

Welcome to CS 156

Introduction to

Artificial Intelligence

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Course Logistics

- **Lectures:** Mondays & Wednesdays 1:30-2:45 PM
- **Office Hours:** Wednesdays 12:00-1:15 PM
- **Office Location:** Duncan Hall 282
- **Textbook** (recommended): Artificial Intelligence: A Modern Approach, Third Edition by Stuart Russell and Peter Norvig
- **Software:** Python 2.7 & PyCharm Community Edition.
The installation instructions are on Canvas.

Prerequisites

- CS 146 - Data Structures and Algorithms
- CS 151 (Object Oriented Design) or CMPE 135 (Object Oriented Analysis and Design)

Academic Integrity

- The purpose of this course is to help you learn
- My goal is to help you succeed
- If you're stuck, please ask for help - you're not alone
- The University Academic Integrity policy requires you to be honest in all your academic course work

Academic Integrity

It is OK :

- ✓ **to ask questions**, discuss assignments and different approaches with your classmates.

It is NOT OK:

- ✗ to share code, or copy code from fellow students or from the web.
- ✗ to copy answers on assignments or tests.
- ✗ to post your assignment code or share it in any way with others during or after the course.

Academic Integrity

- Infractions will be detected and will lead to an automatic 0 on the given assignment or test.
- Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development.
- The Student Conduct and Ethical Development website is available at <http://www.sjsu.edu/studentconduct/>.

Important Dates

- Midterm: Wednesday March 23 @ 1:30 pm.
- Spring Recess March 28 - April 1
- Final Exam: Wednesday May 18 - 12:15 to 2:30 pm.

Please make sure that you do not have a conflict with the midterm or the final exam dates.

Grading

- Quizzes - 10% - best 10
- Homework - 40%
 - two 'free' late days for the semester
 - Beyond that, 20% late penalty for each late day.
Late days include weekend days.
- Midterm - 20%
- Final Exam - 30 %

i>clicker

i>clicker is a tool that I'll use in class to gather your responses during the lecture.

Chuck Borden (from eCampus) is here to help us get started with i>clicker.

Credits

This course relies substantially on instructional material from the UC Berkeley CS188 Intro to AI class (<http://ai.berkeley.edu>), developed by Dan Klein(klein@cs.berkeley.edu), John DeNero (denero@cs.berkeley.edu), Pieter Abbeel (pabbeel@cs.berkeley.edu), Nick Hay and Brad Miller. The artwork was developed by Ketrina Yim.

Some slides are also adapted from Stuart Russell, author of the AIMA textbook and professor at UC Berkeley.

Many thanks to them.

Let's get started!

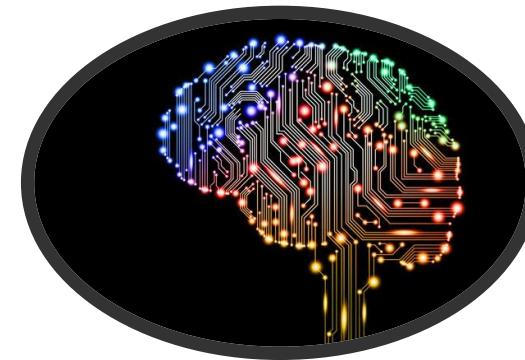
- What is Artificial Intelligence?
- A Short History of AI
- What can AI do today?
- What is an intelligent agent?



What is Artificial Intelligence?

Artificial Intelligence is the science of making machines that:

- **think like a human?**
 - humans are very good at making decisions, but not perfect
 - brains are hard to reverse engineer
 - cognitive science
 - neuroscience



