

Questions for Review

Introduction to Neural Networks

CSC357 Advanced Topic: Machine Learning

29 January 2020

1. Which API will Géron invite us to use in building our first neural network models?
2. Artificial Neural Networks have a long history. How long?
3. What is propositional logic? How does it differ from predicate logic?
4. Interest in neural networks has waxed and waned over the years. When was interest high? When was it low?
5. Géron lists Moore’s Law, developments in computer gaming, the popularity of GPUs, and cloud computing among the factors that have made neural networks practical. Elaborate.
6. Géron claims that some theoretical limitations of training algorithms for neural networks are benign. What is the example of this does he share?
7. Géron says that a “virtuous circle” has fed the development of neural networks. Explain.
8. McCulloch and Pitts invented a simple artificial neuron that has one more inputs and a single output. What is the nature of the signals on the inputs and output?
9. How does a Threshold Logic Unit differ from the McCulloch/Pitts artificial neuron?
10. What is the heaviside function? Who was Oliver Heaviside?
11. Define a Perceptron in a sentence.
12. Who was Donald Hebb? What was his contribution to the development of neural networks?
13. What are the meanings of each of the letters in Equation 10-2?

$$h_{\mathbf{w},\mathbf{b}}(\mathbf{X}) = \phi(\mathbf{X}\mathbf{W} + \mathbf{b})$$

14. The Greek letter η shows up in this chapter, too. Do you remember what it denotes?

$$w_{i,j}^{\text{next-step}} = w_{i,j} + \eta(y_j - \hat{y}_j)x_i$$

15. Chapter 10 includes a short program that creates a Perceptron and uses it to classify iris flowers. What are the required imports?
16. How could we create an equivalent program with an `SGDClassifier`?
17. What is a reason to prefer Logistic Regression classifiers over Perceptrons?
18. Who was Marvin Minsky? Who was Seymour Papert?
19. Name a limitation that Perceptrons share with other machine learning models.
20. Computer scientists found a way to get past some of the problems that Minsky and Papert identified with the invention of MLPs. What is an MLP?
21. David Rumelhart, Geoffrey Hinton, and Ronald Williams gave the world the backpropagation training algorithm in which year?
22. Backpropagation training is like which idea that we previously encountered?
23. *autodiff* is an idea that connects to a previously encountered idea. What is it about?
24. Find in Chapter 10 a description of the backpropagation training algorithm. Géron first presents the steps of the algorithm in an itemized list. Then he repeats the steps in a summary paragraph.
Find this description. Be prepared to read it aloud when called upon.
25. In a box labeled `WARNING`, the author says that it is necessary to *break symmetry* when assigning initial values to connection weights. How is this done? What happens if it is not done?