

## What is Artificial Intelligence?

Does taking out the garbage require intelligence?

"By 2010 we will see mobile robots as big as people but with the cognitive abilities similar in many respects to those of a lizard. These machines will be capable of carrying our simple chores, such as vacuuming, dusting, delivering packages and taking out the garbage" Hans Moravec, Scientific American 2008

"Perhaps by 2020 the process will have produced the first broadly competent 'universal robots,' the size of people but with lizard like 10,000 MIPS minds that can be programmed for almost any simple chore." Hans Moravec, CACM 2003

"By 2050 robot "brains" based on computers that execute 100 trillion instructions per second will start rivaling human intelligence." Hans Moravec, Scientific American 2008

Is an insect intelligent?  
Are computers intelligent?  
Are we intelligent??

What would an artificial or synthetic entity have to do to convince you that it was intelligent?

Nils J. Nilson, "Artificial Intelligence (AI), broadly (and somewhat circularly) defined, is concerned with intelligent behavior in artifacts."  
He defined intelligent behaviour as: Perception, reasoning, learning communicating, acting in complex environments.

AI's long term goal is to do these things as well as humans can, maybe better!

Man	vs.	Machine
	Calculation	X
X	Face recognition	
	Data processing	X
X	Navigation	
X	Object manipulation	

Russell and Norvig - Definitions of AI can be organized into four categories.

	Humans	Rationality
Thought processes and reasoning	Systems that think like humans	Systems that think rationally
Behavior	Systems that act like humans	Systems that act rationally

### Acting Humanly

Alan Turing in 1950 said that we should not be concerned with whether machines could think but if they can exhibit human behavior well enough to fool an impartial interrogator.

The test as Turing described it:

Described as a game where there is a man(A), a woman(B) and an interrogator (C), who can be of either sex. The interrogator sits in a separate room from A and B and communicates with them by a teletype. The goal: the interrogator must find out which is the man and which the woman.

To find this out the interrogator asks A questions, i.e. What is the length of your hair?

A is supposed to make the interrogator classify the two wrongly.

B is supposed to help the interrogator.

If we were to replace player A with a machine, will the interrogator be as accurate as when the game is played with a man and woman.

How the test is defined today (the politically correct version). A machine must convince a human interrogator that it is human.

Turing - by the year 2000 a computer could be programmed well enough to have a conversation with an interrogator for 5 mins with a result of 30% chance of fooling a human interrogator

computer needs to pass test:

natural language processing - ability to communicate

knowledge representation - store's knowledge

automated reasoning - able to answer questions from stored knowledge  
machine learning - adapt to new situations

Total Turing test - includes video signal, and "hatch" where objects can be passed  
computer vision  
robotics

1991 Hugh Loebner offered \$100,000 prize to the author of the first computer program to pass the Turing test.

" Originally, \$2,000 was awarded for the most human-seeming chatterbot in the competition. The prize was \$3,000 in 2005 and \$2,250 in 2006. In 2008, \$3,000 was awarded.

In addition, there are two one-time-only prizes that have never been awarded. \$25,000 is offered for the first chatterbot that judges cannot distinguish from a real human and that can convince judges that the human is the computer program. \$100,000 is the reward for the first chatterbot that judges cannot distinguish from a real human in a Turing test that includes deciphering and understanding text, visual, and auditory input. Once this is achieved, the annual competition will end."  
Wikipedia

Competition is still ongoing.

Converse with a chatbot - see assignment

### Systems that think humanly

In order to decide if a computer thinks humanly we have to decide how a human thinks.

- a) introspection - How do I think?
- b) psychological experiments
- c) brain imaging

General Problem Solver - Newell and Simon (1961) solved simple puzzles and games

significant - first program that was not as much concerned with getting the right answer, but in finding the answer using the same reasoning a human would.

Today the trend is for modern expert programs to be able to explain how they derived their answers.

The field of cognitive science combines AI models with results from psychology to theories and models as to how the mind works.

### Thinking rationally

Aristotle's syllogisms - styles of deductive reasoning.

Ex. Imberman is a woman  
All woman are beautiful  
Therefore Imberman is beautiful.

forerunner of the field of logic.

Formal logic - late 19th - early 20th century.

Logicist approach to AI - program represents a problem in logical notation and then try to find a solution. If none exists the program knows to stop looking.

Hard to represent knowledge, the world symbolically.

Some problems may be solvable but intractable.

### Acting rationally

rational agent - one that acts to achieve the best outcome, or when there is uncertainty, the best expected outcome

Given a set of beliefs, act on their beliefs to achieve your goals.

"laws of thought" approach to AI - Need to make correct inferences in order to determine goals and act on them.

Acting rationally means you need to make correct inferences.

Acting rationally incorporates, and is therefore more general, than some of the other definitions

Text approach - construction of rational agents.