**CS 4730-5730**

**Artificial Neural Networks**

**Final Exam**

**(200 pts.)**

**Date:** 5-2-2020

**Due:** 5-8-2020 by 5 pm

**Given:** Breast cancer data set. Construct an appropriate FFNN with the following characteristics:

https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Diagnostic%29

*- The input (X = [instances, 30]) → matrix*

*- The output (****y*** *= [instances,1]) → vector*

*- The hidden nodes (****h\_0*** *= [40,1]) → vector*

*- Data set structure =**[ID number, Diagnosis (M=malignant, B=benign), 3-32 real valued features]*

*- Fully connected*

*- Learning rate is adjustable (start with eta = 0.001)*

*- Randomize your two weight matrices W\_0 and W\_1 to initialize them*

*- Ignore bias values*

*- Start your number of epochs = 1000*

*Hint: Remember to convert M=1 and B=0 for your labeled output*

**1. Find: (100 pts.)**

**a)** Utilizing the example source code predict whether the patient is either M or B. **b)** Show a graph of the actual label values against your predicted values, y\_hat. **c)** Discuss your model in terms of weight matrices, W\_0 and W\_1 (discuss dimensions of these matrices and why they are the size they are.) **d)** Write out in matrix form all input, weight matrices, hidden vector and predicted output vector mathematically. **e**) Write out your gradient based on the paper discussed in class. **f**) Write out your back propagation update laws for the two weight matrices, W\_0 and W\_1.  **g)** Discuss how your computer source code achieves this.