Welcome to the Class of
Artificial Intellingence

ARTIFICIAL INTELLIGENCE

Outline

- What is AI?

- A brief history

- The state of the art

What is intelligence?

- Intelligence is the ability to learn/ understand/deal with new situations.

- It is the ability to apply knowledge/ to think abstractly.

What is AI?

- It is the study of how to make computers behave intelligently.

- By Shapiro :- " AI is the field of science and engineering concerned with the conceptual understanding of what is commonly called intelligent behavior and with the creation of artifacts that exhibits such behavior."

What is AI?

- By Rich :- "AI is the study of how to make computers do things which at the moment human beings do better."
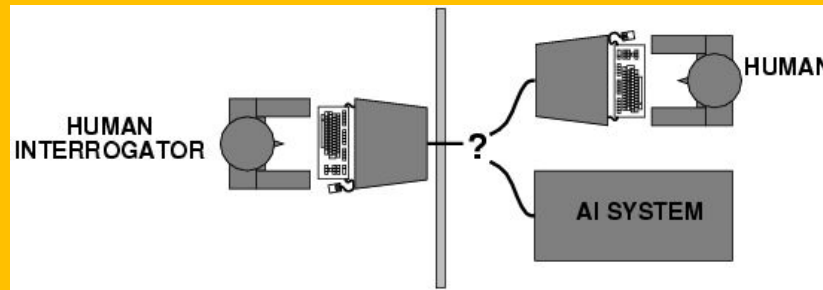
What is AI?

Views of AI fall into four categories:

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

Acting humanly: Turing Test

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

- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning

Thinking humanly: cognitive modeling

- 1950s "cognitive revolution": information-processing psychology
- Requires scientific theories of internal activities of the brain
- -- How to validate? Requires
  1) Predicting and testing behavior of human subjects
  or 2) Direct identification from neurological data
- Both approaches (roughly, Cognitive Science and Cognitive Neuroscience)
- are now distinct from AI

[cognitive revolution

- The **cognitive revolution** is the name for an intellectual movement in the 1950s that began what are known collectively as the cognitive sciences. It began in the modern context of greater interdisciplinary communication and research. The relevant areas of interchange were the combination of psychology, anthropology, and linguistics .

- A key idea in cognitive psychology was that by studying and developing successful functions in artificial intelligence and computer science, it becomes possible to make testable inferences about human mental processes.]

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:
  1. Not all intelligent behavior is mediated by logical deliberation
  2. What is the purpose of thinking? What thoughts should I have?

Acting rationally: rational agent

- 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

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:

$$[f: \mathcal{P}^{\star} \ \square \ \mathcal{A}]$$

- 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
  - $\square$ design best program for given machine resources

AI prehistory

- Philosophy   Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality
- Mathematics   Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
- Economics   utility, decision theory
- Neuroscience   physical substrate for mental activity
- Psychology   phenomena of perception and motor control, experimental techniques
- Computer engineering   building fast computers
- Control theory   design systems that maximize an objective function over time
- Linguistics   knowledge representation, grammar

Abridged history of AI

- 1943   McCulloch & Pitts: Boolean circuit model of brain
- 1950   Turing's "Computing Machinery and Intelligence"
- 1956   Dartmouth meeting: "Artificial Intelligence" adopted
- 1952—69   Look, Ma, no hands!
- 1950s   Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
- 1965   Robinson's complete algorithm for logical reasoning
- 1966—73   AI discovers computational complexity Neural network research almost disappears
- 1969—79   Early development of knowledge-based systems
- 1980--   AI becomes an industry
- 1986--   Neural networks return to popularity
- 1987--   AI becomes a science
- 1995--   The emergence of intelligent agents

State of the art

- Deep Blue defeated the reigning world chess champion Garry Kasparov in 1997
- Proved a mathematical conjecture (Robbins conjecture) unsolved for decades
- No hands across America (driving autonomously 98% of the time from Pittsburgh to San Diego)
- During the 1991 Gulf War, US forces deployed an AI logistics planning and scheduling program that involved up to 50,000 vehicles, cargo, and people
- NASA's on-board autonomous planning program controlled the scheduling of operations for a spacecraft
- `Proverb` solves crossword puzzles better than most humans

State of the art

- AI recently took the spotlight when IBM's Watson supercomputer routed human competitors on the game show *Jeopardy*.

- But when it comes to AI, Watson is just the tip of the virtual frontal lobe. Labs across the United States and around the world are exploring much more than just ways to outwit Ken Jennings. Scientists are teaching robots to explore extraterrestrial planets and serve you coffee, cars are learning to drive themselves, computers are trying to assist doctors with medical diagnoses, and video game soldiers are training to do battle in a virtual theatre of war.

Applications of AI

- AI has been used in a wide range of fields including [medical diagnosis](), [stock trading](), [robot control](), [law](), scientific discovery and toys. Many thousands of AI applications are deeply embedded in the infrastructure of every industry. It includes :

Applications of AI

- ## 1 Computer science
  - AI researchers have created many tools to solve the most difficult problems in computer science.

