

## 4 Project 4 (Neural Network)

**Due date: April 26**

In this project implement a Neural network that is able to approximate a function of two variables  $f(x, y)$ . Ideally the network will have at least two hidden layers and it is trained using the backpropagation algorithm. The test cases we consider are **XOR** function and  $f(x, y) = x/y$ .

As training data for the algorithm construct a matrix of input output triplets of the functions. For  $f(x, y) = x \text{ XOR } y$  the data is

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}.$$

For  $f(x, y) = x/y$ ,  $x, y \in [1, 10]$  the matrix would contain training triplets of the form  $[x_i, y_j, x_i/y_j]$ , where  $x_i$  and  $y_j$  are equidistant in  $[1, 10]$ .

For the XOR function test with the training values.

For the division test with values that you withhold from the training matrix.

Grading:

- 1) Network with 1 hidden layer = 20
- 2) Network with 2 hidden layers = 40
- 3) General Neural network set with 2 hidden layers = 60
- 4) Correct output on XOR +20
- 5) Correct output on  $x/y$  + 20