Artificial Intelligence

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Administrative

- Lectures
  - Lecture slides will be available after the lecture at the end of the day
- Tutorial
  - Programming Assignments
  - Sheets
- Textbook
  - Artificial Intelligence a modern approach by Norvig and Russels.

Outline

- AI in our lives
- AI history
- What is AI
- Course roadmap
- Intelligent Agents

AI in our lives

- ATM
  - Check deposit
  - How things are done??
    - Handwriting recognition → Must attain great accuracy.

AI in our lives

- Virtual assistants
  - Google’s “Now” and Apple’s “Siri”
  - How things are done??
    - Speech recognition
    - Natural language understanding
    - Suggesting actions

AI in our lives

- Email
  - Spam filters and automatic categorization
  - How things are done??
    - Processing your input
    - Natural language understanding
    - Suggesting actions

AI in our lives

- Game Playing
  - 8-Queens, Checker, Chess, AlphaGo
  - How things are done??
    - Search for a goal
    - Search for a policy

AI in our lives

- Robotics
  - Nao, Roomba, Asimo
  - How things are done??
    - Engineering
    - Learning how to act.

AI in our lives

- Much more applications
  - Recommendation systems (collaborative filtering)
  - Search engines
  - Face Detection
  - Detection of breast cancer in mammography images
  - Autonomous Driving
  - Question answering systems
  - Social network analysis
  - Medical diagnosis, imaging
  - Route finding
  - Document Summarization
  - … And more

History of AI

- 1940-1950: Gestation of AI
  - McCulloch & Pitts: Boolean circuit to model of brain
  - Turing's Computing Machinery and Intelligence
- 1950-1970: Early enthusiasm, great expectations
  - Early AI programs, Samuel's checkers program
  - Birth of AI @ Dartmouth meeting 1956.
- 1970-1990: Knowledge-based AI
  - Expert systems, AI becomes an industry
  - AI winter
- 1990-present: Scientific approaches
  - Neural Networks
  - The emergence of intelligent agents
  - AI becomes "scientific", use of probability to model uncertainty
  - AI Spring! The availability of very large datasets. Data will drive future discoveries and alleviate the complexity in AI.

What is AI?

- Four schools of thoughts

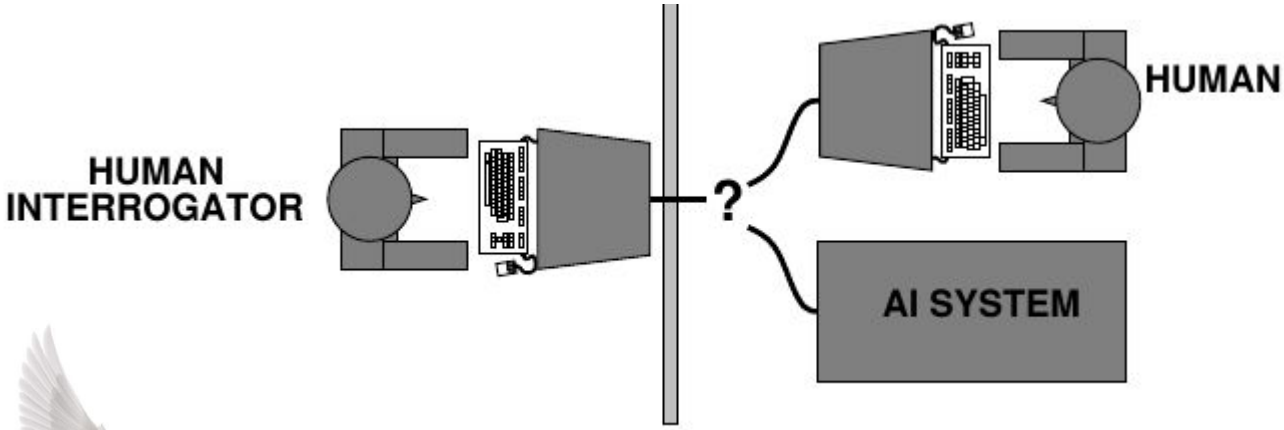
Thinking humanly	**Thinking rationally**
"The exciting new effort to make computers think... *machines with minds*, in the full and literal sense." (Haugeland, 1985)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985
Acting humanly	**Acting rationally**
"The study of how to make computers do things 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)

Thinking humanly: Cognitive Science

- Requires scientific theories of internal activities of the brain
  - – What level of abstraction? “Knowledge” or “circuits”?
  - – How to validate?
- Now distinct from AI

Acting humanly: The Turing test

- Turing (1950) “Computing machinery and intelligence”:
- “Can machines think?” −→ “Can machines behave intelligently?”
- Operational test for intelligent behavior: the Imitation Game



Thinking rationally: laws of thoughts

- Codify “right thinking” with logic.
- Several Greek schools developed various forms of logic:notation and rules of derivation for thoughts.
- Problems:
  - Not all knowledge can be expressed with logical notations.
  - Computational blow up.

Act rationally

- The right thing: that which is expected to maximize goal achievement, given the available information.
- A rational agent is one that acts so as to achieve the best outcome, or when there is uncertainty, the best expected outcome.

Course Roadmap

1. Intelligent Agents
2. Search
    a. Uninformed Search
    b. Informed Search
    c. Local search
    d. Adversarial search
3. Constraint Satisfaction Problem
4. ~~Logic~~
5. Uncertainty
    a. ~~Probability and Markov Models~~
    b. Machine Learning
6. Applications (NLP related tasks)

Resources

- http://aima.cs.berkeley.edu/
- Edx AI course: https://courses.edx.org/courses/course-v1:ColumbiaX+CSMM.101x+2T2017/info
- http://www.cse.wustl.edu/~garnett/cse511a/