathbf{x} \\
\text{Mistakes on negaitive:} \quad & \mathbf{w}_{t+1}^- = \mathbf{w}_t^- - \mathbf{x} \\
\text{Weight update:} \quad & \mathbf{w}_{t+1} = \mathbf{w}_{t+1}^+ + \mathbf{w}_{t+1}^-
\end{aligned}$$

If the inputs are images from two categories: apple (positive) and banana (negative). What would the final weights of $\mathbf{w}_T^+$ look like as an image after T iterations, and why? What about $\mathbf{w}_T$?

$T = 0$, $w_T = w_0^+ + w_0^- = 0$ and it makes mistake.

$T \geq 1$. if an apple image x_{apple} is given, $w_{t+1}^+ = w_t + x_{apple}$, $w_{t+1} = w_t + x_{apple}$ (+4)

if an banana image x_{banana} is given, $w_{t+1}^- = w_t - x_{banana}$, $w_{t+1} = w_t - x_{banana}$

Thus, w_T^+ will looks like an apple after iterations. (+3)

Similarly, w_T^- will look like an inverse banana.

Therefore, w_T will look like an image of an apple substract a banana. (+3)

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Problem 2. (10 points)
Consider a multiclass logistic regression with L2 regularization as follows:

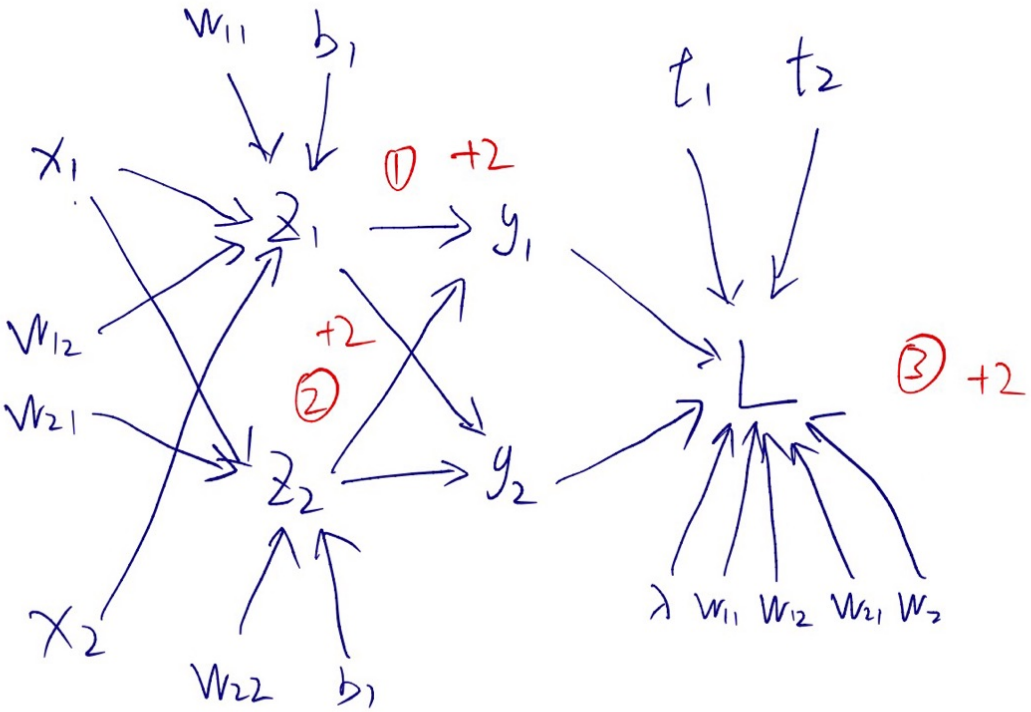
$$z_l = \sum_{j=1}^{2} w_{lj} x_j + b_l,\ l = 1, 2$$

$$y_k = \frac{e^{z_k}}{\sum_l e^{z_l}},\ k = 1, 2$$

$$\mathcal{L} = -\sum_k t_k \log y_k + \lambda \sum_{l=1}^{2} \sum_{j=1}^{2} \|w_{lj}\|^2$$

Draw a computational graph for this network and its loss. Note each node should be a scalar in this graph.
Write down the forward pass based on the graph you have built.

图对+6，①②③处关键节点 输入输出有错-2



$z_1 = w_{11} x_1 + w_{12} x_2 + b_1$

$z_2 = w_{21} x_1 + w_{22} x_2 + b_2$

$y_1 = \frac{e^{z_1}}{\sum_{i=1}^{2} e^{z_i}}$ $y_2 = \frac{e^{z_2}}{\sum_{i=1}^{2} e^{z_i}}$

$L =$ 照抄题干即可...

+4 forward 过程

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