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1. What is AI

Eight definitions of according to eight textbooks are shown in *figure 1.1* These definitions vary along two main dimensions, roughly, the ones on top are concerned with *thought processes* and *reasoning*, whereas the one on the bottom address *behavior* the definition on the left measure success in terms fidelity to *human* performance, whereas the one on the right measure against an *ideal* concept of intelligence, which we will call rationality. A system is rational if it does the "right thing" given what it knows.

Systems that think like humans	**Systems that think rationally**
"The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Systems that act like humans	**Systems that act rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Figure 1.1 Some definitions of artificial intelligence, organized into four categories.

A tension exists between approaches centered a round humans and approaches centered around rationality. A human-centered approach must be an empirical science, involving hypothesis and experimental confirmation. A rationalist approaches involves a combination of mathematics and engineering. Each group has both disparaged and helped the other. Let us look at the four approaches in more detail.

1.1 Acting humanly: The Turing Test approach

The Turing test, Proposed by Alan Turing (1950), was designed to provide a satisfactory operational definition of intelligence. Rather than controversial list of qualifications required for intelligence, he suggested a test based on indistinguishability from undeniably intelligent entities-human beings. The computer pass the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from person or not, we note that programming a computer to pass the test provides plenty to work on, the computer need to posses the following capabilities:

- **Natural language processing** to enable it to communicate successfully in English;
- **Knowledge representation** to store what it knows or hears;
- **Automated reasoning** to use stored information to answer and draw new conclusions;
- **Machine learning to** adapt to new circumstances and to detect and extrapolate patterns.

Turing's test deliberately avoided direct physical interaction between the interrogator and the computer, because physical simulation of pearson is unnecessary for intelligence. However, the so called total Turing Test include a video signal so that the interrogator can test the subject's perceptual abilities, as well as the opportunity for interrogator to pass physical object "through the hatch." By isolating the interrogator from both the machine and the other human participant, the test ensures that the interrogator will not be biased by the appearance of the machine or any mechanical property of its voice. The interrogator is free, however, to ask any questions, no matter how devious or indirect, in an effort to uncover the computer's identity. For example, the interrogator may ask both subjects to perform a rather involved arithmetic calculation, assuming that the computer will be more likely to get it correct than the human; to counter this strategy, the computer will need to know when it should fail to get a correct answer to such problems in order to seem like a human. To discover the human's identity on the basis of emotional nature, the interrogator may ask both subjects to respond to a poem or work of art; this strategy will require that the computer have knowledge concerning the emotional makeup of human beings.

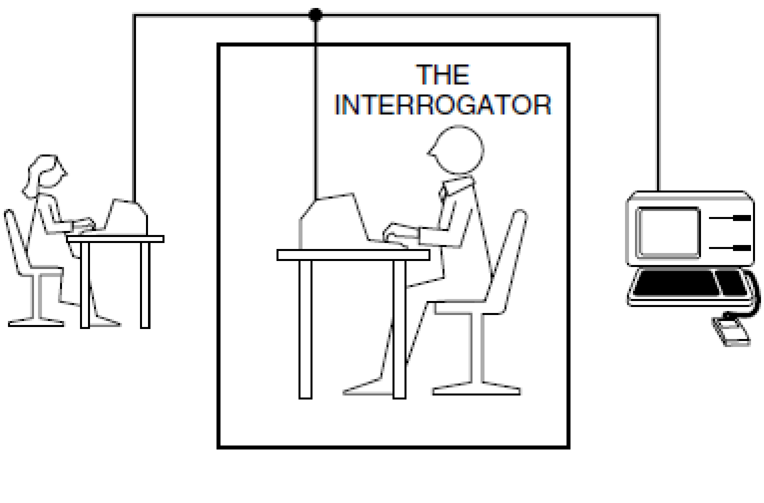

Figure 1.1 The Turing test

To pass the total Turing test, the computer will need

- **Computer vision** to perceive objects, and
- **Robotics** to manipulate objects and move about.

