EDA132: Applied Artificial Intelligence or TAI: Tillämpad Artificiell Intelligens

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Plan for today

- Administrative stuff
- Brief intro (AIMA Chapter 1)
- Agents (AIMA Chapter2)

What is (Artificial) Intelligence?

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- adaptivity

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- learning

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What is Intelligence?

- adaptivity
- learning
- creativity

What is (Artificial) Intelligence?

What is Intelligence?

- adaptivity
- learning
- creativity
- logical reasoning

What is (Artificial) Intelligence?

What is Intelligence?

- adaptivity
- learning
- creativity
- logical reasoning
- problem solving capability
- ...

Can it be compared? Measured?

What is Artificial Intelligence?

Artificial intelligence (AI) is the intelligence of machines and the branch of computer science that aims to create it.

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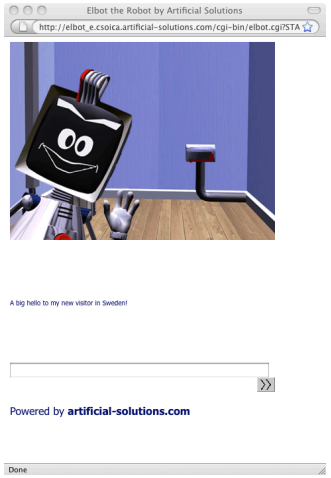
Late John McCarthy, who coined the term in 1956, defines it as *“the* **science** *and* **engineering** *of making intelligent machines.”* (Wikipedia)

In 2005:

Automated agent traders account for over 50% of portfolio trades by value most weeks on the New York Stock Exchange and, in some weeks, as much as 70% of portfolio trades.

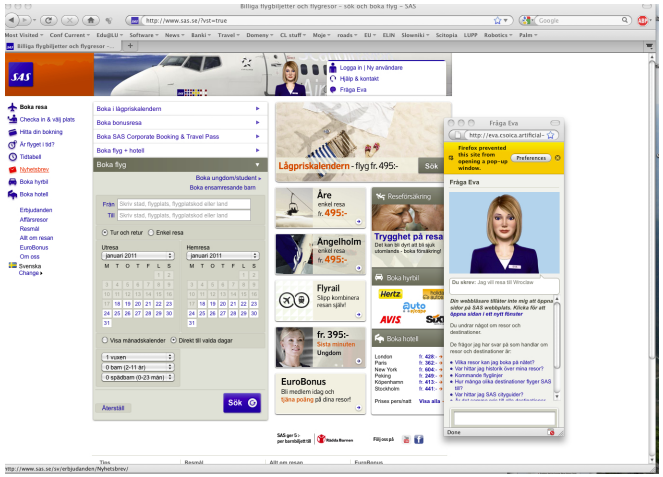
Problems: “2010 flash crash”

In 2011:



www.elbot.com

A couple of agents more ...



Movie time

- Watson;
- Geminoid;
- Google car.

But...

"What is the only former Yugoslav republic in the European Union?" (2012)

2880 POWER7 cores, 16 Terabytes memory, 4 Terabytes clustered storage (i.e., IBM Watson) still could not answer this question!

Subdomains of Artificial Intelligence

- Search, Problem solving
- Reasoning, Logical reasoning, Probabilistic reasoning
- Machine Learning
- Natural Language Processing
- Perception, Computer Vision
- Autonomous Robots
- Knowledge Processing
- ...

About the course

- EDA132: Applied artificial intelligence
- `http://cs.lth.se/EDA132`
- Serves as an announcement board as well!
- Meaning I expect you to read it often!!!
- Teachers: Pierre Nugues, Elin Anna Topp, Jacek Malec
- Administrator: Lena Ohlsson

Contents

- 7,5 hp (ECTS)
- Lectures (14), normally Wednesdays, 13–15 in MA:3 and Fridays, 13–15, in M:B (one exception)
- Three programming assignments
- Home reading (textbook)
- S. Russell, P. Norvig, Artificial Intelligence, a Modern Approach, 3rd int. ed., Prentice Hall

Evaluation

- Exam: worth 4,5p out of 7,5p. Material pointed to in the “reading advice” section.
- Programming assignments: worth 3p. Important: both correctness **and presentation** count.
- Complexity level of programming assignments may vary, although we strive for even division of labour;

but

- We need your feedback ...
- Kursombud (course representatives) need to be chosen

Programming assignments

1. Search
2. Machine Learning (tentative list)
   1. Decision Trees
   2. Logistic Regression
3. Probabilistic reasoning

Programming assignment submission

- The submission is to be sent to `tai@cs.lth.se` in the format described on the course web.
- This address works for **assignment submissions only!**. May or may not work for other things, so mail me (or any of the other teachers) **directly** for other purposes.
- All assignments are to be handed in electronically (as pdf documents), **on time!**

End of the admin stuff

Questions? Comments?

Please elect a course representative. Thank you.

