

Class #01: AI & the Intelligent Agent Concept

Artificial Intelligence (CS 131)

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What is Artificial Intelligence?

Image courtesy of [Dartmouth College](https://www.dartmouth.edu/~ai/)

▶ Historical definition (Dartmouth Workshop on AI, 1956):

A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

June 17 - Aug. 16

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

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Modern AI: An Engineering Enterprise


- ▶ Building (partially) autonomous machines for a variety of tasks
 - ▶ Construction, transportation, search-and-rescue, exploration...
- ▶ Automating intelligence and formalizing knowledge
 - ▶ Internet search, expert systems, data mining, ...
- ▶ Using computational models to understand complex behavior
 - ▶ Automated planning, large-scale crowd simulation, traffic analysis, ...
- ▶ Using computers to discover new information
 - ▶ Medical image analysis, intrusion detection, stock market trading, ...
- ▶ Allowing computers to work better with people
 - ▶ Reactive tutoring, automated assistants, "sensitive" GPS systems, ...

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Why is AI So Difficult?

- ▶ Originally, the desire was for a single system that would be "fully intelligent" on some human-approximate level
- ▶ It turns out, however, that many of the basic capacities that go into "being human" are **themselves** very difficult
 - ▶ Highly complex
 - ▶ Involving various distinct capacities
 - ▶ Not well understood how **we** actually do them!



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Sources of Difficulty for AI Developers

- ▶ **Ambiguity in language**
 - ▶ “When the hammer hit the nail it bent.”
- ▶ **Computational difficulties**
 - ▶ “Is there a winning opening move in a chess game?”
- ▶ **Reasoning under uncertainty**
 - ▶ “What is the best strategy for a baseball game?”
- ▶ **Trade-offs between goals and outcomes**
 - ▶ “Filter my spam, but not my requested commercial mail.”

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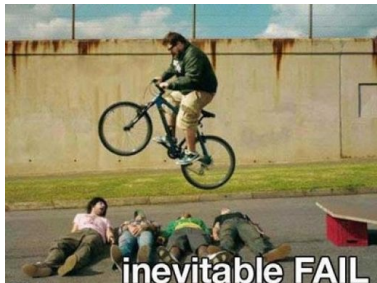
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How Do We Define Intelligence?

- ▶ It is not clear how “intelligence” should be understood (let alone how to get a machine to behave that way)
- ▶ How a **human being** might act?



- ▶ Or is it some sort of **ideal rationality**?

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Turing Test: Intelligence = **Acting Humanly**

- ▶ Alan Turing (1950) “Computing Machinery and Intelligence”
 - ▶ Proposed an **imitation game**
 - ▶ Predicted that by 2000, machines could fool average person for 5 minutes, 30% of the time
- ▶ One problem: not everyone agrees on the standard proposed by the test, and whether it is meaningful
- ▶ In any case, we still haven’t got there yet...
 - ▶ Loebner prize for convincing bots would award up to \$100,000 (and a gold medal) for a truly convincing interactive agent
 - ▶ No such agent has ever really been approached

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What Should an Intelligent System Do?

- ▶ Following Turing, we take an **operational** approach:

Intelligence is defined by some means of measuring performance in a set task.

- ▶ An intelligent system is one that **optimizes** some measure
- ▶ How much it changes things so that it gets closer towards the goals that have been set for it
 - ▶ The word-count of error-free text translated
 - ▶ Customer satisfaction for automated dialogue systems
 - ▶ Hours of accident free, real-time driving
 - ▶ Amount of data collected by an autonomous space-vehicle
 - ▶ ...