The important features of Turing's test are:

1. It attempts to give an objective notion of intelligence, i.e., the behavior of a known intelligent being in response to a particular set of questions. This provides a standard for determining intelligence that avoids the inevitable debates over its "true" nature.

2. It prevents us from being sidetracked by such confusing and currently unanswerable questions as whether or not the computer uses the appropriate internal processes or whether or not the machine is actually conscious of its actions.

3. It eliminates any bias in favor of living organisms by forcing the interrogator to focus solely on the content of the answers to questions.

Because of these advantages, the Turing test provides a basis for many of the schemes actually used to evaluate modern AI programs.

1.2 Thinking humanly: the cognitive modeling approach

If we are going to say that a given program thinks like human, we must have some way of determining how humans think. We need to go inside the actual workings of human minds. There are two ways to do this: through introspection— trying to catch our thoughts as they go by and —through psychological experiments. Once we have a sufficiently precise theory of mind, it becomes possible to express the theory as a computer program. If the program's Input/ output and timing behavior match corresponding human behaviors, that is evidence that some of program's mechanisms could also operating in humans. For example the general problem solver (Newell and Simon, 1961), were not content to have their program solve problems correctly. They were more concerned with comparing the trace of its reasoning steps to trace of human subject to solve the same problems. The interdisciplinary field of cognitive science brings together computer models from AI and experimental techniques from psychology to try to construct precise and testable theories of working of human mind.

1.3 Thinking rationally the law of thinking approach

The Greek philosopher Aristotle was one of the first to attempt to codify" right thing, that is, irrefutable reasoning processes. His **syllogisms** provide patterns for argument structures that always yielded correct conclusions when given correct premises — for example, "Socrates is a man; all men are mortal. Therefore, Socrates is mortal." These laws of thought were supposed to govern the operation of mind; there study initiated the field called **Logic**.

Logicians in the 19th century developed a precise notation for statement about all kinds of things in the world and about the relation among them. By 1965, program existed that could, in principle, solve *any* solvable described in logical notation. The so called **logicist** tradition within artificial intelligence hopes to build on such program to build intelligent system.

There are two main obstacles to this approach. First, it is not easy to take informal knowledge is less that 100% certain. Second, there is a big difference between being able to solve a problem "in principle" and doing so in practice. Even a problem with just few dozen facts can exhaust the computational resources of any computer unless it has some guidance as to which reasoning steps to try first.

1.4 Acting rationally: the rational approach

An **agent** is just something that acts (agent come from Latin agree, to do). But computer agents are expected to have other attributes that distinguish them from mere "programs," such as operating under autonomous control, perceiving their environment, persisting over prolonged time period, adapting to change, and being capable of taking on another's goals. A **rational agent** is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.

The study of AI as rational-agent design has at least two advantages. *First*, it is more general than "laws of thought" approach, because correct inference is just one of several possible mechanisms for achieving rationality. *Second*, it is more amenable to scientific development than are approaches based on human behavior or human thought because the standard of rationality is clearly defined and completely general. Human behavior, on the other hand is well-adapted for one specific environment and the product, in part of a complicated and largely unknown evolutionary process that still is far from producing perfection.

2. The scope of AI

AI has a very wide scope. Some of its applications are discussed below:

2.1 Game

According to Newell and Simon the essential basis for human problem solving is to systematically explore a space of problem state i.e., successive and alternative stages in the problem solving. For example the different board configuration or intermediate steps in the reasoning process. This space called **state space**. This space of alternative solution is then searched to find a final answer.

Please understand that games can generate extremely large search spaces. So we need powerful technique to search our solution in this space. These techniques are called *heuristics* and constitute a major area of AI research.