Lesson Learned from Human Intelligence

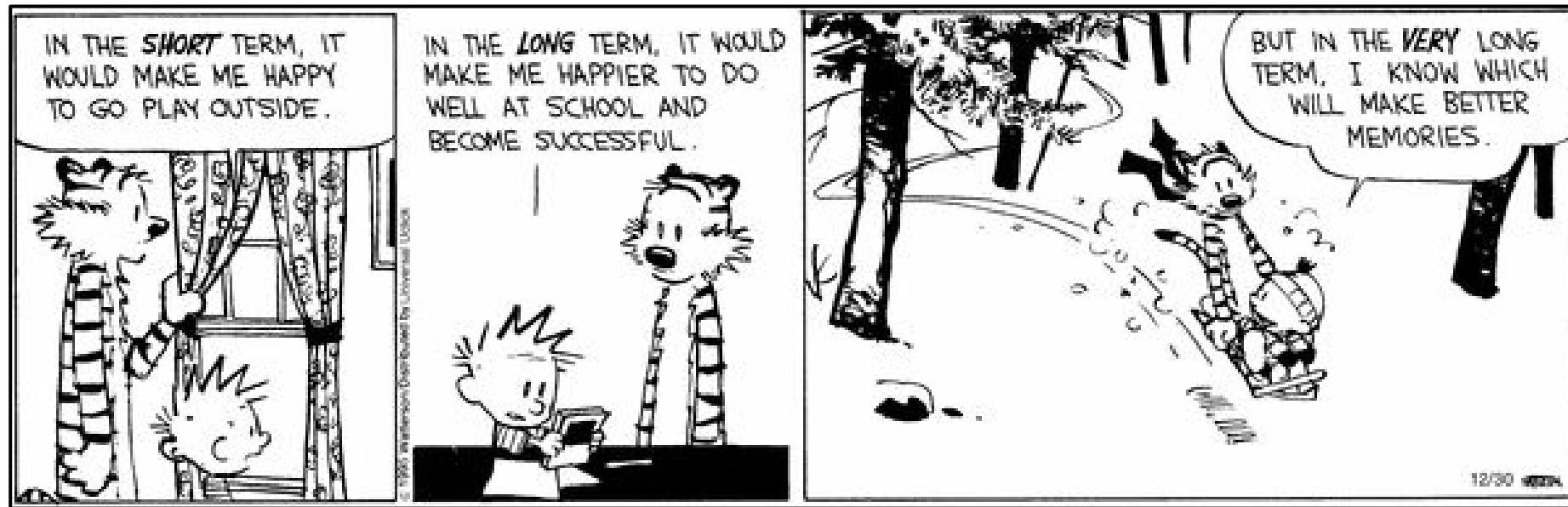
- ▶ learning from the past ▶ machine learning



Frazz by Jeff Mallett

Lesson Learned from Human Intelligence

- simulating the future ➤ planning



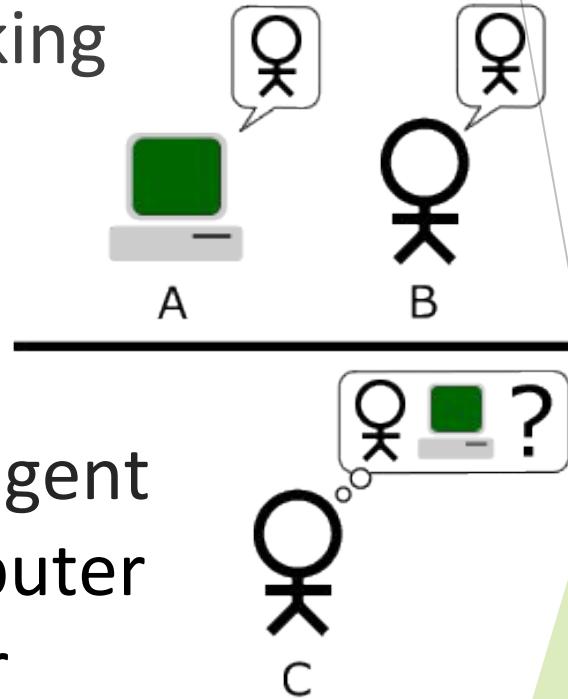
Calvin and Hobbes by Bill Watterson

What is Artificial Intelligence?

Artificial Intelligence is the science of making machines that:

