Biologically Inspired Computing

Neural Networks 1

September, 2020

Some tutorial questions culled from various sources.

1. Sketch a peceptron, along with weight values, that will model the line:

$$y = -0.3x + 0.7$$

2. For the neuron below:

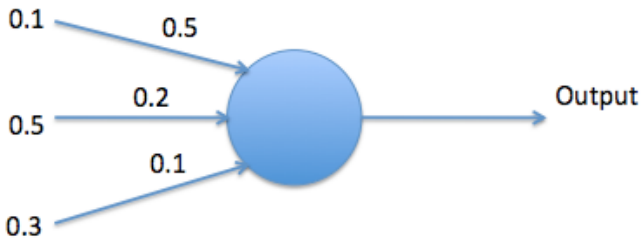

Figure 1:

   (a) Calculate the output assuming a threshold of 0.5.
   (b) Repeat the calculation assuming the output has a sigmoid output function. (Use the exponential function $(1 + e^y)^-1$.)

3. For the system shown in Figure 2, which if any of the images would be recognised by the neuron. The neuron has a threshold of 1.5. (In the images, the dark square should be taken to have value 1 and the light square's value as 0.)

4. Another image is shown in Figure 3. Here thee inputs are: a = 0.2, b = 0.7, c = 0.1, and d = 0.9.

   (a) Show whether the neuron shown in Figrue 2 would recognise this pattern.
   (b) What advantage would using a sigmoid function give?

5. A single neuron cannot compute an XOR function.

   (a) Explain why this is.
   (b) Construct by hand a neural network that does compute the XOR function for two inputs. Remember to specify what output function you are using.

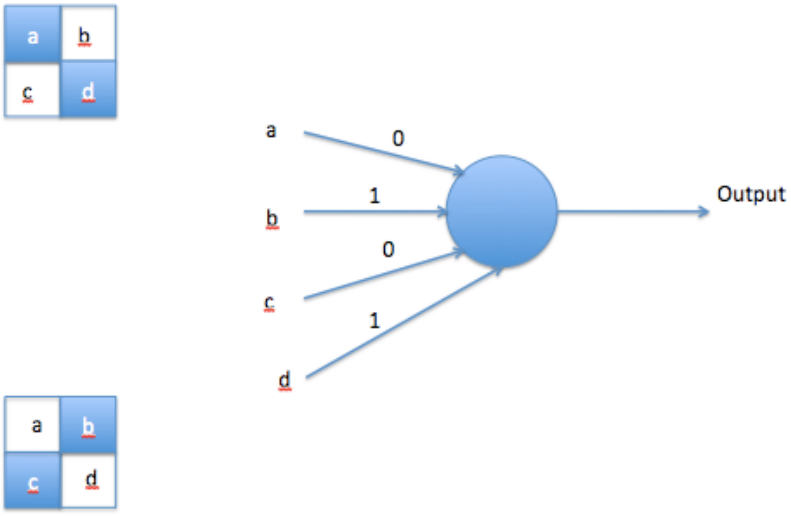

Figure 2:

Figure 3: