Artificial Intelligence

Introduction

Definition of AI

Artificial intelligence is the <u>simulation</u> of human intelligence <u>processes</u> by machines, especially computer systems. These processes include <u>learning</u> (the acquisition of information and rules for using the information), <u>reasoning</u> (using the rules to reach approximate or definite conclusions), and <u>self-correction</u>. Particular applications of AI include e<u>xpert systems</u>, <u>speech recognition</u> and <u>machine vision</u>. (http://searchcio.techtarget.com/definition/AI)

Four approaches to AI

1. Thinking Humanly
2. Acting Humanly
3. Thinking Rationally
4. Acting Rationally

Thinking Humanly

➔ "The cognitive modeling approach."
➔ Machines with minds.
➔ Effort to make computers think.
➔ The automation of activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)
➔ Find ways of determining how humans think.
➔ Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program
➔ See GPS, the General Problem Solver - by Allen Newell and Herbert Simon.

Acting Humanly

➔ 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)

➔ The Turing Test, proposed by Alan Turing (1950).

➔ A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer.

Acting Humanly...

➔ **The computer would need to possess the following capabilities:**
1. Natural language processing to enable it to communicate successfully in English.
2. Knowledge representation to store what it knows or hears.
3. Automated reasoning to use the stored information to answer questions and to draw new conclusions.
4. Machine learning to adapt to new circumstances and to detect and extrapolate patterns.
  - *See The Total Turing Test...*

Thinking Rationally

➔ "The laws of thought approach."
➔ 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)
➔ See the syllogisms of Aristotle - an argument structure always yields correct conclusions when given correct premises.
➔ For example, "Socrates is a man; all men are mortal; therefore, Socrates is mortal."
➔ Gave birth to the study of logics.

Acting Rationally

➔ The rational agent approach.

➔ 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)

➔ Agent? All computer programs do something, but computer agents are expected to do more; operate autonomously, perceive their environment, persist over a prolonged time period, adapt to change, and create and pursue goals.

➔ A rational agent is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.

Acting Rationally ...

The rational-agent approach has <u>two advantages</u> over the other approaches.

1. First, it is more general than the "laws of thought" approach because correct inference is just one of several possible mechanisms for achieving rationality.
2. Second, it is more amenable to scientific development than are approaches based on human behavior or human thought.

Disciplines that gave birth to AI.

- History of the disciplines that contributed ideas, viewpoints, and techniques to AI
1. Philosophy
2. Mathematics
3. Philosophy
4. Mathematics
5. Economics

Disciplines that gave birth to AI...

6. Neuroscience
7. Psychology
8. Cognitive psychology
9. Computer engineering
10. Control theory and cybernetics
11. Linguistics

The History of Artificial Intelligence

1. The birth of artificial intelligence (1956)
2. Early enthusiasm, great expectations (1952–1969)
3. A dose of reality (1966–1973)
4. AI becomes an industry (1980–present)
5. The return of neural networks (1986–present)
6. AI adopts the scientific method (1987–present)
7. The emergence of intelligent agents (1995–present)
8. The availability of very large data sets (2001–present)

The History of Artificial Intelligence ...

9.   What can AI do today?
  -   Robotic vehicles
  -   Speech recognition
  -   Autonomous planning and scheduling
  -   Game playing
  -   Spam fighting
  -   Logistics planning
  -   Robotics
  -   Machine Translation