**BENG 420/520: Homework #3 Sigmoid Neuron**

**Due: Wednesday, 4/1/2020, by 11:59pm**

*This is an add-on assignment to Homework #2. Please work with the same partner as you had for Homework #2. Reuse your implementation of Homework #2 to complete this one.*

*Work on the parts highlighted in red.*

1. The objective of this question is to enhance your understanding of the **sequential** *delta learning rule* used in Perceptron learning and multi-layer neural network. You are asked to implement the learning and prediction algorithms of a perceptron with threshold transfer function. The following Matlab programs are provided:
2. Data generation and plotting routines are given in **h3\_neurons.m**, which is the file you should program to (1) call your perceptron learning function to learn the weights and (2) predict the labels using the learned perceptron. Similar to the second assignment, you will need to program at places where there is a “**YOU**” indicator in the code comment. You will need to copy your implemented program on the perceptron with a transfer function in h2\_neurons.m to h3\_neurons.m.
3. **perceptron\_neuron.m**: Use your implementation from homework #2.
4. **logistic\_neuron.m**: The parameters of the function are defined. Implement the learning algorithm with a logistic sigmoid transfer function.
5. **sig.m**: Implement a scaled logistic sigmoid function so that the output is between **-1 and 1**. Not that the logistic sigmoid function formulation given in class is different, with the output between 0 and 1. You will need to transform that function to make the output between -1 and 1.
6. **dsig.m**: Implement the derivative of that scaled logistic sigmoid function in sig.m.
7. Run h3\_neuron.m so that the same data points are learned by the perceptron with the threshold transfer function and the sigmoid neuron. **Describe** your observation on the accuracy performances of these two neurons on this type of data and **explain** why it occurs. You may want to run it several times confirm your observation. **Include** snapshots of the plotted results of two neurons from one run in your report.
8. Note that class labels are +1 and -1, instead of +1 and 0.
9. Submit **perceptron\_neuron.m logistic\_neuron.m, sig.m, dsig.m,** and your modified **h3\_neurons.m** in addition to the **discussion** on your observation. Make sure to **comment** your code.