Unit 4 - Week 1 - Introduction to Neural Networks

Assignment 01

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-08-14, 23:59 IST.

Instructions:

1. **Attempt all questions.**
2. **Submission deadline:** 14th August 2019 23:59 IST
3. **Solutions to be posted:** 15th August 2019
4. Older browsers might show **unnecessary vertical bars** at the end of math equations.

1) Consider a two-layer network of the form shown in Figure 1 with M hidden units having $\phi(.) = \tanh(.)$ activation functions and full connectivity in both layers. If we change the sign of all of the weights and the bias feeding into a particular hidden unit, then, for a given input pattern **2 points**

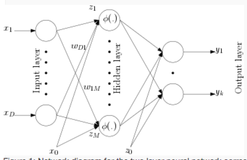


Figure 1: Network diagram for the two layer neural network corresponding to questions 1, 2, 3 and 4. The input, hidden, and output variables are represented by nodes, and the weight parameters are represented by links between the nodes, in which the bias parameters are denoted by links coming from additional input and hidden variables x_0 and z_0. Arrows denote the direction of information flow through the network during forward propagation.

- The sign of the activation of the hidden unit will be reversed.
- The sign of the activation of the hidden unit will remain same.
- The output of the hidden unit will be zero irrespective of the input.
- The output of the hidden unit will be scaled by a positive integer.

No, the answer is incorrect.
Score: 0
Accepted Answers:
The sign of the activation of the hidden unit will be reversed.

2) (Refer to Figure 1) In continuation with the question 1, if we change the sign of all of the weights leading out of hidden unit also, then **2 points**

- The input-output mapping function represented by the network will be negated.
- The input-output mapping function represented by the network will be same.
- The output of the network will always be a zero vector.
- Nothing can be commented on the input-output mapping function.

No, the answer is incorrect.
Score: 0
Accepted Answers:
The input-output mapping function represented by the network will be same.

3) (True/False) One property of feed-forward network shown in Figure 1 is that multiple distinct choices for the weight vector $\overline{w}$ can all give rise to the same **1 point** mapping function from inputs to outputs.

- False
- True

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

4) (Refer to Figure 1) In continuation with the questions 1, 2, and 3, for M hidden units, there will be M such 'sign-flip' symmetries, and thus any given **2 points** weight vector will be one of a set _____ equivalent weight vectors.

- 2^M
- 2^{M-1}
- 2^D
- 2^{D-1}

No, the answer is incorrect.
Score: 0
Accepted Answers:
2^M

5) Memory can be modeled with a feedback loop as shown in figure. With $|w| < 1$, the system with feedback loop has **2 points**

- Infinite memory
- Finite memory
- System is stable
- System is unstable

No, the answer is incorrect.
Score: 0
Accepted Answers:
Infinite memory
System is stable

6) Suppose if you were to design a neural network architecture for an object recognition task which is capable of identifying the object irrespective of its orientation, then which of the following would be built into the neural network architecture. **2 points**

- Invariant feature space
- Invariance by training
- Invariance by structure
- Invariance by restricting the connections in the network.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Invariance by structure

7) (True/False) Let $\overline{x}$ and $\overline{y}$ be two unit norm vectors. Then minimizing the Euclidean distance between $\overline{x}$ and $\overline{y}$ corresponds to minimizing the inner product of $\overline{x}$ and $\overline{y}$. **2 points**

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

8) Which of the following gives non-linearity to a neural network. **2 points**

- Convolution operator
- Stochastic gradient descent
- Sigmoid activation
- Non-zero bias

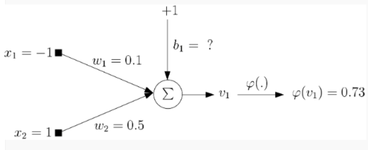
No, the answer is incorrect.
Score: 0
Accepted Answers:
Sigmoid activation

9) (True/False) Given $y = ax^2 + bx + c$ where x is the input to the network and y is the output of the network. We can represent this with a neural network **1 point** of single hidden layer with linear activation functions.

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

10) Consider a two input neuron with logistic activation function with slope parameter $a = 2$. Let the inputs be $[-1, 1]$ and the weights are $[0.1, 0.5]$ respectively. The output of the neuron is 0.73 . The value of the bias b_1 is (Round bias value till 1 decimal point)?



No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.09,0.11

3 points

11) Consider a fully connected feedforward network (with a single hidden layer) with no self loops. The network takes inputs of dimension 100 and consists **1 point** of 5000 hidden neurons. What are the total number of connections between the input and the hidden layer?

- 5×10^3
- 1×10^5
- 5×10^5
- 100^{5000}

No, the answer is incorrect.
Score: 0
Accepted Answers:
5×10^5