COMP 472 Artificial Intelligence   Summer 2023

Mini project 2

Due date: as indicated on Moodle

You can work in a group of 2 minimum or 3 maximum. One submission per group.

Question 1:

Using Java or Python, please develop a neural network that mimics the behavior of an AND boolean gate. Weights, biases, and the activation function must all be implemented by you. **Do not use any libraries for the functionality of the neural net; you implement it fully from scratch**. You need to answer the following questions:

a) How many hidden layers have you used?

b) What are the weights and biases of each node?

You must write the answers to these questions in a document and submit it along with your code.

You should provide a simple driver to test it.

Question 2:

Using Python and any of the libraries it provides, please implement a feed-forward neural network for the following training set:

A	B	C	D	E	output
1	1	1	0	0	1
1	1	1	0	1	1
0	0	0	1	0	0
0	0	0	1	1	0
0	0	1	0	0	1
0	0	1	0	1	1
0	0	1	1	0	1
0	0	1	1	1	1
0	1	0	0	0	0
0	1	0	0	1	0
0	1	0	1	0	0
0	1	0	1	1	0

0	1	1	0	0	1
0	1	1	0	1	1
0	1	1	1	0	1
0	1	1	1	1	1
1	0	0	0	0	1
1	0	0	0	1	1
1	0	0	1	0	1
1	0	0	1	1	1
1	0	1	0	0	1
1	0	1	0	1	1
1	0	1	1	0	1
1	0	1	1	1	1

Use the following testing set to check how good the neural net is in classification:

A	B	C	D	E	output
1	1	0	0	0	1
1	1	0	0	1	1
0	0	0	0	0	0
0	0	0	0	1	0
1	1	0	1	0	1
1	1	0	1	1	1
1	1	1	1	0	1
1	1	1	1	1	1

You need to think of/ examine / contemplate about / consider / meditate about 😊 / answer the following questions:

a) How many hidden layers have you used? And why?

b) How many nodes in each hidden layer and why that number of nodes in particular?

c) What is the activation function that you used and why? Did you use the same activation function in all layers? Why?

d) What learning algorithm did you use to train the neural net and why?

e) Can you use one hidden layer only to solve this problem? If yes, how many nodes are you going to have in it? And why?

f) Can we use 5 hidden layers? Is that a good idea? Justify your answer.

g) How did the neural net do in classifying the testing set? Comment on how good or bad it learned the function from the training set.

You must write the answers of/reflections about these questions in a document and submit it along with your code.

Documentation and Presentation: Document your program's functionality, and code structure. You will give a demo to a TA. The TA's will post time slots on Moodle for the demos. All group members must be present during the demo. You must submit the code on Moodle once you are done as a zip archive. The name of the archive must be of the following format:
<Student1 first name Student 1 last name> <Student 1 ID>-<Student2 first name Student 2 last name> <Student 2 ID> - <Student3 first name Student 3 last name> <Student 3 ID> Question <X>.zip where x is the question number: either 1 or 2. You are expected to answer questions similar to the ones above during your demo.