Because most of us have some experience simple games, it is possible to devise and test the effectiveness of our own heuristics. We do not need to find and consult an expert in some esoteric problem area such as medicine or mathematics (chess is an obvious exception to this rule). For these reasons, games provide a rich domain for the study of heuristic search.

2.2 Theorem proving

It is a formal system wherein logic lends itself to automation. A large variety of problems can be solved by using logical axioms and treating problem instances as theorems to be proved. Theorem proving has devised powerful solution heuristics and reduced the complexity of the search space. For example, design and verification of logic circuits, control of complex system etc., will respond to such an approach.

Many modern theorem provers function as "intelligent assistant" by this we mean that it allows humans to do the task of decomposition of large problem into sub-problems and devising heuristics for searching the space of possible proofs. On the other hand, the theorem provers then performs the simpler but still demanding task of proving lemmas, verifying smaller guesses and completing the formal aspect of a proof outlined by the humans.

2.3 Natural language processing

It is subfield of AI which deals with the methods of communicating with a computer in ones own natural language. This will fill the gap between the human and the machines. So, now one need not be a computer literate to communicate with it.

2.4 Vision and speech processing

Computer vision is a computation intensive process. It involves multiple transformations. This relies more on classical AI methods of symbolic processing.

Speech understanding requires recognition of basic speech patterns. These patterns are matched against lexicon patterns for recognition. Developing systems that understand speech has been a continuing goal of AI researchers.

2.5 Robotics

According to the robot institute of America (RIA)—" A robot is a programmable, multifunctional, maniplar that it designed to move move materials, part tools or specialized devices through various programmed motions for the performance of the variety of tasks."

Today, we need intelligent robot to make them smaller devices. So intelligent need to be embedded into it. So, now vision is very essential. These intelligent robots as well as AI promise us to solve our complex problem easily.

2.6 Expert system (ES)

They are knowledge intensive programs that solve problems in a domain that need a good technical expertise. AI specialist or knowledge engineer or expert system designer are responsible for implementing knowledge in a program, both effectively and intelligently.

Expert system examples:

1. DENDRAL —Developed at Stanford University in late 1960s. It was designed to infer the structure of organic molecules from their chemical formals and mass spectrographic information about the chemical bonds present in molecules. As these organic molecules tend to be very large, so the numbers of possible structures for these molecules tend to be huge. DENDRAL address this problem of large search space by applying a heuristic knowledge of expert chemists to the structure elucidation problem.
2. MYCIN—it use the expert medical knowledge to diagnose and prescribe treatment for spinal meningitis and bacterial infections of blood. It we developed at Stanford in mid 1970s. It provides clear and logical explanation of its reasoning. It uses control structure appropriate to the specific problem domain.
3. PROSPECTOR——A program for determining the probable location and the type of ore deposits based on geological information about site.

Please note that most expert system have peen written for relatively specialized expert level domains.

3. AI program v/s conventional program

Let us tabulate the differences between AI and conventional program

AI program	conventional program
1.they manipulate symbolic information	1. they manipulate numeric information
2. It use heuristic search method	2.It use algorithmic search method
3. It seek for satisfactory answers	3. It seek for optimal answers
4. It involves large KB.	4. It involves large DB.
5. It involves frequent modifications.	5. It involves rare modifications.

There are two more concepts that might be hear from a many resources they are: weak and strong AI let us differentiate them

strong AI	Weak AI
1. A strong AI claims that computers can be made to thing on a level at least equal to humans.	1. A weak AI claims that some "thinking like" features are added to computer to make them more useful tool.
2. It deals with the creation of some form of computer based AI that can truly reason and solve problems.	2. It deals with the creation of some form of computer – based AI that can reason and solve problems in a limited domain.
3. In strong AI, the programs are themselves the explanation.	3. A machine need not posses true intelligence
4."Doing" is sometimes referred to as strong AI.	4." Helping" is called as weak AI.
5. We have still to achieve the objective of strong AI	5.We have already reached the objective of weak AI