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CSCI 5521: Machine Learning Fundamentals (Spring 2022)

Quiz 3 (Thurs, Mar 31))

Due on Gradescope at 02:00 PM, Friday, Apr 1

Instructions:

- This quiz has 3 questions, 30 points, on 1 page.
- Please **write your name & ID on this cover page**.

1. (**9 points**) Select all the correct statement(s).

   (a) A Perceptron (without activation functions) is a linear model.

   (b) A Multilayer Perceptron (without activation functions) is a linear model.

   (c) A Perceptron can be used for both classification and regression.

2. (**13 points**) Pick one parameter in a (Multilayer) Perceptron, and write its update equation. The parameter can be for a node at any layer and for either classification or regression. Start with writing the objective function.

$$E(w, v \mid X) = \frac{1}{2}\sum_t (r^t - y^t)^2$$

$$-\eta \frac{\partial E}{\partial v_h} = \Delta v_h = \eta \sum_t (r^t - y^t) z_h^t$$

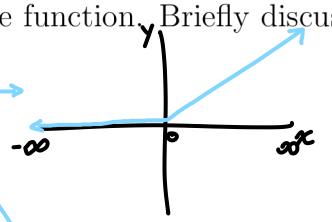
$$\Delta w_{hj} = -\eta \sum_t \frac{\partial E}{\partial y^t} \frac{\partial y^t}{\partial z_h^t} \frac{\partial z_h^t}{\partial w_{hj}}$$

$$= -\eta \sum_t -(r^t - y^t) v_h z_h^t (1 - z_h^t) x_j^t$$

$$\Delta w_{hj} = \eta \sum_t (r^t - y^t) v_h z_h^t (1 - z_h^t) x_j^t$$

3. (**8 points**) Give an example of an activation function in Multilayer Perceptron. You can write either the name or the mathematical representation of the function. Briefly discuss roles of activation functions in a Multilayer Perceptron.

An example of an activation function would be ReLU(x)



$$ReLU(x) = \max(0.0, x)$$

The role of activation functions in MLP is to take some input, calculate said input w/ some function α, and run its output through the activation function to determine if it's positive or negative.