

AI Programming (CSC416) - Textbook Assignment #1

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What follows is a series of selected questions and answers from Chapter 1 of Stephen Lucci's "Artificial Intelligence in the 21st Century". The chapter acts as an overview of the history of artificial intelligence, with some brief discussion of attempts from the ages before modern computation was possible, and many topics which were birthed with the advent of modern computing. Accordingly, these questions act as an overview of those topics, and provide some further insight into them.

Questions for discussion

2. Distinguish between strong and weak AI.

Strong AI is characterized by reproducing natural intelligences, namely: humans. Weak AI, on the other hand, is less concerned with mimicking existing intelligences, and instead focuses on producing results that are traditionally viewed as requiring intelligence to obtain.

4. What was Alan Turing's significant contribution to Artificial Intelligence.

The obvious answer to this question is the Turing Test, a method he invented for judging whether something is intelligent or not. However, his biggest contribution to AI, and society as a whole, was his invention of the Turing Machine, which is the foundation for the Von Neumann Machine, the basis of all modern computer processors.

5. What did John McCarthy contribute to Artificial Intelligence?

McCarthy was the first person to implement the Lambda Calculus through the programming language LISP. LISP and its many dialects have been heavily utilized in the design and production of AI systems, especially in the 1980's.

7. Why is medical diagnosis a very typical and suitable domain for AI research?

Medical diagnoses can be seen as a decision based upon a set of conditions. A doctor can be very proficient in making decisions based on past medical knowledge, but a doctor is only human and therefore cannot consider the whole of their knowledge at once, and is subject to human biases. A sufficiently powerful AI can weigh the whole of its knowledge, and draw upon the optimal solution given that knowledge, and even draw confidence statistics.

8. Why have two-person games been a very suitable domain of study for AI?

Games in general have been a good medium for AI research, because they involve many of the same challenges encountered in the real world, without any of the consequences. Single-player games are fairly easy to solve, because there are presumably no unpredictable factors that come into play, and the AI can focus on the optimal solution. Two-person games, on the other hand, involve a constant weighing of benefits to oneself, and detriments to the competitor, and thus provide greater challenge, and more real world applications.

Exercises

1. A variation of the Turing test is the so-called Inverted Turing test; in this test, a computer must determine whether it is dealing with a person or another computer. Can you envision any practical applications for this version of the Turing test?

One common implementation of the Inverted Turing test today is the CAPTCHA and reCAPTCHA systems. In such systems, a human must pass a test which a computer would not be able to pass. In its current form, the test is very simple, and solvable by computers, but with innovations there may be better systems put forth in the future.

4. Consider the following tests for a city to be considered a great city:

- It should be possible to obtain a steak dinner at 3:00 a.m.
- A classical music concert should be scheduled somewhere within the city bounds each evening.
- A major sporting event should be scheduled each evening.

Further, suppose a small town somewhere in America determines that they want to pass this test. To do so, they open a 24-hour steak joint and purchase a symphony orchestra and major sports franchise. Do you feel that this town passes our litmus test for being a great city? Relate this discussion to the criteria for passing the original Turing test and the possession of intelligence.

The small town may pass the great city test, but it did so by making passing the test a conscious goal, and completing those goals in an un-natural way. In doing so, it passed the test, but failed the *spirit* of the test. A great city would presumably meet these three criteria unintentionally, as they are merely a by-product of being great. The same goes for the Turing test. By being an intelligent being, one would presumably be able to pass the test (by a very narrow definition of intelligence). The *spirit* of the test is to measure intelligence, but it is possible to pass it while violating this spirit, as in the lookup-table solution.

8. Suggest a heuristic that would help to hail a taxi on a visit to New York City (or any other major city) during rush hour when taxis are scarce.

One heuristic would be to walk towards locations which people are constantly coming and going from (e.g. shopping centers, landmarks, and subway stations), and are therefore more appealing for a taxi to look for passengers in. Another would be to frequently shout “taxi” and whistle.

9. What heuristic do lions employ as they pursue their prey?

Lions follow the heuristic of “move slowly and quietly so long as your prey has not seen you” and “chase and kill your prey as fast as you can after or just before being seen”.

12. Suppose that at some time in the future, NASA plans an unmanned mission to Europa, a moon of the planet Jupiter. Suppose that at the time of launch our understanding of this moon’s surface is scant. Suggest advantages to sending an “army” of Rodney Brooks-insect-type robots rather than one or two more substantial machines.

Europa’s surface is unlike the surface of any other known celestial body, as it is comprised entirely of ice floating atop a vast, moon-wide ocean. There may be unforeseen hazards in navigating such a surface, which would be better discovered by losing one of many robots, rather than losing one of several. An army of small robots also has the advantage of being able to cover a wider area by splitting up, fitting into smaller areas due to their size, and possibly standing atop ice which would collapse beneath a heavier machine.