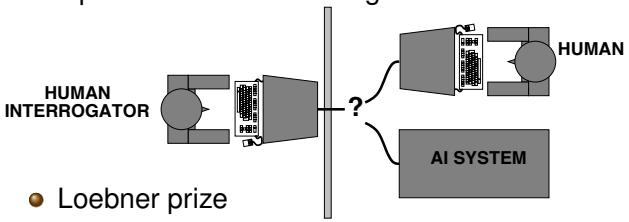
What is AI

Systems that think like humans	**Systems that think rationally**
Systems that act like humans	**Systems that act rationally**

Acting humanly: The Turing test

Turing (1950) “Computing machinery and intelligence”:

- Can machines think? $\longrightarrow$ Can machines behave intelligently?
- Operational test for intelligent behavior: the *Imitation Game*



- Loebner prize
- Anticipated all major arguments against AI in last 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning

Problem: Turing test is not *reproducible*, *constructive*, or amenable to *mathematical analysis*

Thinking humanly: cognitive science

1960s “*cognitive revolution*”: information-processing psychology replaced the then prevailing orthodoxy of *behaviorism*
Requires scientific theories of internal activities of the brain

- What level of abstraction? “Knowledge” or “circuits”?
- How to validate? Requires
  - Predicting and testing behavior of human subjects (top-down),
  - or Direct identification from neurological data (bottom-up)

Both approaches (roughly, *Cognitive Science* and *Cognitive Neuroscience*) are now distinct from AI
Both share with AI the following characteristic: *the available theories do not explain (or engender) anything resembling human-level general intelligence*
Hence, all three fields share one principal direction!

Thinking rationally: laws of thought

Aristotle: what are correct arguments/thought processes?

Several Greek schools developed various forms of **logic**:
notation and *rules of derivation* for thoughts;
may or may not have proceeded to the idea of mechanization

Direct line through mathematics and philosophy to modern AI

Problems:

- Not all intelligent behavior is mediated by logical deliberation
- What is the purpose of thinking? What thoughts *should* I have out of all the thoughts (logical or otherwise) that I *could* have?

Acting rationally

Rational behavior: doing the right thing

The right thing: that which is expected to maximize goal achievement,
given the available information

Doesn’t necessarily involve thinking—e.g., blinking reflex—but thinking should be in the service of rational action

Aristotle (Nicomachean Ethics):

> *Every art and every inquiry, and similarly every action and pursuit, is thought to aim at some good*

Rational agents

An *agent* is an entity that perceives and acts

This course is about designing *rational agents*

Abstractly, an agent is a function from percept histories to actions:

$$f : \mathcal{P}^* \to \mathcal{A}$$

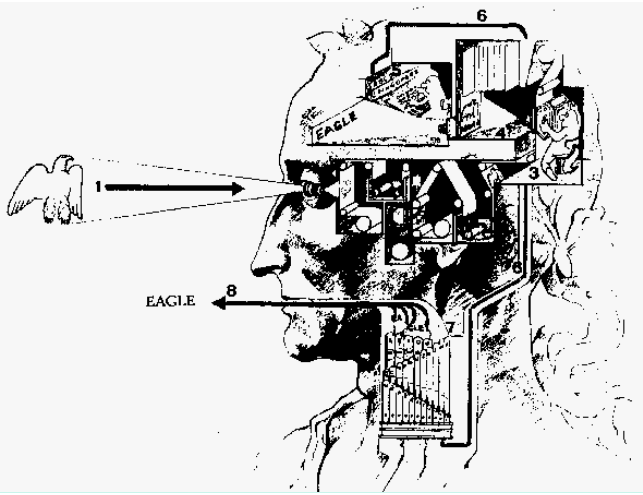
For any given class of environments and tasks, we seek the agent (or class of agents) with the best performance

Caveat: *computational limitations make perfect rationality unachievable*
→ design best **program** for given machine resources

State of the art

- Human-level AI back on the agenda
- 1997: Deep Blue defeats Kasparov
- Robbins conjecture (mathematics) proven after decades of human attempts
- Autonomous driving, flying, sailing, ...
- Logistics for Gulf, Iraq and Afghanistan
- Warfare for Iraq and Afghanistan
- 2011: Watson defeats humans in Jeopardy
- 2011: Siri
- Medical diagnoses and treatment
- 2016: Alpha Go defeats Lee Sedol
- 2017: Deep Stack or Libratus defeats ...?
  (Heads-up no-limit Texas hold'em poker)

What's in the course



What's missing in the course

Ethics

- enhancements of our capacities (bodies, minds)
  - do we want that?
  - can we afford not having that?
- elderly care, rehabilitation, medicine
  vs. war-fighting, sex, socializing
- emotional artificial partners
- large finances come from military sources (e.g., DARPA)
  - defensive
  - preventive attacks
  - robots that kill

Do we have the **right** to create robot servants?