- ## 2 Finance
  - Banks use artificial intelligence systems to organize operations, invest in stocks, and manage properties. In August 2001, robots beat humans in a simulated financial trading competition.[4]
  - Financial institutions have long used artificial neural network systems to detect charges or claims outside of the norm, flagging these for human investigation.
  - Creative Virtual has deployed artificial intelligence customer support systems, or automated online assistants, at E*TRADE, HSBC, Intuit and Lloyds Banking Group, to assist financial services customers with services such as checking an account balance, signing up for a new credit card or retrieving a forgotten password.

Applications of AI

- ## 3 Hospitals and medicine

  - A medical clinic can use artificial intelligence systems to organize bed schedules, make a staff rotation, and provide medical information.

  - Artificial neural networks are used as clinical decision support systems for medical diagnosis, such as in Concept Processing technology in EMR software.

  - Other tasks in medicine that can potentially be performed by artificial intelligence include:

  - Computer-aided interpretation of medical images. Such systems help scan digital images.

Applications of AI

- 4 Heavy industry
  - Robots have become common in many industries. They are often given jobs that are considered dangerous to humans. Robots have proven effective in jobs that are very repetitive which may lead to mistakes or accidents due to a lapse in concentration and other jobs which humans may find degrading. Japan is the leader in using and producing robots in the world. In 1999, 1,700,000 robots were in use worldwide.

Applications of AI

- 5 Online and telephone customer service
  - Artificial intelligence is implemented in automated online assistants that can be seen as avatars on web pages . It can avail for enterprises to reduce their operating and training cost . A major underlying technology to such systems is natural language processing.
  - Similar techniques may be used in answering machines of call centres , such as speech recognition software to allow computers to handle first level of customer support, text mining and natural language processing to allow better customer handling, agent training by automatic mining of best practices from past interactions, support automation and many other technologies to improve agent productivity and customer satisfaction.

Applications of AI

- 6 Transportation
  - Fuzzy logic controllers have been developed for automatic gearboxes in automobiles (the 2006 Audi TT, VW Toureg and VW Caravell feature the DSP transmission which utilizes Fuzzy Logic, a number of Škoda variants (Škoda Fabia) also currently include a Fuzzy Logic based controller).

- 7 Telecommunications
  - Many telecommunications companies make use of heuristic search in the management of their workforces, for example BT Group has deployed heuristic search in a scheduling application that provides the work schedules of 20,000 engineers.

Applications of AI

- ## 8 Toys and games
  - The 1990s saw some of the first attempts to mass-produce domestically aimed types of basic Artificial Intelligence for education, or leisure. This prospered greatly with the Digital Revolution, and helped introduce people, especially children, to a life of dealing with various types of Artificial Intelligence, specifically in the form of Tamagotchis and Giga Pets, the Internet (example: basic search engine interfaces are one simple form), and the first widely released robot, Furby. A mere year later an improved type of domestic robot was released in the form of Aibo, a robotic dog with intelligent features and autonomy. AI has also been applied to video games.

- ## 9 Music
  - The evolution of music has always been affected by technology. With AI, scientists are trying to make the computer emulate the activities of the skillful musician. Composition, performance, music theory, sound processing are some of the major areas on which research in Music and Artificial Intelligence are focusing.

Applications of AI

- ## 10 Aviation

  - The Air Operations Division AOD, uses AI for the rule based expert systems. The AOD has use for artificial intelligence for surrogate operators for combat and training simulators, mission management aids, support systems for tactical decision making, and post processing of the simulator data into symbolic summaries.

  - The use of artificial intelligence in simulators is proving to be very useful for the AOD. Airplane simulators are using artificial intelligence in order to process the data taken from simulated flights. Other than simulated flying, there is also simulated aircraft warfare. The computers are able to come up with the best success scenarios in these situations. The computers can also create strategies based on the placement, size, speed, and strength of the forces and counter forces. Pilots may be given assistance in the air during combat by computers.

Applications of AI

- ## 10 Aviation
  - The system used by the AOD in order to measure performance was the Interactive Fault Diagnosis and Isolation System, or IFDIS. It is a rule based expert system put together by collecting information from TF-30 documents and the expert advice from mechanics that work on the TF-30. This system was designed to be used to for the development of the TF-30 for the RAAF F-111C. The performance system was also used to replace specialized workers. The system allowed the regular workers to communicate with the system and avoid mistakes, miscalculations, or having to speak to one of the specialized workers.
  - The AOD also uses artificial intelligence in speech recognition software.
  - The Artificial Intelligence supported Design of Aircraft [1], or AIDA, is used to help designers in the process of creating conceptual designs of aircraft.

Applications of AI

- [11 News and publishing](#)
  - The company Narrative Science makes computer generated news and reports commercially available, including summarizing team sporting events based on statistical data from the game. It also creates financial reports and real estate analyses.