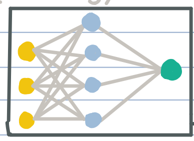
(eventing)

HOW A NEURAL NETWORK WORKS



- Input layer: enter either a Ø or a 1 - training set
- Hidden layer: where the integration of the calculation occurs
- Output layer: returns either a Ø or 1 (* best case scenario)

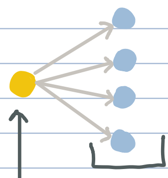
this is what our neural network looks like. So cute!

X1	X2	X3	Y
0	0	1	0
0	1	1	1
1	0	1	1
1	1	1	0

Summary: In this example, we are taking 3 input values, passing each through 4 perceptrons (hidden layer), then summing the results into an output. To make things easier, the bias value will be Ø.

each row is a set of #s we want our nn to learn

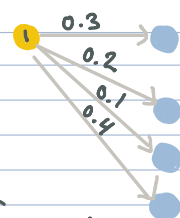
this column is the values we want our neural net to get close to for each corresponding dataset ie. [0,0,1] should produce Ø



1 input value (Ø or 1)

Hidden Layer

⊛ each perceptron (●) has its own specific weight value that the input value is "fed through", or multiplied by.



① Let's say our first input is a 1. We'd multiply (1 * weight of the individual perceptron). We repeat this process with our other 2 input values (ie. 0,0).

→ (1 * 0.3) = 0.3

(0 * 0.3) = 0

(0 * 0.3) = 0

② We repeat this process for each individual perceptron (so, in this case 4 times).

③ Each perceptron should have 3 numbers "inside" - one from each input multiplied by its weight:

0.3 Ø Ø | 0.2 Ø Ø | 0.1 Ø Ø | 0.4 Ø Ø

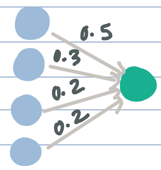
④ Next, we sum these values:

0.3 | 0.2 | 0.1 | 0.4

⑤ Here comes the fun part: we apply a non-linear activation function to each perceptron's sum - in this case, we're using a Sigmoid function: $\frac{1}{1+e^{-x}}$ (* these answers are truncated after the hundreths place and are not accurate). Plug in each sum to the x value of the sigmoid function!

$\frac{1}{1+e^{-0.3}} = 0.574\ldots$ $\frac{1}{1+e^{-0.2}} = 0.549\ldots$ $\frac{1}{1+e^{-0.1}} = 0.475\ldots$ $\frac{1}{1+e^{-0.4}} = 0.401\ldots$

⑥ Almost there! Now we multiply each of these values by the 2nd set of weights (* note: weights are random at first, then are incrementally adjusted through back propegation)



0.574 * 0.5 = 0.287
0.549 * 0.3 = 0.165
0.479 * 0.2 = 0.096
0.401 * 0.2 = 0.080 +

0.628 → 0.628

7 Now we sum all of these values to get ...

8 Last step! (sort of) Remember that fun sigmoid function from before? You guessed it, we're plugging in the sum of our weights into it to get our final answer...

$\frac{1}{1+e^{-0.628}}$ = 0.652!!!

⚠ But wait a minute, according to our table from before, the inputs [1, 0, 0] should have given us a 0?! We're way off! :(That's ok, that's where Back Propagation comes in (I'll discuss that a seperate time) which is what we'll use to adjust our weights until we get closer and closer to 0! This takes a TON of iterations (repetitions) — like 10,000! For reference, we only just walked through 1/2 of an iteration!