

Neural Network - Mini Project

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In this mini project you will build a neuron, which you will then use to build a neural network. Here are the step by step instructions:

1. (10 points) Write a sigmoid activation function. The formula of a sigmoid activation function is:

$$f(a) = \frac{1}{1 + e^{-a}} \quad (1)$$

2. (10 points) Write a binary step activation function. The formula of a step function is:

$$f(a) = \begin{cases} 0 & \text{if } a < 0, \\ 1 & \text{if } a \geq 0 \end{cases} \quad (2)$$

3. (20 points) Write a function to depict the input to a neuron:

$$In = b + \sum_i w_i x_i \quad (3)$$

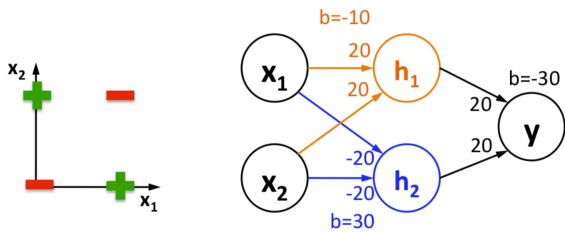
4. (30 points) You can now create a neuron by including the activation function within it. For example, a neuron with a sigmoid activation function will look like this:

$$f(In) = \frac{1}{1 + e^{-In}}; \quad (4)$$

where In is shown in Equation 3. Create a neuron with binary step function and a neuron with sigmoid activation functions.

5. (30 points) You will use the neuron with the binary step function you created above to build a xor neural network. The bias and weights for every input to each neuron is indicated in the diagram. Refer to the lecture notes for help. Do not create a

new function for every neuron, you will need to call just one function created in 4



multiple times.

Test the neural network by providing it 4 different input sets: $\{1,1\}$, $\{0,1\}$, $\{1,0\}$ and $\{0,0\}$. The output should be 0, 1, 1, 0.