**ELE 888 Lab Report 3**

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**Plots**

**For Pars 1 and 2**



**Figure 1**: Decision Boundary for the XOR operation.



**Figure 2**: Leaning curve for XOR operation

**For Parts 3 and 4**

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**Figure 3:** Decision Boundary for wine data set



**Figure 4:** Learning curve for wine data set

**Observations**

**For Parts 1 and 2**

* Everything is classified correctly, and it takes 277 epochs to reach conversion which is shown in the learning curve.
* The final weight vectors are -1.0000 -0.9216, 1.0000 0.9415, 1.0000 0.9405, -1.0000 -0.9179, which do indeed fit the XOR criteria.

**For Parts 3 and 4**

* The error is approximately 5.7485%, which leads to 18 items misclassified.
* Due to the error present when classifying (error is different every time the program is ran due to randomness), the curve never converges.

**Conclusions**

The purpose of this experiment was to construct a 2-2-1 neural network using the back-propagation algorithm to perform the XOR operation and using the wine data set given. Some key findings were that the XOR problem did indeed converge after a certain number of epochs, but the learning curve for the wine data set did not converge. This is because the XOR problem did not have any errors, but the wine error set had an error, which lead to misclassified items. The reasons that the wine data set lead to more error was evident when comparing the graphs, the data was much more clustered with the wine data set due to the nature of the data. While there was more space between the samples of the XOR operation, which led to completely accurate results. To conclude, a greater understanding of multi layer neural networks were learned, which includes what to expect when performing the network with different data sets.