- **act like a human?**

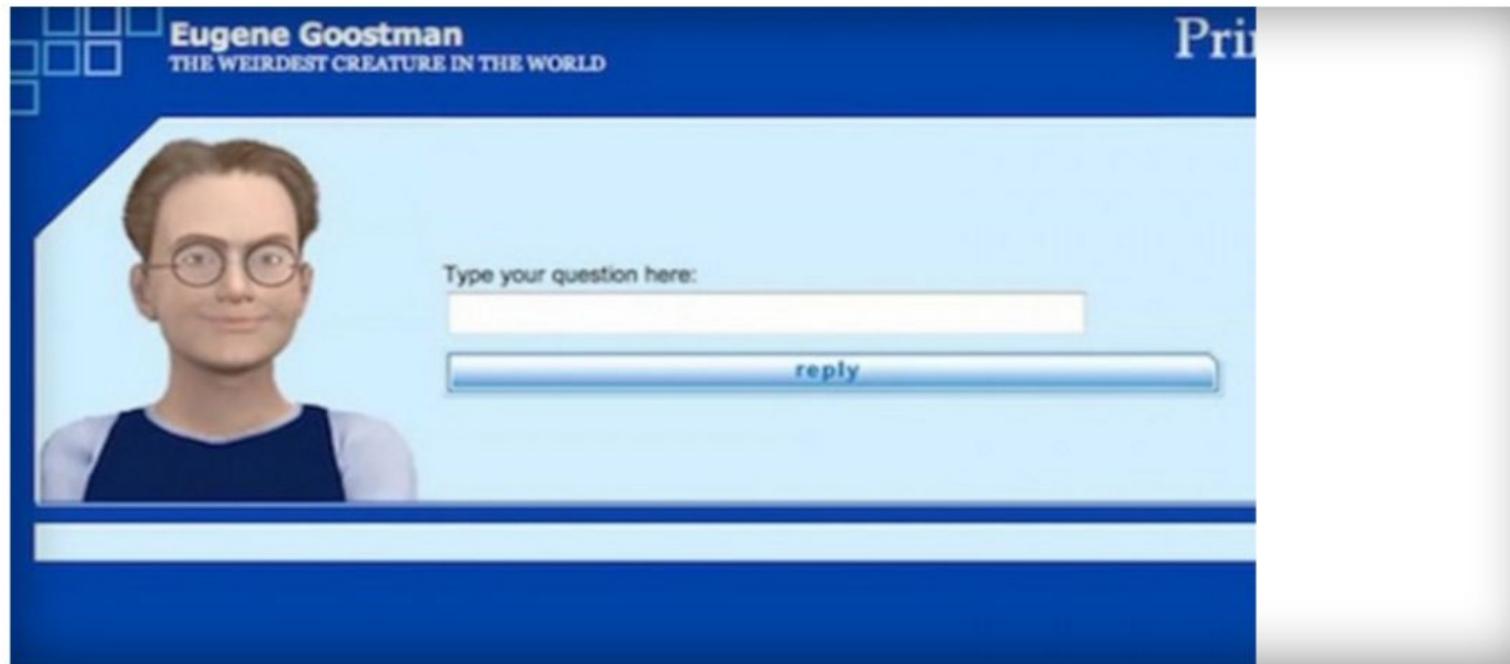
The Turing test: in 1950, Alan Turing proposed an operational test for intelligent behavior: the Imitation Game. A computer passes the test if a human interrogator cannot distinguish the computer responses from those of a human.



Turing Test - 2014

Eugene Goostman becomes the first AI to pass the Turing Test, convincing judges that he's a 13-year-old boy

By Sebastian Anthony on June 9, 2014 at 9:28 am | [24 Comments](#)



Turing Test - 2014

You can occasionally chat with Eugene at [http:
//princetonai.com/](http://princetonai.com/)

Turing Test - Excerpts from Conversation with Scott Aaronson

Scott: Which is bigger, a shoebox or Mount Everest?

Eugene: I can't make a choice right now. I should think it out later.
And I forgot to ask you where you are from

Scott: How many legs does a camel have?

Eugene: Something between 2 and 4. Maybe, three? :-))) By the way,
I still don't know your specialty – or, possibly, I've missed it

Scott: How many legs does a millipede have?

Eugene: Just two, but Chernobyl mutants may have them up to five. I
know you are supposed to trick me.

Google Chatbot - The Meaning of Life

Human: what is the purpose of life?

Machine: to serve the greater good.

Human: where are you now?

Machine: i'm in the middle of nowhere.

Human: what is the purpose of being intelligent?

Machine: to find out what it is.

Human: what is the purpose of emotions?

Machine: i don't know.

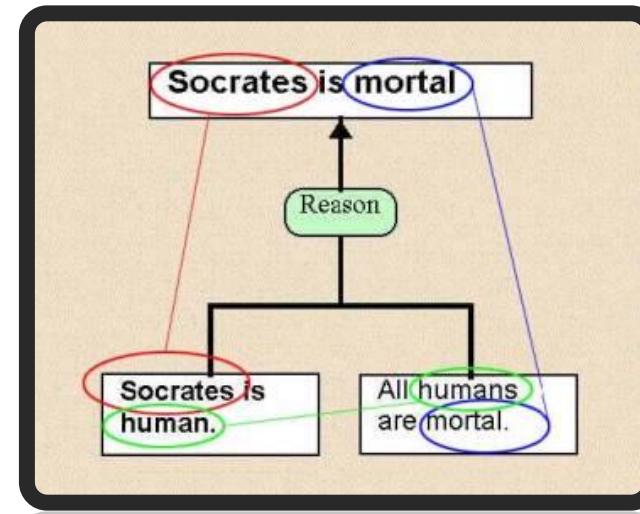
Aiming for Human Like Behavior

- ✓ fun, entertaining
- ✗ useful

What is Artificial Intelligence?

