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Chapter-1

Artificial Intelligence(Introduction)-(PG-31)

1.1 Define in your own words: (a) intelligence, (b) artificial intelligence, (c) agent, (d)rationality, (e) logical reasoning.

Solution:

a. Dictionary definitions of **intelligence** talk about "the capacity to acquire and apply knowledge" or "the faculty of thought and reason" or "the ability to comprehend and profit from experience." These are all reasonable answers, but if we want something quantifiable we would use something like "the ability to apply knowledge in order to perform better in an environment."

b. We define **artificial intelligence** as the study and construction of agent programs that perform well in a given environment, for a given agent architecture.

c. We define an **agent** as an entity that takes action in response to percepts from an environment.

d. We define **rationality** as the property of a system which does the "right thing" given what it knows.

e. We define **logical reasoning** as the a process of deriving new sentences from old, such that the new sentences are necessarily true if the old ones are true. (Notice that does not refer to any specific syntax or formal language, but it does require a well-defined notion of truth.)

1.2 Read Turing's original paper on AI (Turing, 1950). In the paper, he discusses several objections to his proposed enterprise and his test for intelligence. Which objections still carry weight? Are his refutations valid? Can you think of new objections arising from developments since he wrote the paper? In the paper, he predicts that, by the year 2000, a computer will have a 30% chance of passing a five-minute Turing Test with an unskilled interrogator.What chance do you think a computer would have today? In another 50 years?

Solution:.

The probability of fooling an interrogator depends on just how unskilled the interrogator is. One entrant in the 2002 Loebner prize competition (which is not quite a real Turing Test) did fool one judge, although if you look at the transcript, it is hard to imagine what that judge was thinking. There certainly have been examples of a chatbot or other online agent fooling humans. For example, see See Lenny Foner's account of the Julia chatbot at foner.www.media.mit.edu/people/foner/Julia/. We'd say the chance today is something like 10%, with the variation depending more on the skill of the interrogator rather than the program. In 50 years, we expect that the entertainment industry (movies, video games, commercials) will have made sufficient investments in artificial actors to create very credible impersonators.

1.7 To what extent are the following computer systems instances of artificial intelligence:

- Supermarket bar code scanners.
- Web search engines.
- Voice-activated telephone menus.
- Internet routing algorithms that respond dynamically to the state of the network.

Solution:

#Although bar code scanning is in a sense computer vision, these are not AI systems. The problem of reading a bar code is an extremely limited and artificial

form of visual interpretation, and it has been carefully designed to be as simple as possible, given the hardware.

In many respects the problem of determining the relevance of a web page to a query is a problem in natural language. Search engines like Ask.com, which group the retrieved pages into categories, use clustering techniques analogous. Likewise, other functionalities provided by a search engines use intelligent techniques; for instance, the spelling corrector uses a form of data mining based on observing users' corrections of their own spelling errors. On the other hand, the problem of indexing billions of web pages in a way that allows retrieval in seconds is a problem in database design, not in artificial intelligence.

#To a limited extent. Such menus tends to use vocabularies which are very limited –e.g. the digits, "Yes", and "No" — and within the designers' control, which greatly simplifies the problem. On the other hand, the programs must deal with an uncontrolled space of all kinds of voices and accents.

This is borderline. There is something to be said for viewing these as intelligent agents working in cyberspace. The task is sophisticated, the information available is partial, the techniques are heuristic (not guaranteed optimal), and the state of the world is dynamic. All of these are characteristic of intelligent activities. On the other hand, the task is very far from those normally carried out in human cognition.

1.10 Is AI a science, or is it engineering? Or neither or both? Explain.

Solution:

This question is intended to be about the essential nature of the AI problem and what is required to solve it, but could also be interpreted as a sociological question about the current practice of AI research.

A *science* is a field of study that leads to the acquisition of empirical knowledge by the scientific method, which involves falsifiable hypotheses about what is. A pure *engineering* field can be thought of as taking a fixed base of empirical knowledge and using it to solve problems of interest to society. Of course, engineers do bits of science—e.g., they measure the properties of building materials—and scientists do bits of engineering to create new devices and so on.

The "human" side of AI is clearly an empirical science—called cognitive science these days—because it involves psychological experiments designed out to find out how human cognition actually works. What about the the "rational" side? If we view it as studying the abstract relationship among an arbitrary task environment, a computing device, and the program for that computing device that yields the best performance in the task environment, then the rational side of AI is really mathematics and engineering; it does not require any empirical knowledge about the *actual* world—and the *actual* task environment—that we inhabit; that a given program will do well in a given environment is a *theorem*. (The same is true of pure decision theory.) In practice, however, we are interested in task environments that do approximate the actual world, so even the rational side of AI involves finding out what the actual world is like. For example, in studying rational agents that communicate, we are interested in task environments that contain humans, so we have to find out what human language is like. In studying perception, we tend to focus on sensors such as cameras that extract useful information from the actual world. (In a world without light, cameras wouldn't be much use.) Moreover, to design vision algorithms that are good at extracting information from camera images, we need to understand the actual world that generates those images. Obtaining the required understanding of scene characteristics, object types, surface markings, and so on is a quite different kind of science from ordinary physics, chemistry, biology, and so on, but it is still science. In summary, AI is definitely engineering but it would not be especially useful to us if it were not also an empirical science concerned with those aspects of the real world that affect the design of intelligent systems for that world.

1.13 "Surely animals, humans, and computers cannot be intelligent—they can do only what their constituent atoms are told to do by the laws of physics." Is the latter statement true, and does it imply the former?

Solution:

The statement that the computers can do only what their programmers tell them is ambiguous. It is true that computers cannot be intelligent because computers are machines that do not have knowledge. Thus, they are not intelligent. They act according to the instructions given by the humans (programmers). They cannot act on their own and they cannot make the decisions by themselves. They are dependent on the algorithms. As they

completely depend on the knowledge and instructions of programmers, computers cannot be intelligent.
From the given statements, the second (latter) one is not true. According to the laws of physics, animals are not equally intelligent at all tasks. Here, intelligence refers to the performance of various tasks, and this performance may depend crucially on the animal's normal behaviors.

The former statement states that computers cannot be intelligent because they can do only what their programmers tell them. Animals cannot be intelligent they can do only what their genes tell them.

There is a possibility that computers might become just as intelligent as humans. It has been suggested that intelligent systems (humans, animals, and computers) achieve their intelligence by manipulating symbols of real-world items. The symbolic manipulation processes are similar in all such systems.