What is “AI”?
Some classic definitions

Buildings computers that …

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Requires (presumably) that we have some knowledge of how humans think; currently more the purview of cognitive science
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Requires (presumably) that we have some knowledge of how humans think; currently more the purview of cognitive science

“May not machines carry out something which ought to be described as thinking but which is very different from what a man does?” – Alan Turing
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The fields of logic and automated reasoning, a common theme in much original AI research
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The fields of logic and automated reasoning, a common theme in much original AI research

Searching through logical deductions proved a very computationally intensive task, and it is unclear whether logic is a good basis for the “more vague” notions of knowledge
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The *Turing Test*: talk to a computer or human for an hour, can you tell which one?
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The *Turing Test*: talk to a computer or human for an hour, can you tell which one?

Interviewer: “What is $32,839 \times 128,394$?”
Computer: “I don’t know!”
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The basis for the “intelligent agent” framework in Russell and Norvig
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The basis for the “intelligent agent” framework in Russell and Norvig

Unclear if this accurately captures the scope of current AI research, or if AI researchers see themselves as working toward this goal
The pragmatist’s view

AI is that which appears in academic conferences on AI
The pragmatist’s view

Knowledge System

Reasoning

Learning

Qualitative

Systems

1980s
The pragmatist’s view

1990s
The pragmatist’s view
The pragmatist’s view

2010s
A broader definition

We won’t worry too much about definitions of AI, but the following will suffice:

Artificial Intelligence is the development and study of computer algorithms that address a problem typically associated with some form of intelligence.
Some notable milestones in AI
1950

1950 paper, “Computing Machinery and Intelligence,” introduces Turing test

Interviewer talks to a person and machine via a terminal interface, must determine which is which
1952-1959

Arthur Samuel develops checkers program while at IBM

Program includes a version of alpha-beta pruning in game search, position scoring, and learning from self-play
1955-1956

Alan Newell, Herbert Simon, J.C. Shaw develop Logic Theorist, which sought to prove mathematical theorems form *Principia Mathematica*

A pioneering effort in intelligence as search, found a shorter proof of one well-known theorem
1956

Dartmouth Conference on Artificial Intelligence, organized by John McCarthy, Marvin Minksy, Nathaniel Rochester, and Claude Shannon
1958

Frank Rosenblatt’s Perceptron algorithm learns to recognize letters of the alphabet from images
1966

Joseph Weizenbaum develops ELIZA, a “virtual therapist” program
Men are all alike.
IN WHAT WAY
They’re always bugging us about something or other.
CAN YOU THINK OF A SPECIFIC EXAMPLE
Well, my boyfriend made me come here.
YOU BOYFRIEND MADE YOU COME HERE
He says I’m depressed much of the time.
I AM SORRY TO HEAR YOU ARE DEPRESSED
It’s true. I am unhappy.
DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY
I need some help, that much seems certain.
WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP
Perhaps I could learn to get along with my mother.
TELL ME MORE ABOUT YOUR FAMILY
My conversation with ELIZA

Hello.
HOW DO YOU DO. PLEASE STATE YOUR PROBLEM.
I am worried that I am just speaking to a computer.
DO COMPUTERS WORRY YOU
No, but I’m trying to discern if you are a real person or a computer.
ARE YOU SAYING NO JUST TO BE NEGATIVE
You did not address my question.
YOUR QUESTION
Are you a computer?
DO COMPUTERS WORRY YOU
1966-1972

Shakey the robot developed at Stanford Research Institute

Goal is to develop a general purpose robot capable of reasoning and interacting with the world
1980-1988

Marc Raibert of CMU and MIT develops hopping robots
Backpropagation for training multi-layer neural networks popularized by David Rumelhart, John Hopfield (amongst many others)
1988

Judea Pearl publishes *Probabilistic Reasoning in Intelligent Systems*, bring probability and Bayesian networks to forefront of AI
1997

Deep blue defeats Gary Kasparov in a six-game chess match (two wins, one loss, three draws)
2005-2007

Stanford and CMU respectively win 2005 and 2007 DARPA Challenges, requiring a car to drive autonomously through desert and simulated urban environments.
2011

IBM’s Watson defeats human opponents on Jeopardy
AI is all around us

Face detection

Personal assistants

Software verification

Logistics planning
This course

- 15-780 is intended to be a broad but intensive introduction to a wide variety of topics in AI

- We will cover topics include: uninformed and informed search, numerical optimization, constrain satisfaction, integer programming, machine learning, classical planning, probabilistic planning and reinforcement learning, probabilistic reasoning, computer vision, robot motion planning, scheduling, natural language processing, multiagent systems... (whew)

http://www.cs.cmu.edu/~zkolter/course/15-780-s14
Instructors

Instructor
Zico Kolter

Instructor
Zack Rubinstein

TA
Vittorio Perera
Recommended background

- No formal pre-requisites

- But, substantial programming background is required (assignments will be in Python)

- Additional background in data structures and algorithms, linear algebra, probability will all be helpful, but not required
Textbook

- Textbook for the course is *Artificial Intelligence, A Modern Approach, 3rd Edition* (2nd edition is also ok, though you may need to map question numbers)

- Also additional material not covered in the textbook, this will be covered in slides and possibly supplemental notes
# Course grading

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- Four problem sets, each with written and 1-2 programming assignments

- Written portion to be turned in at the *beginning* of class, programming portion turned in using Autolab

- You may discuss problems in groups, but must be written up and programmed *independently*
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- Class participation measured through in-class polls and Piazza discussion forums

- 50% of the credit for just answering in-class polls, remaining 50% for answering them correctly and for participating in Piazza forums
Piazza

http://www.piazza.com

- As mentioned above, we will use Piazza for discussion and in-class polls

- All students must register for the course page on Piazza, and bring either a laptop or smartphone with the Piazza app to class

- Any enrolled student who has not signed up for Piazza by next week will be dropped from the course to make room for those on the waitlist
Late days

- You will have 5 late days to use throughout the semester, no more than 3 late days can be used on a single assignment.

- Late days extend the deadline for homework by 24 hours (remember, homework due at beginning of class).

- Turn in late homework to Vittorio Perera’s office, GHC 7002, sliding under the door if no one there and write the time of submission.
Cheating

- Don’t do it (please)

- CMU’s academic integrity policy is here: http://www.cmu.edu/academic-integrity/

- Remember, written problem sets and programming must be written up independently

- If you consult any outside material, you need to cite all of your references
Some parting thoughts

“Computers in the future may have only 1,000 vacuum tubes and weigh only 1.5 tons.” – Popular Mechanics, 1949
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“Computers in the future may have only 1,000 vacuum tubes and weigh only 1.5 tons.” – Popular Mechanics, 1949

“Machines will be capable, within twenty years, of doing any work a man can do.” – Herbert Simon, 1965