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CSC 482

Chapter 2: Neural Networks and the Ascent of Machine Learning

→ Reading/Mining/Discussion Assignment

1). TRUE or FALSE: Multilayer Neural networks - the extension of perceptrons that was dismissed by Minsky and Papert as likely to be “steril” - have instead turned out to form the foundation of much of modern artificial intelligence.

True

2). What is a network?

“A network is simply a set of elements that are connected to one another in various ways.” (M.M., 27)

3). In a very direct way, answer this question: How do you distinguish a social network, from a computer network, from a neural network?

- Social networks: Elements are people
- Computer networks: Elements are computers
- Neural networks: Elements are neurons

4). What does it mean for a unit of a multilayer neural network to be a hidden unit?

A unit that does not have output

5). What phrase is used to designate a network that has more than one layer of hidden units?

Deep networks are used to describe networks that have more than one hidden unit.

6). What is the difference, with respect to processing, of each “unit” of a perceptron and each “unit” of a multilayered neural network?

- Perceptron: Simply “fire” or “not fire”.
- Unit: Compute a number between 0 and 1.

7). Define the term “classification” with respect to a multilayered neural network.

The network’s answer, taken from the digit category with the highest confidence.

8). How do most neural network researchers determine how many layers of hidden units are needed, or how many hidden units should be included in a layer, for a network to perform well on a given task?

It's hard to know ahead of time, most network researchers use a form of trial and error to find the best settings.

9). In their book *Perceptrons*, Minsky and Papert were skeptical that a successful algorithm could be designed for learning the weights in a multilayer neural network. Their skepticism (along with doubts from others in the symbolic AI community) was largely responsible for the sharp decrease in funding for neural network research in the 1970s. But despite the chilling effect of Minsky and Papert's book on the field, a small core of neural network researchers persisted, especially in Frank Rosenblatt's own field of cognitive psychology. And by the late 1970s and early '80s, several of these groups had definitively rebutted Minsky and Papert's speculations on the "sterility" of multilayer neural networks by developing a general learning algorithm for training these networks. What is the name of this algorithm?

A general learning algorithm called "back-propagation".

10). Describe, in just a few sentences, how the standard multilayer network learning algorithm works.

When an error occurs, it will take a look at the output units, and "propagate" the blame for that error backwards, in order to assign proper blame to each of the weights in the network.

11). To what sorts of applications have neural networks been applied?

It have been applied on the handwritten-digit-recognition task

12). In the 1980s, the most visible group working on neural networks was a team at the University of California at San Diego headed by two psychologists. What were their names? What adjective (other than neural) did they use to refer to the networks which constituted the focus of their attention, and why did they use this qualifier? What was the name of the two-volume treatise that these researchers published in 1986?

David Rumelhart and James McClelland, they used to refer to neural networks as connectionist networks because the term connectionist refers to the idea that knowledge in these networks resides in weighted connections between units. The treatise they published was called "Parallel distributed processing".

13). TRUE or FALSE: Over the last six decades of AI research, people have repeatedly debated the relative advantages and disadvantages of symbolic and subsymbolic approaches.

True

14). Select the best answer: Symbolic systems ...

(a) can be engineered by humans, be imbued with human knowledge, and use human-understandable reasoning to solve problems.

(b) tend to be brittle, in that they are error-prone and often unable to generalize or adapt when presented with new situations.

(c) both of the above.

15). In a relatively short paragraph, answer the question: What is MYCIN?

MYCIN was a paradigmatic example of symbolic AI, it was developed in the early 1970s to help physicians diagnose and treat blood diseases. It uses both logic and probabilistic reasoning together with rules in order to come up with a diagnosis, and it was able to explain its reasoning process.

16). Select the best answer: Subsymbolic systems ...

(a) tend to be hard to interpret, and no one knows how to directly program complex human knowledge or logic into these systems.

(b) tend to be better than symbolic systems at perceptual or motor tasks for which humans can't easily define rules.

(c) both of the above.

17). How did the philosopher Andy Clark characterize the nature of subsymbolic systems?

"The nature of subsymbolic systems is to be 'bad at logic, good at Frisbee'".
(page 35)

18). TRUE or FALSE: Inspired by statistics and probability theory, AI researchers developed numerous algorithms that enable computers to learn from data, and the field of machine learning became its own independent subdiscipline of AI, intentionally separate from symbolic AI.

True

19). Fill in the blank: In rejecting symbolic AI methods, and hoping to lure others to reject them as well, machine learning researchers disparagingly referred to symbolic AI as BLANK.

GOFAL, or good old-fashioned AI.

20). Identify a bit of knowledge presented in this chapter that you found to be particularly interesting, describe that bit of knowledge, and provide a few words pertaining to why you found the knowledge to be particularly interesting.

M.M. wrote on the handwritten-digit-recognition tasks that perception was correct on about 80% of new examples, while 94% is achieved with a neural network with 50 hidden units.

I found this interesting because perception was supposed to be coded with human logic, and neural networks were a machine's trial and error. It would make sense that human logic would be better at recognizing handwriting than machines, yet the result turns out to be the opposite.