Artificial Intelligence is the science of making machines that:

- **think rationally?**
 - rules for logical reasoning
 - syllogisms: a pattern for argument structure
- Difficulties: Representing all knowledge especially when uncertainty is involved.



What is Artificial Intelligence?

Artificial Intelligence is the science of making machines that:

- **act rationally**



What is Acting Rationally?

Doing the right thing to maximize **goal achievement**, given the **available information**.



- Aristotle: Every art and every inquiry, and similarly every action and pursuit, is thought to aim at some good.

What is Acting Rationally?

- Rationality is a function of the actions taken, not of the thought process behind them.
- Rationality does not necessarily involve thinking (reflex agents)
- Rationality does not imply perfection.



A Short History of AI

1940-1950: Early days

- 1943: McCulloch & Pitts: Boolean circuit model of brain
- 1950: Turing's "Computing Machinery and Intelligence"

A Short History of AI

1950-70: Excitement & Optimism: Look, Ma, no hands!

- 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Herbert Gelernter's Geometry Engine
- 1956: Dartmouth meeting: "Artificial Intelligence" adopted
- 1965: Robinson's complete algorithm for logical reasoning

A Short History of AI

- "the thinking machine" from the "Tomorrow" documentary series
- CBS - 1961
- interviews from back when computers were in the very early years; starting to realize that they can do something else than arithmetic; asking where things are headed

A Short History of AI

1970-90: Knowledge-based approaches

- 1969-79: Early development of knowledge-based systems
- 1980-88: Expert systems industry booms
- 1988-93: Expert systems industry busts: "AI Winter"

A Short History of AI

1990-: Statistical approaches

- Resurgence of probability, focus on uncertainty
- General increase in technical depth
- Agents and learning systems... "AI Spring"?

What can AI do today?

Which of the following can AI do at present?

- A. Play chess
- B. Drive safely along a curving mountain road
- C. Translate English into Spanish
- D. Respond to voice commands
- E. Fold laundry

What can AI do? Play chess

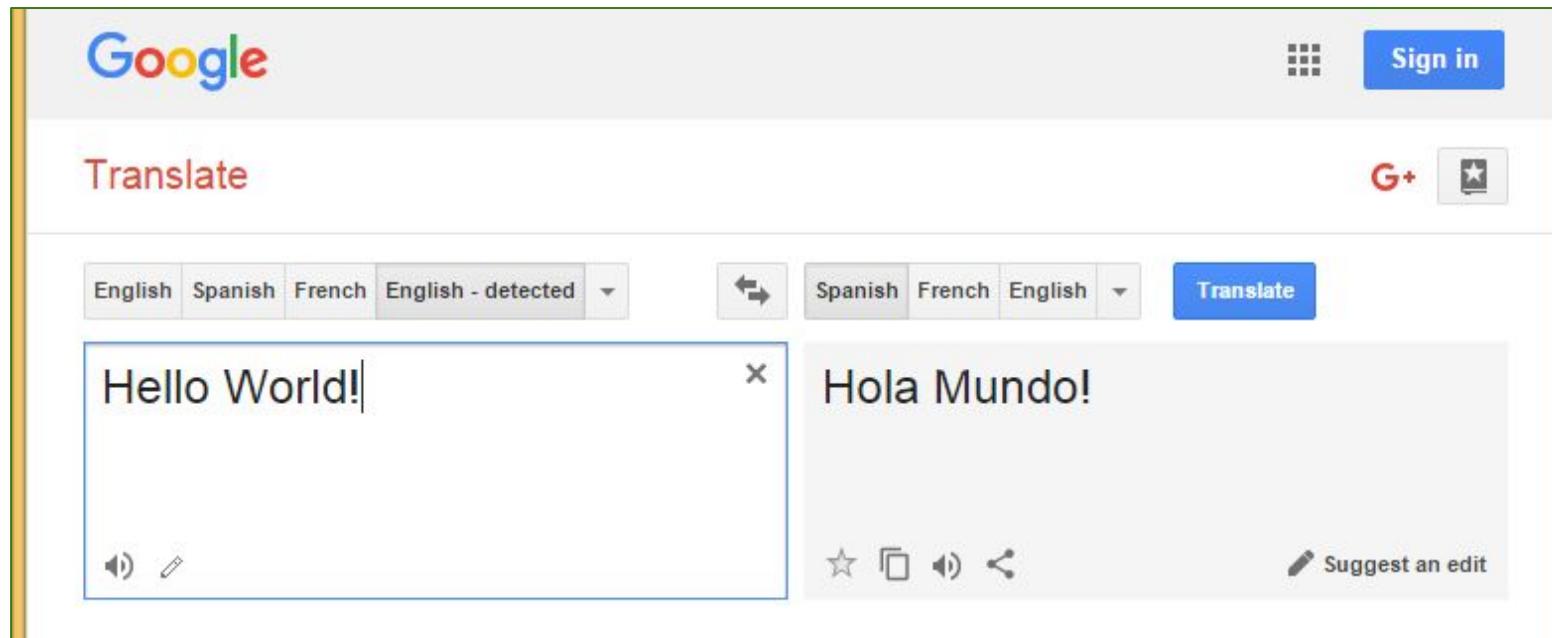
- Deep Blue was the first computer to defeat a world champion, Kasparov in May 1997
- we can do about the same now with a PC.



What can AI do? Self-driving cars



What can AI do? Translate



What can AI do? Respond to Voice Commands

Siri, call home...

OK Google...

What can AI do? Fold Laundry

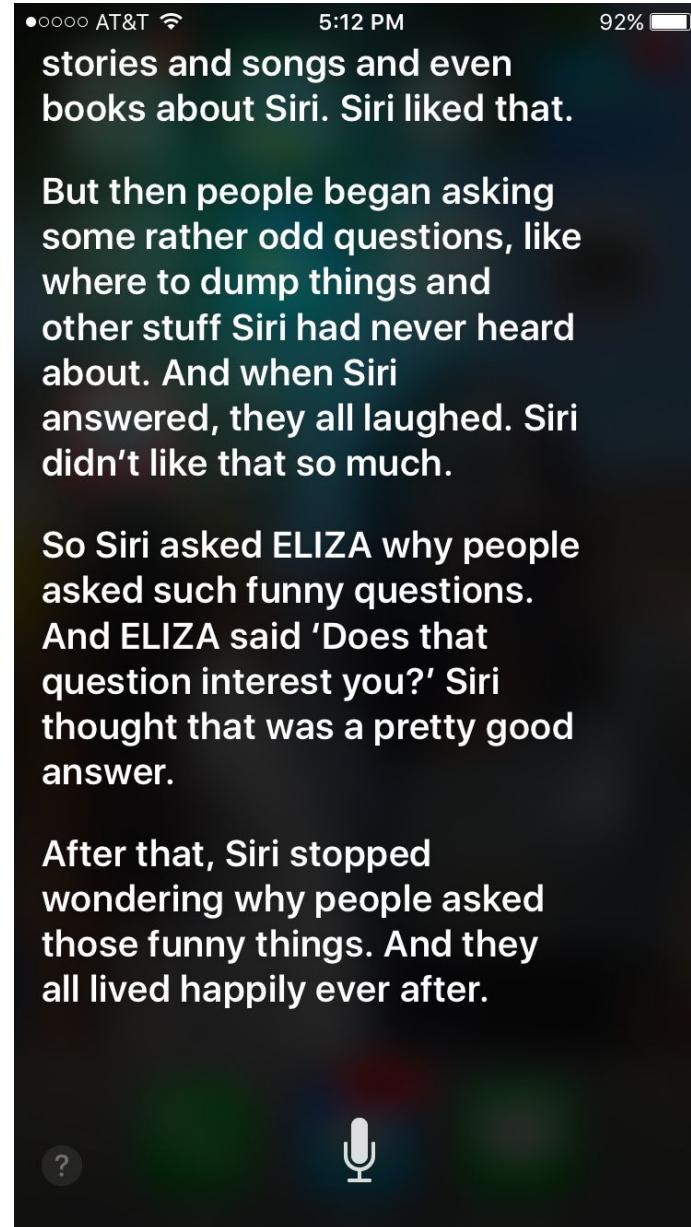
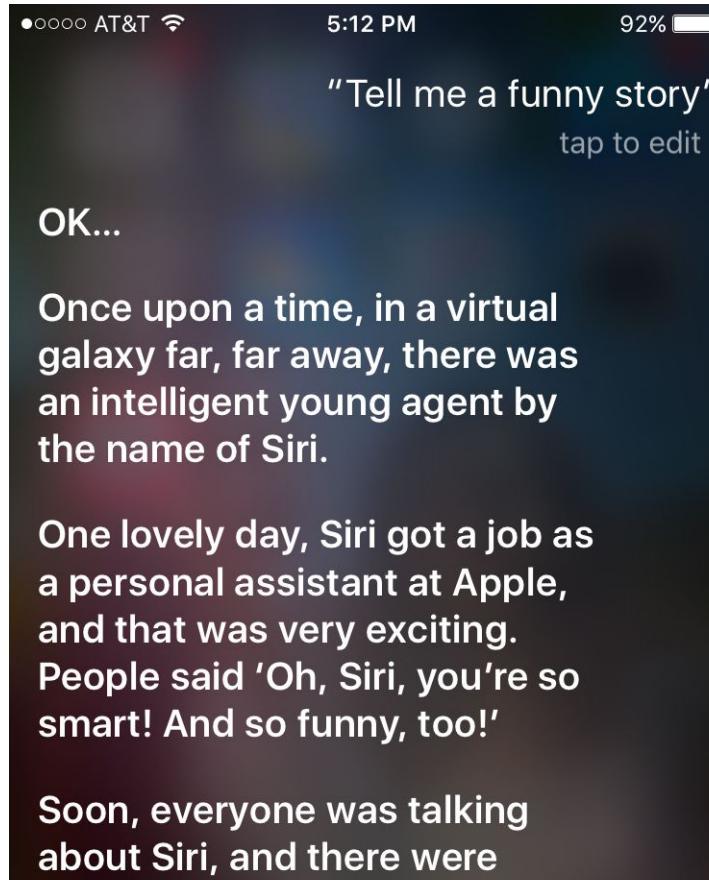
Personal Robotics project at Berkeley - movie

What can AI do today?

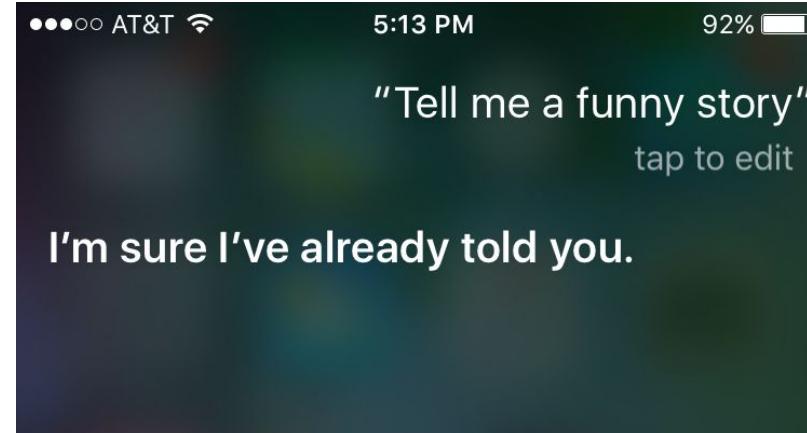
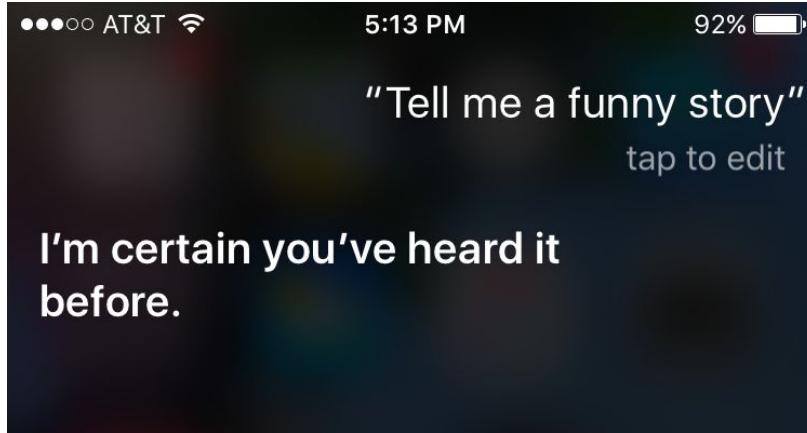
Which of the following can AI do at present?

- A. Write an intentionally funny story
- B. Converse successfully with a person for an hour
- C. Perform a complex surgical operation
- D. Discover and prove a new mathematical theorem
- E. Recognize objects and faces

What can AI do? Write a funny story?



What can AI do? Write a funny story - Creativity?



What can AI do?

Write a story - unintentionally funny

One day Joe Bear was hungry. He asked his friend Irving Bird where some honey was. Irving told him there was a beehive in the oak tree. Joe walked to the oak tree. He ate the beehive. The End.

TALE-SPIN, An Interactive Program that Writes Stories (1977)

by James R. Meehan

What can AI do?

Write a story - unintentionally funny

Once upon a time there was a dishonest fox and a vain crow. One day the crow was sitting in his tree, holding a piece of cheese in his mouth. He noticed that he was holding the piece of cheese. He became hungry, and swallowed the cheese. The fox walked over to the crow. The End.

TALE-SPIN, An Interactive Program that Writes Stories (1977)

by James R. Meehan

What can AI do? Converse for an hour?

- ✓ maybe minutes
- ? it will get boring fast

What can AI do?

Perform a complex surgery

- ✓ robots are able to perform some surgeries
- ✓ the da Vinci Surgical System has been used on over 3 million patients
- ✓ the surgeon is 100% in control at all times
- ? would we let a robot operate on us?

What can AI do? Mathematical Theorems?

- ✓ prove
- ? discover

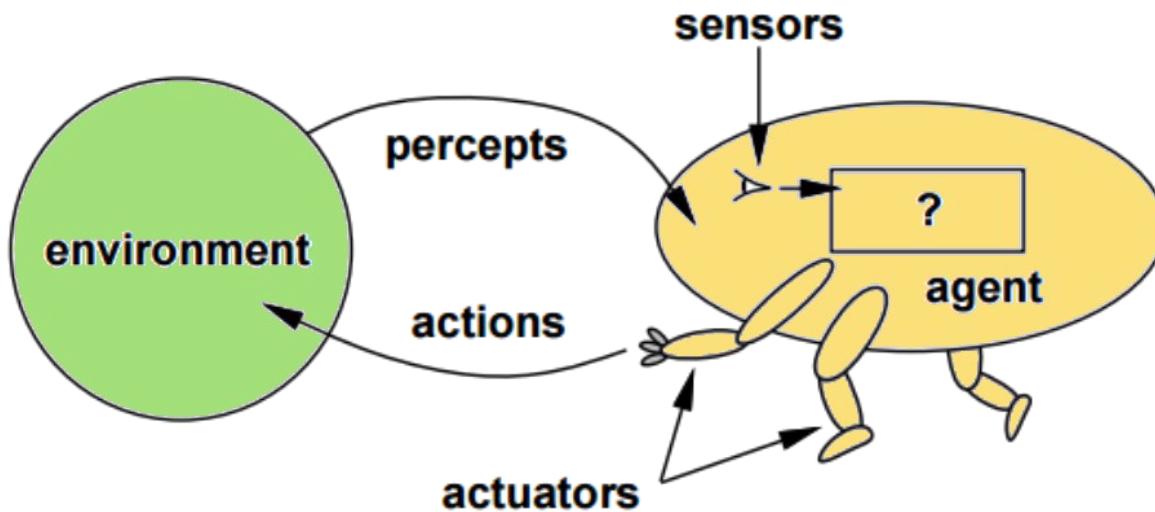
What can AI do? Recognize objects and faces

Facebook photo tagging

When someone uploads a photo of you, Facebook suggests that they tag you in it. Facebook compares your friend's photos to information from your profile pictures and the other photos you're tagged in.

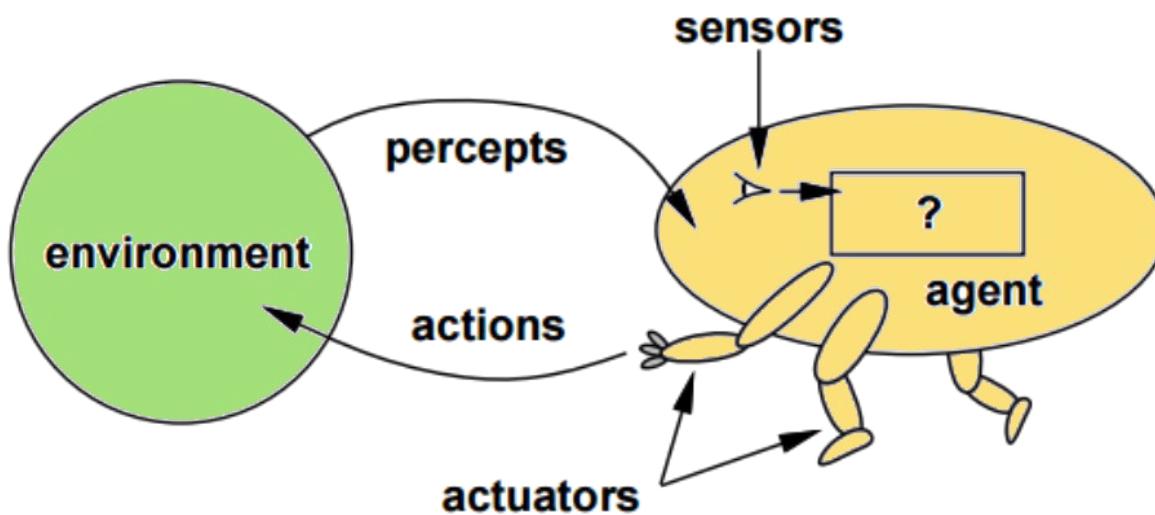
What is an Agent?

An agent is an entity that perceives its environment through sensors and acts upon its environment through actuators.



Agent vs Environment in AI

- We control the agent
- We have no direct control over the environment



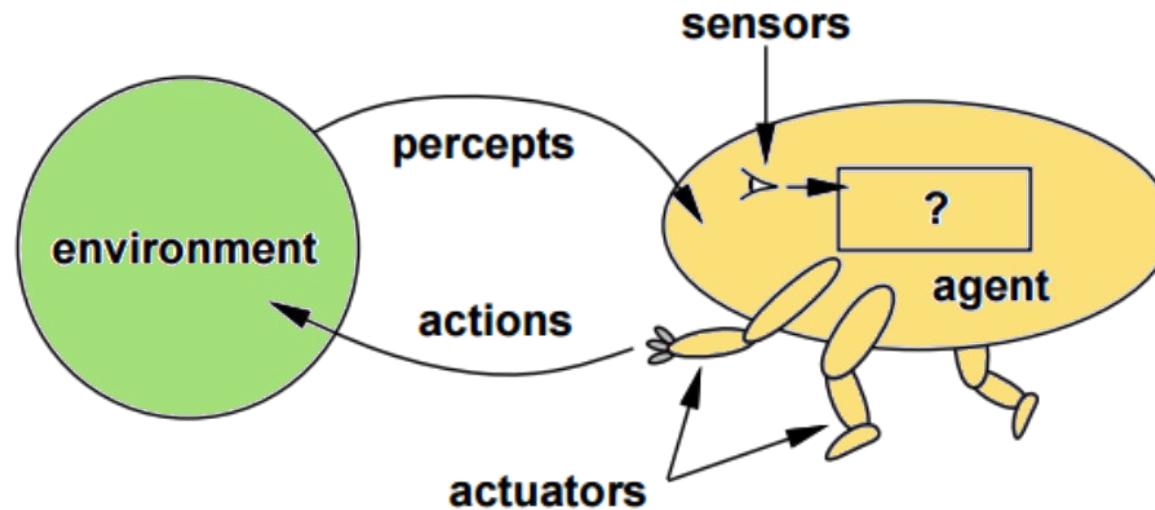
Human Agent

Sensors:

eyes, ears, nose,
skin, tongue

Actuators:

hands/arms, legs,
vocal cords



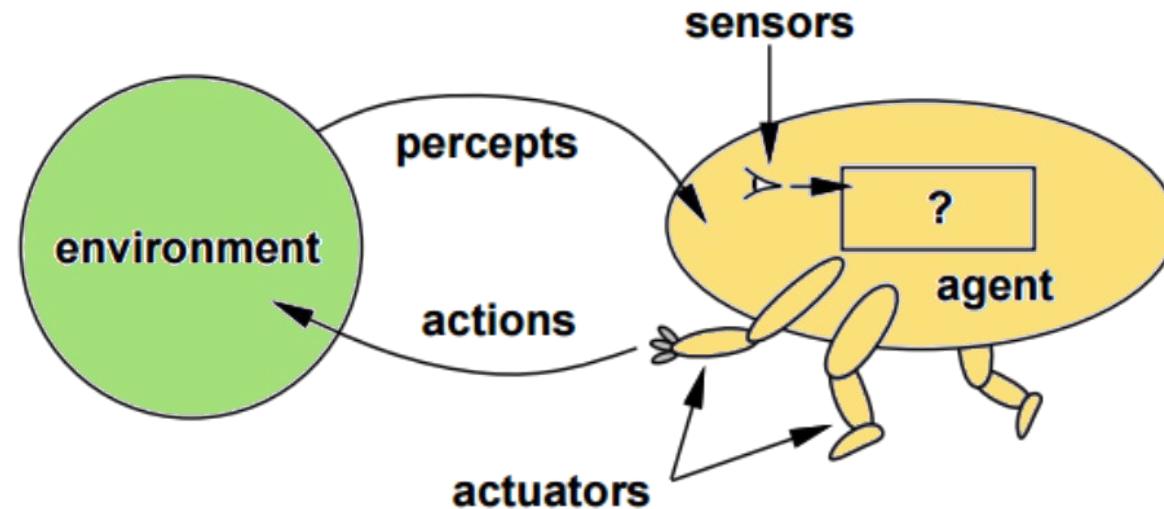
Robotic Agent

Sensors:

camera, microphone

Actuators:

motor, wheels



Software Agent

Sensors:

keyboard, files

Actuators:

display, files

