Chapter 1: What is Artificial Intelligence?

First chapters are fully based on presentations by Prof. Gerhard Lakemeyer (Aachen), Dr. Jana Koehler, Prof. Joschka Boedecker, Wolfram Burgard, Frank Hutter, Bernhard Nebel (Freiburg)

What is Artificial Intelligence?

- The attempt to make computers more "intelligent"

- The attempt to better understand human intelligence

- Four approaches:
  - Is it about thought thinking ...

  - ... or acting?

  - Oriented towards a human model (with all its defects) ...

  - ... or normative (how should a rational being think/act)?

A Few Definitions

Thinking Humanly	Thinking 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)
Acting Humanly	**Acting 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)

Turing Test

TURING TEST EXTRA CREDIT:
CONVINCE THE EXAMINER
THAT <u>HE'S</u> A COMPUTER.

YOU KNOW, YOU MAKE
SOME REALLY GOOD POINTS.

I'M ... NOT EVEN SURE
WHO I AM ANYMORE.

Quite nice chat-robot: http://www.mitsuku.com

Systems that Think Humanly

- What cognitive capabilities are necessary to produce intelligent performance?

- Not important: Being able to solve problems correctly

- Important: Being able to solve problems like a human would

- $\rightarrow$ Cognitive science and cognitive psychology

- $\rightarrow$ Also important for human-machine interaction

- . . . will not be discussed in this course

Systems that Think Rationally

- What are the laws of thought?

- How should we think?
    - → The logical approach

    - → Problems:

    - Presentation of problem descriptions using a formal notation Computability

    - → These are problems that appear regardless of the formalization method

Systems that Act Rationally

- Rational agents (or rational actors)
    - A rational agent acts so as to achieve its given goals, under the assumption that its impressions of the world and its convictions are correct

    - Rational thinking is a prerequisite for rational acting, although it is not a necessary condition

    - $\rightarrow$ What to do, for example, when we must make a decision faced with insufficient information?

The AI Scene (1/2)

- Problem solving and searching

- Knowledge representation and processing

- Action planning

- Machine learning

- Handling uncertain knowledge Neural networks

The AI Scene (2/2)

- Many coexisting paradigms
  - $\rightarrow$ Reactive vs. deliberative approaches
  - $\rightarrow$ Probabilistic vs. analytic
  - $\rightarrow$ . . . often hybrid approaches as well
- Many methods (partly from other disciplines): $\rightarrow$ Logic, decision theory, algorithms
- Many approaches:
  - $\rightarrow$ Theoretical, algorithmic experimentation, system-oriented
  - Today, many methods are no longer regarded as pure AI methods. Examples: Board game programs, logic programming (PROLOG), search procedures, . . .
  - Deep learning has become the new hype . . .

Content

- Introduction

- Rational Agents

- Solving Problems by Searching

- Informed Search

- Constraint Satisfaction Problems

- Games

- Propositional Logic

- Satisfiability and Model Construction

- Predicate Logic

- Introduction to Prolog

- Introduction to Fuzzy Logic

- Planning

- Machine Learning

Do not be disappointed!
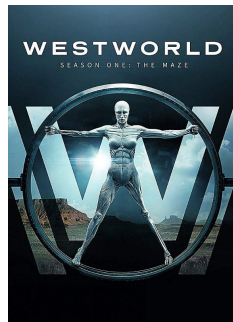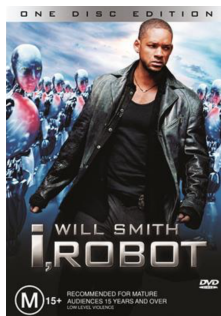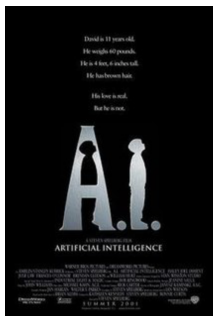
The basic methods did not significantly change over the past 20 years - we just have now more data and much more powerful computers!