ECE 2195 Neuromorphic Systems Design – Homework #4

Total 50 points Due 02/21/2024

Problem 1. Build a Neural Network to implement XOR (10pts)

Using the neuron logistic unit taught in Week 5, build a neural network to implement the Boolean XOR function.

Hint: XOR(A,B) = OR[AND(NOT(A), B) + AND(A,NOT(B))]. You will need a hidden layer!

Problem 2. MNIST Classification using MLP (40pts)

Build and train a Multi Layer Perceptron (MLP) to perform the task of handwritten digit classification. Use the MNIST dataset as your input data (To know more about this dataset, refer to http://yann.lecun.com/exdb/mnist/). Refer to the python notebook, attached on Canvas, as a baseline to start.

1. Set the number of hidden layers to 1 and adjust the number of nodes in the hidden layer as 16, 32, 64 (total 3 cases), and the type of activation function (as ReLU or sigmoid) and train the 6 networks. **(20pts)**
2. Determine which network gives the best prediction accuracy for the training and testing dataset. Comment the impact of the activation function. **(10pts)**
3. What is the issue with too little nodes and too many nodes in the hidden layer? **(5pts)**
4. What will happen to the ANN performance if we increase the number of hidden layers? **(5pts)**