EECS 545 – Machine Learning - Homework #6

Due: 5:00PM 11/29/2018

Homework submission via Gradescope as usual.

1) **Neural Network (20 pts).**

Consider that you have a three layer neural network as shown in the figure 1. let x be the input, W_1, W_2, W_3 be the weights of the these layers, b_1, b_2, b_3 be the corresponding biases and y be the output.

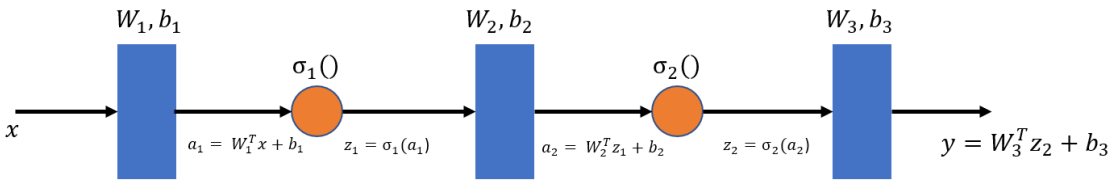

Figure 1: Neural Network

Let's revisit the body fat data which we have seen earlier. Let's try to fit the data using neural network. Use the first 150 examples for training, and the remainder for estimating the mean squared error. Assume that all activation functions are rectified linear unit (ReLU).

a. (5 pts) Implement the forward pass.

b. (10 pts) Implement the backward pass.

c. (5 pts) Please submit your code and report: 1) the mean squared error on the training data and 2) the mean squared error on the test inputs

Additional comments:

- Initialize weights of all layers using normal distribution (Please add rng(0) or np.random.seed(0))
- Initialize biases with zeros.
- Size of the first layer is 64 and the second layer is 16.
- Try to vectorize the code to reduce running time.
- Use gradient descent for training and use reasonable stopping criteria to terminate the gradient updates.
- Use the learning rate $1e-7$ for gradient descent.