CMSC 636 Homework 1

1.1)

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* I have received my bachelor’s degree in computer science with a focus in machine learning and data science from VCU.
* I hope to increase my understanding and knowledge base of neurons and deep learning. I would also like to learn more about fuzzy learning and its uses.

1.2)

In order to complete this neuron, I finished the truth table below. Before that, I started with the neuron definition. The first step of competing this table was to fill in the 3 first columns to get all input combinations. The next step was to compute the output column. In order to find acceptable weights, I created the inequalities column of the table, which is just an amalgamation of the previous 4 columns. Once these were constructed, it was trivial to see that the following values would fit the requirements of the neuron: wA = 2, wB = 1, wC = 1, T = (1,2].

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Description automatically generated

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1.2 | A | B | C | A+BC | inequatilies | possible values |
|  | 0 | 0 | 0 | 0 | 0 < T | 0 < T |
| wA = 2 | 0 | 0 | 1 | 0 | wC < T | 1 < T |
| wB = 1 | 0 | 1 | 0 | 0 | wB < T | 1 < T |
| wC = 1 | 0 | 1 | 1 | 1 | wB+wC >= T | 2 >= T |
| T = (1,2] | 1 | 0 | 0 | 1 | wA >= T | 2 >= T |
|  | 1 | 0 | 1 | 1 | wA+wC >= T | 3 >= T |
|  | 1 | 1 | 0 | 1 | wA+wB >= T | 3 >= T |
|  | 1 | 1 | 1 | 1 | wA+wB+wC >= T | 4 >= T |

1.3)

After defining both neurons and completing the associated truth tables with the method from 1.2, I learned that:

* These neurons are different due to their different weights and thresholds (seen next to the tables). By only changing these 4 values, the entire behavior of the neuron was altered.
* The possible thresholds range from (2,3] for the first neuron and (2,4] for the second neuron.

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1.3a | A | B | C | ABC | inequalities | possible values |
|  | 0 | 0 | 0 | 0 | 0 < T | 0 < T |
| wA = 1 | 0 | 0 | 1 | 0 | wC < T | 1 < T |
| wB = 1 | 0 | 1 | 0 | 0 | wB < T | 1 < T |
| wC = 1 | 0 | 1 | 1 | 0 | wB+wC < T | 2 < T |
| T = (2,3] | 1 | 0 | 0 | 0 | wA < T | 1 < T |
|  | 1 | 0 | 1 | 0 | wA+wC < T | 2 < T |
|  | 1 | 1 | 0 | 0 | wA+wB < T | 2 < T |
|  | 1 | 1 | 1 | 1 | wA+wB+wC >= T | 3 >= T |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| 1.3b | A | B | C | A+BC | inequalities | possible values |
|  | 0 | 0 | 0 | 0 | 0 < T | 0 < T |
| wA = 4 | 0 | 0 | 1 | 0 | wC < T | 2 < T |
| wB = 2 | 0 | 1 | 0 | 0 | wB < T | 2 < T |
| wC = 2 | 0 | 1 | 1 | 1 | wB+wC >= T | 4 >= T |
| T = (2,4] | 1 | 0 | 0 | 1 | wA >= T | 4 >= T |
|  | 1 | 0 | 1 | 1 | wA+wC >= T | 6 >= T |
|  | 1 | 1 | 0 | 1 | wA+wB >= T | 6 >= T |
|  | 1 | 1 | 1 | 1 | wA+wB+wC >= T | 8 >= T |

1.4)

I once again used the same method as question 1.2. This resulted in the truth table shown below. Using these values, I drew a possible neuron (see below).

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1.4 | A | B | C | AC | inequalities | possible values |
|  | 0 | 0 | 0 | 0 | 0 < T | 0 < T |
| wA = 1 | 0 | 0 | 1 | 0 | wC < T | 1 < T |
| wB = 0 | 0 | 1 | 0 | 0 | wB < T | 0 < T |
| wC = 1 | 0 | 1 | 1 | 0 | wB+wC < T | 1 < T |
| T = (1,2] | 1 | 0 | 0 | 0 | wA < T | 1 < T |
|  | 1 | 0 | 1 | 1 | wA+wC >= T | 2 >= T |
|  | 1 | 1 | 0 | 0 | wA+wB < T | 1 < T |
|  | 1 | 1 | 1 | 1 | wA+wB+wC >= T | 2 >= T |

A picture containing door, group, standing

Description automatically generated

1.5)

A picture containing computer, monitor, laptop, orange

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