

Machine Learning

ECE 4370 / ECE 5332

Project 5

Use your own implementation of the feed-forward neural network to

- a. Solve the (modified) XOR classification problem, as shown below, using an architecture with one hidden layer composed of 2 units.

Plot the loss function value throughout the training process. Once convergence is achieved, plot the resulting decision surface together with the input data.

$$C_1 = \left\{ \begin{bmatrix} -1 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix} \right\}; C_2 = \left\{ \begin{bmatrix} -1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \end{bmatrix} \right\}$$

- b. Solve the regression problem described below.
 - i. Generate the following dataset. For those programming in Python, the dataset is provided in the attached Excel file.

```
rng(100)
X=2*rand(1,50)-1;
T=sin(2*pi*X)+0.3*randn(1,50);
```

- ii. Network architecture: One hidden layer composed of 3 hyperbolic tangent units
 - iii. Repeat with 20 hyperbolic tangent units

Plot the loss function value throughout the training process. Once convergence is achieved, plot the resulting model together with the input data and report the training error on the figure.

When executed, your code must display all required plots and data at once.

Upload your .m or .py file to Blackboard prior to the deadline. Name your files as Lastname_Firstname_Project5.*