History of AI
## Origins of AI

<table>
<thead>
<tr>
<th>Year</th>
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Herbert Simon, 1957

• “It is not my aim to surprise or shock you---but ... there are now in the world machines that think, that learn and that create. Moreover, their ability to do these things is going to increase rapidly until---in a visible future---the range of problems they can handle will be coextensive with the range to which human mind has been applied. More precisely: within 10 years a computer would be chess champion, and an important new mathematical theorem would be proved by a computer.”

• Simon’s prediction came true --- but 40 years later instead of 10
Harder than originally thought

• 1966: Weizenbaum’s Eliza
  • “… mother …” → “Tell me more about your family”
  • “I wanted to adopt a puppy, but it’s too young to be separated from its mother.”

• 1950s: during the Cold War, automatic Russian-English translation attempted

  • 1954: Georgetown-IBM experiment
    • Completely automatic translation of more than sixty Russian sentences into English
    • Only six grammar rules, 250 vocabulary words, restricted to organic chemistry

  • 1966: ALPAC (Automatic Language Processing Advisory Committee) report: machine translation has failed to live up to its promise
    • “The spirit is willing but the flesh is weak.” → “The vodka is strong but the meat is rotten.”
Blocks world (1960s – 1970s)

Roberts, 1963
“Moravec’s Paradox”

• Hans Moravec (1988): “It is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility.”

• Why is this?
  • Early AI researchers concentrated on the tasks that “white male scientists” found the most challenging, abilities of animals and two-year-olds were overlooked
  • We are least conscious of what our brain does best
  • Sensorimotor skills took millions of years to evolve
  • Our brains were not designed for abstract thinking
## A dose of reality

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<td>1966-73</td>
<td>Setbacks in machine translation</td>
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<td>Neural network research almost disappears</td>
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<td>Intractability hits home</td>
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# The rest of the story

<table>
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<tr>
<th>Year Range</th>
<th>Event description</th>
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<td>1974-1980</td>
<td>The first “AI winter”</td>
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<td>1970s</td>
<td>Knowledge-based approaches</td>
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<td>1980-88</td>
<td>Expert systems boom</td>
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<tr>
<td>1988-93</td>
<td>Expert system bust; the second “AI winter”</td>
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<tr>
<td>1986</td>
<td>Neural networks return to popularity</td>
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<td>1988</td>
<td>Pearl’s <em>Probabilistic Reasoning in Intelligent Systems</em></td>
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<tr>
<td>1990</td>
<td>Backlash against symbolic systems; Brooks’ “nouvelle AI”</td>
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<tr>
<td>1995-present</td>
<td>Increasing specialization of the field</td>
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<td>Agent-based systems</td>
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<td>Machine learning everywhere</td>
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<td>Tackling general intelligence again?</td>
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[AAAI Timeline](https://www.aaai.org/timeline/)

Some patterns from history

- **Boom and bust cycles**
  - Periods of (unjustified) optimism followed by periods of disillusionment and reduced funding

- **“High-level” vs. “low-level” approaches**
  - **High-level:** start by developing a general engine for abstract reasoning
    - Hand-code a knowledge base and application-specific rules
  - **Low-level:** start by designing simple units of cognition (e.g., neurons) and assemble them into pattern recognition machines
    - Have them learn everything from data

- **“Neats” vs. “scruffies”**
  - Today: triumph of the “neats” or triumph of the “scruffies”?
What accounts for recent successes in AI?

- Faster computers
  - The IBM 704 vacuum tube machine that played chess in 1958 could do about 50,000 calculations per second
  - Deep Blue could do 50 billion calculations per second – a million times faster!

- Lots of storage, lots of data

- Dominance of statistical approaches, machine learning
AI gets no respect?

• **AI effect**: As soon as a machine gets good at performing some task, the task is no longer considered to require much intelligence

• Calculating ability used to be prized – not anymore

• Chess was thought to require high intelligence
  • Now, massively parallel computers essentially use brute force search to beat grand masters

• Learning once thought uniquely human
  • Ada Lovelace (1842): “The Analytical Engine has no pretensions to originate anything. It can do whatever we know how to order it to perform.”

  • Now machine learning is a well-developed discipline

• Similar picture with animal intelligence

• Does this mean that there is no clearcut criterion for what constitutes intelligence?
Take-away message for this class

• Our goal is to use machines to solve hard problems that traditionally would have been thought to require human intelligence
• We will try to follow a sound scientific/engineering methodology
  • Consider relatively limited application domains
  • Use well-defined input/output specifications
  • Define operational criteria amenable to objective validation
  • Use abstraction to zero in on essential problem features
  • Focus on general-purpose tools with well understood properties