**Lesson 02 Practice Exercise**

In order to really understand how backpropagation works, it's helpful to implement it by hand at least once in your career, without letting the computer do all the work. Thus, for this exercise you will start to train a neural network on paper.

Draw by hand a simple 3-layer network (Input: 2 nodes, Hidden: 2 nodes, and Output: 1 node, with bias nodes feeding into the hidden and output layers.) Implement backprop manually. Initialize weights to 0.5 and compute 2 steps of backprop by hand (e.g., feed in two examples of XOR data:  [1 0] -> 1 ; [1 1]->0

**Resources:** Paper and pencil, calculator. You may use python or a Jupyter notebook as a calculator.

**Steps:** Sketch and then compute results. Draw a table showing the initial weights, the weights after running backprop on example 1, and the weights after running backprop on example 2. The table may look something like this (be sure to label the weights (e.g., w\_12) in your drawing.) Use as many columns as necessary to show all the weights in the network.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Step | w\_11 | w\_12 | b\_1 | u\_11 | u\_12 | u\_21 | ... |
| 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | ... |
| 1 |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |