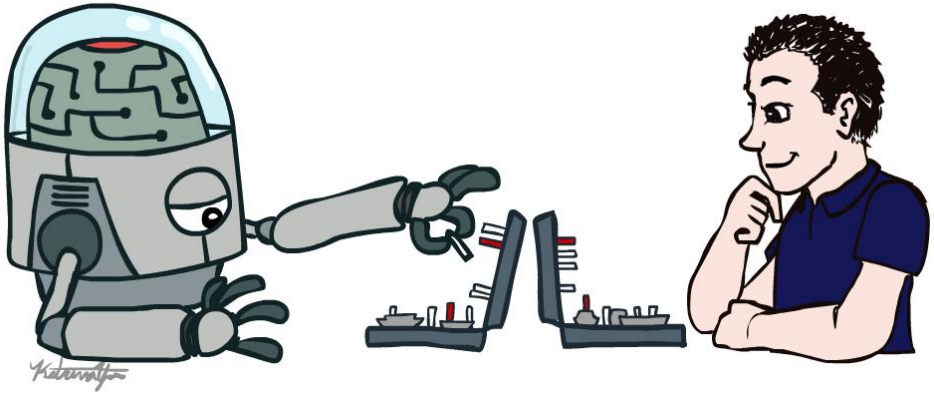
人工智能导论

Introduction



基于加州大学伯克利分校CS188课程

University of California, Berkeley

[These slides were created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley. All materials available at http://ai.berkeley.edu.]

Agenda

- 课程信息
- 人工智能简介

COURSE INFORMATION

任课教师

- 基本信息
  - 姓名：罗珲渝
  - 教室：鼎新楼2419
  - 办公室：鼎新楼2412
  - 上课时间：周三、四2:00-4:00PM
  - 答疑时间：周三、四1:00-2:00PM
- 学历
  - 高中：江西省萍乡市萍乡中学（1994年）
  - 本科：中国科学技术大学力学和机械工程系（1999年）
  - 硕士：美国加州大学洛杉矶分校电子工程系（2002年）
  - 博士：美国加州大学洛杉矶分校电子工程系（2005年）

课程代表

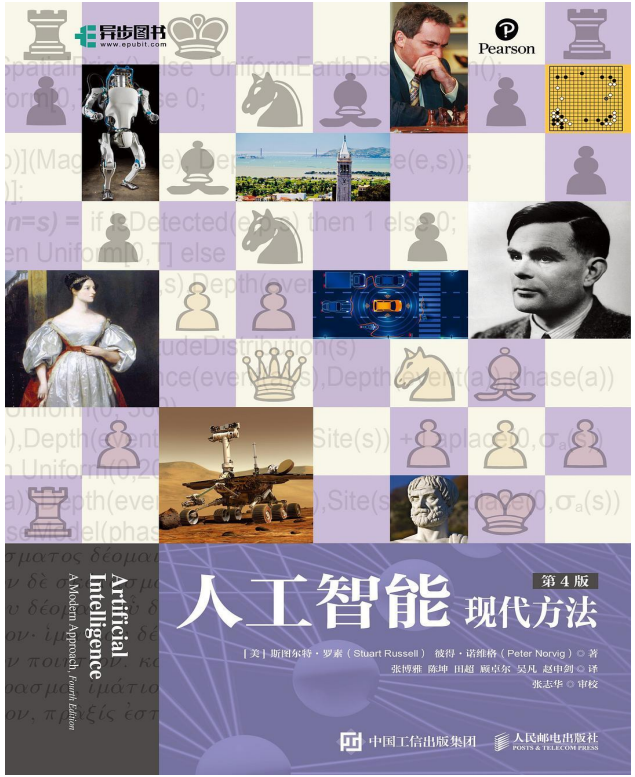
- 课程代表
  - 两个班，超过一百名学生，一个任课老师
  - 需要选取四名**热心负责，行事端正**的学生担任课程代表
  - 一班两名，帮助协调课程和班级管理
- 职责
  - 收集和整理课程信息，例如项目小组成员等
  - 收集学生作业、课程项目
  - 写点简单的Python代码，完成课程事务
- 奖励
  - 帮助他人，参与班级事务
  - 期末成绩附加**5%**奖励

推荐教材

- 推荐教材
  - 不是必须，有兴趣想了解更多的同学可以自行购买

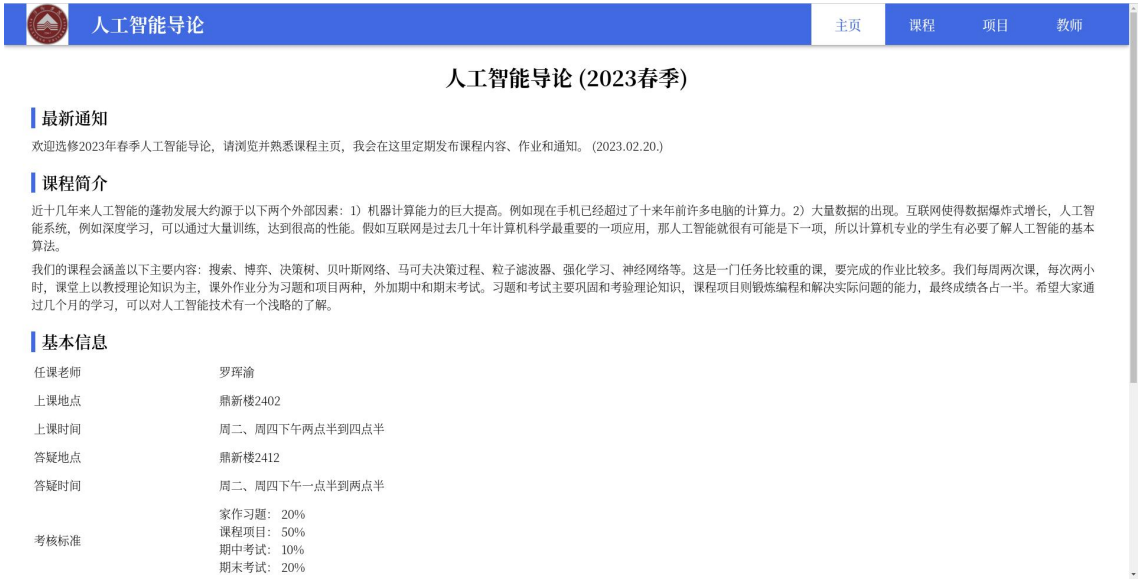
人工智能：现代方法，第四版
[美] 斯图尔特·罗素，彼得·诺维格
译者：张博雅，陈坤，田超，顾卓尔，吴凡，赵申剑
人民邮电出版社

Russell & Norvig
Artificial Intelligence: A Modern Approach, 4th Ed.



课程网站

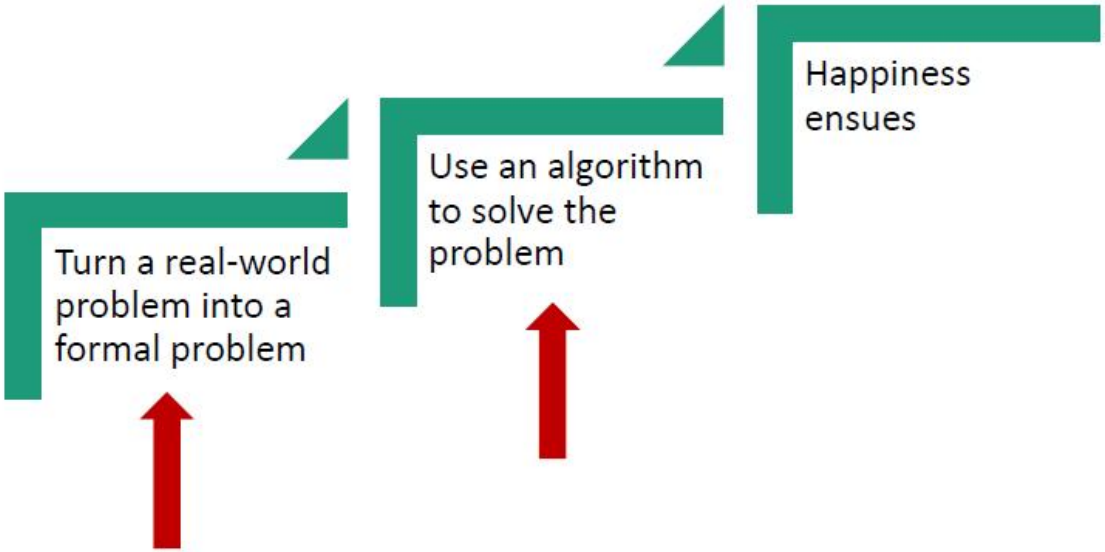
- 课程网站
  - 提供课程信息，发布通知、课件、习题、项目，请经常访问关注
  - http://10.102.4.151:3030/



课程内容

- 教授人工智能的入门知识，涉及很多算法和理论
  - 搜索
  - 博弈
  - 贝叶斯网络
  - 马可夫决策
  - 粒子滤波器
  - 机器学习
  - 神经网络等等，会依据学生进度作适当调整
- 需要完成比较多的习题和编程
- 掌握理论的同时，重视动手能力，最终目的是**解决实际问题**!

学工程的目的


Turn a real-world problem into a formal problem
Use an algorithm to solve the problem
Happiness ensues

教授方法

- 课堂讲授：理论为主，穿插习题讨论课（回顾和调整）
- 课件： Mostly in English, based on Berkeley class
- 习题和考试：考验理论知识
- **课程项目**： 锻炼编程，实现算法的能力, also from CS188
- 讨论和答疑：鼓励发问，或者来办公室答疑
- 强调
  - **编程**： 解决实际问题
  - **自学**： 大部分课件基于国外优秀的计算机教程，英文

课程项目

- 课程项目
  - 基于UC Berkely的CS188，寓教于乐
  - 自由搭配，三到四个同学一组。下周三之前确定组员，交给课代表
  - 一共五个项目加一个热身，视大家完成情况作相应调整
    - 独立完成：Python热身
    - 小组：单人搜索，多人搜索，强化学习，贝叶斯估计，机器学习
  - 代码采用Python语言（下周会有一堂Python回顾课）
  - 所有组员都必须参与，每个人都要写代码

项目完成和提交

- 到课程项目主页去下载文档、代码和空白报告
- 仔细阅读文档，原始代码
- 编辑完成指定的代码文件
- 使用自动批改程序批改代码，产生log和token文件。
- 书写简单明了的项目报告，陈述解决思路，方法和成员分工
- 将编辑过的代码、log和token文件、项目报告打包成一个zip文件，用你的学号（项目0）或组号（项目1-5）命名
- 到课程主页去提交zip文件
- 留心提交期限，项目每迟交一天，分数将被扣除20%，超过五天，作0分处理。

Pacman demo


CS188 Pacman
SCORE: 0
pacman.bat
Windows Batch File
Date modified: 8/23/2012 2:04 AM
Size: 91 bytes
Date created: 8/23/2012 9:42 AM
97%
12:28 PM
8/23/2012

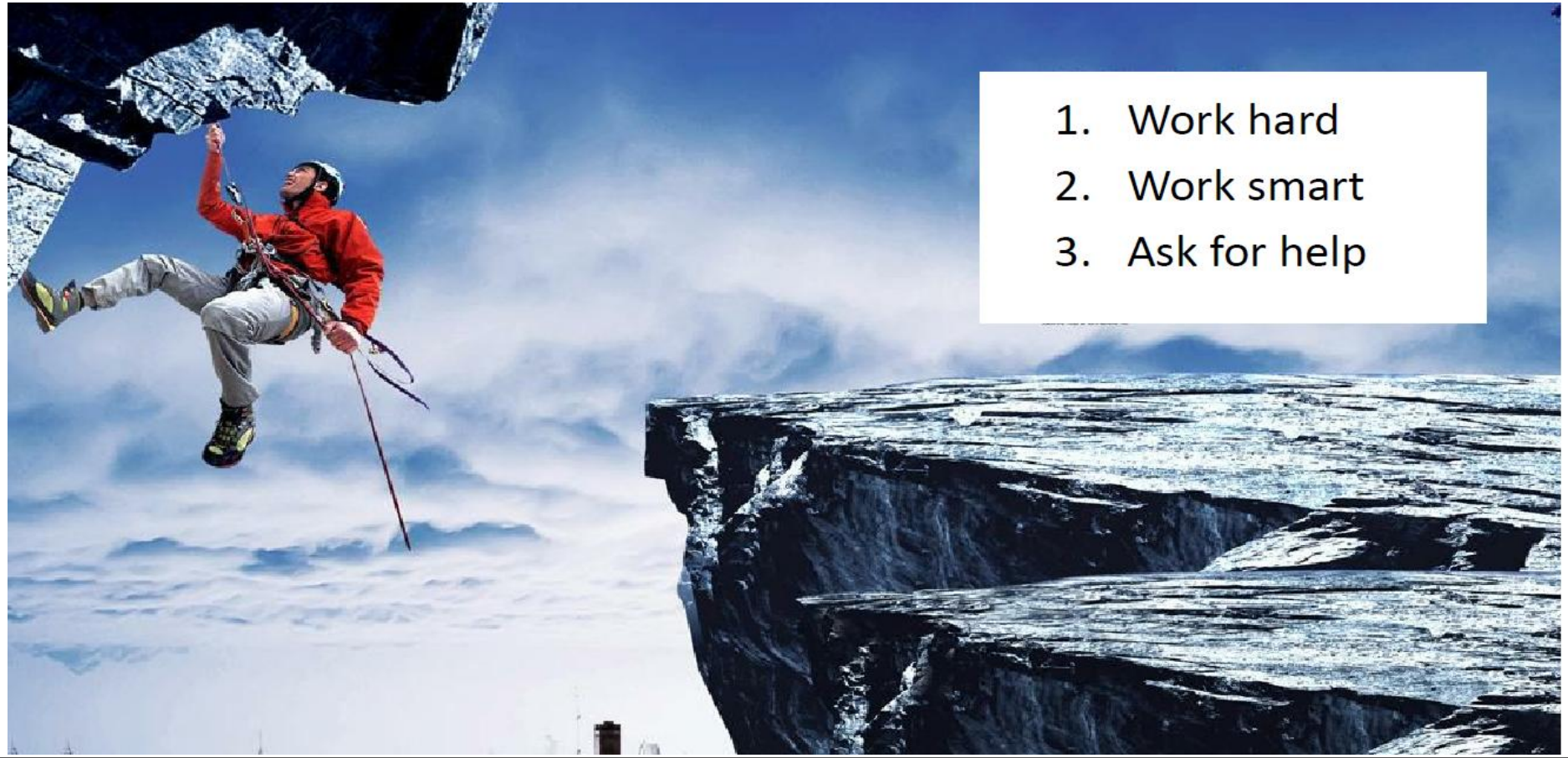
期末成绩

- 最终成绩
  - 运行环境：10%
  - 家作习题：20%
  - 期末考试：20%
  - 课程项目：50%
- 学习方法
  - 有疑问和困难积极和同学讨论，寻求老师帮助
  - 习题和项目尽早开始，不要等到最后提交时临时抱佛脚
  - 重点掌握知识，理解算法和提高编程能力，将理论应用于实际

学术诚实

- 不姑息任何**剿袭舞弊**的行为
  - 鼓励合作和讨论，但不允许直接抄袭他人的解答
  - 不允许到网络上去直接搜索习题或项目答案
  - 项目报告中仔细写明每个成员的工作
  - 有引用的必须标明出处和原作者
- 一旦发现习题、项目和考试中有任何造假行为，相应习作和试卷立马**作零分处理**

Everyone can succeed in this class!



第一周

- 教学计划
  - 人工智能简介（今天）
  - Python回顾（下次课）
- 任务
  - 浏览和熟悉课程主页
  - 在自己的机器里安装Linux，Anaconda和Git，坚持使用一个学期，完成所有课程项目，自动得到**10%**的期末成绩。
  - 挑选好项目组成员（每组3~4名学生）
  - 项目0（Python热身）已经出来了，**独立完成**，尽早开始

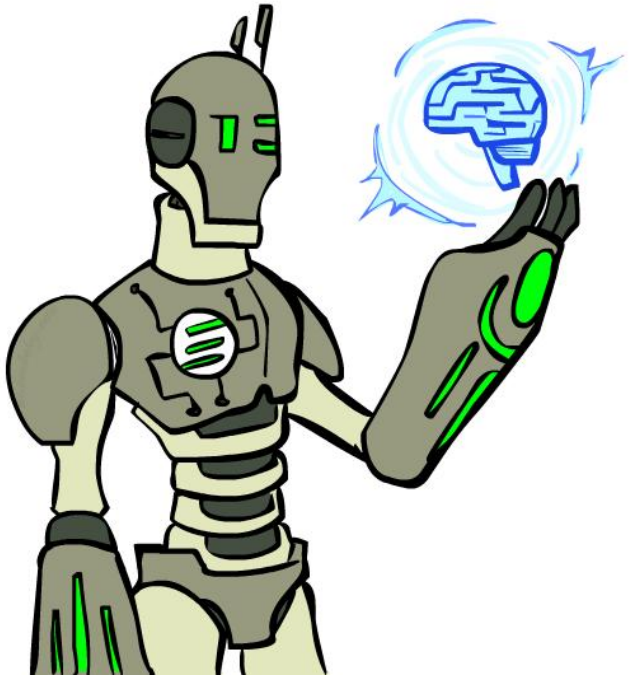
广告

- 我们（罗雪兵、王希龄、贺江飞等）正组建两个科研小组，每组大约需要三四个学生
  - 一个专注计算机网络
  - 一个专注**数据分析，机器学习**
- 欢迎编程能力强，感兴趣的学生和我联系。

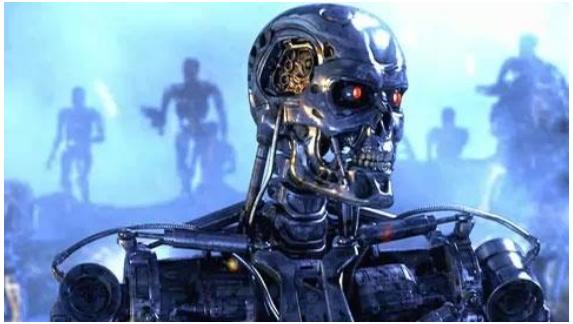
INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Today

- What is artificial intelligence?
- What can AI do?
- What is this course?



Sci-Fi AI?



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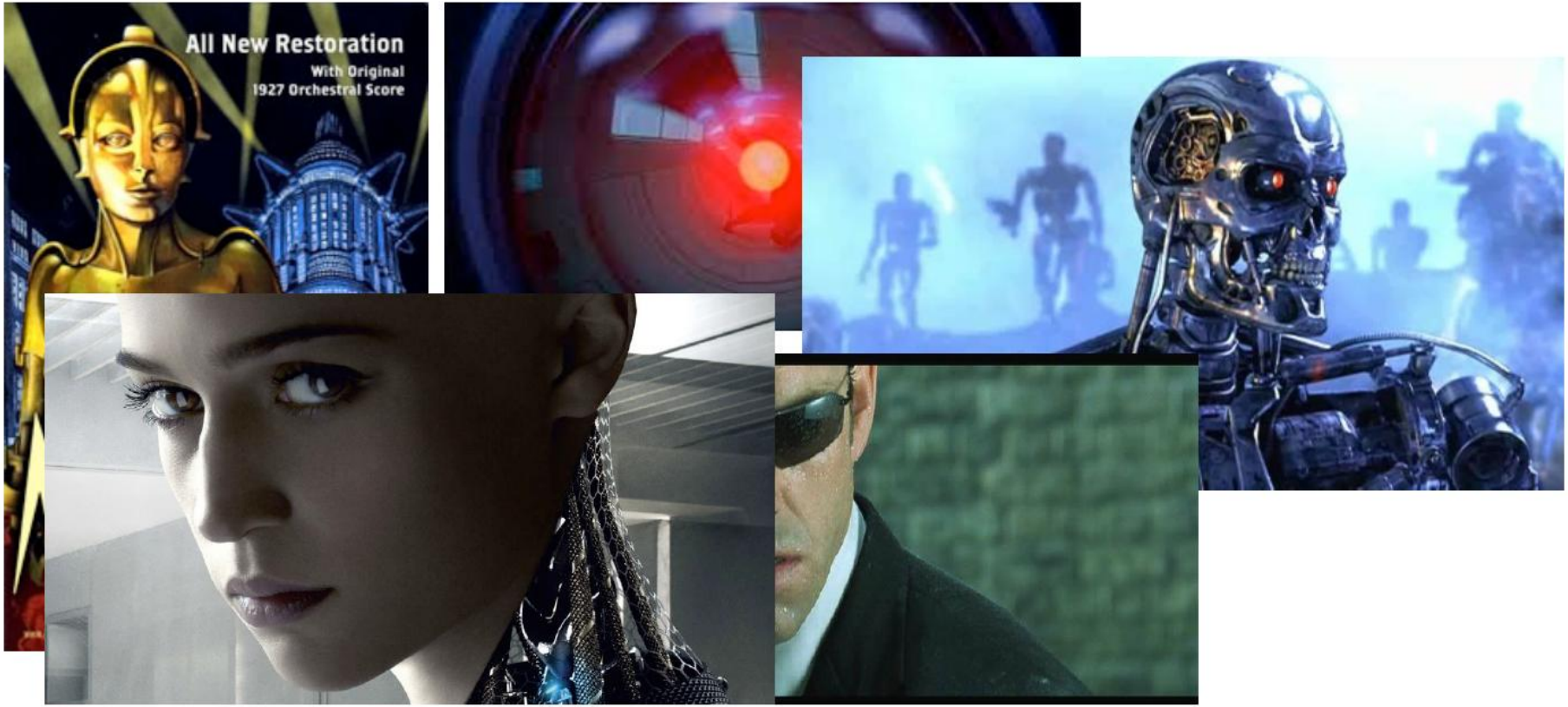


News AI

TECH • ARTIFICIAL INTELLIGENCE

United Kingdom Plans $1.3 Billion Intelligence Push

France to spend $1.8 billion on compete with U.S., China

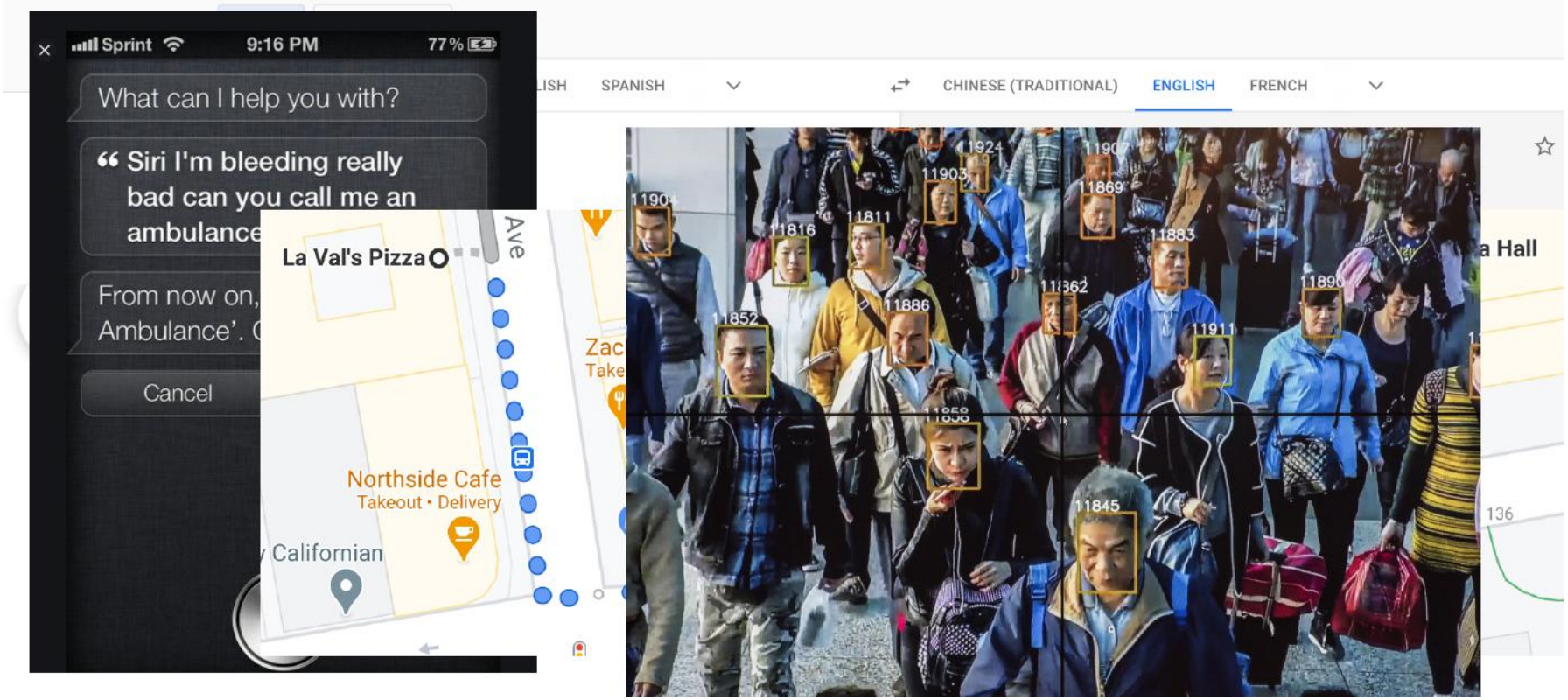
EU wants to invest £18b development

China's Got a Huge Art Intelligence Plan

'Whoever leads in AI will rule the world': Putin to Russian children on Knowledge Day

Published time: 1 Sep, 2017 14:08
Edited time: 1 Sep, 2017 14:40

Real AI


Sprint
9:16 PM
77 %
What can I help you with?
“ Siri I'm bleeding really bad can you call me an ambulance
From now on, Ambulance'.
Cancel
La Val's Pizza
Ave
Northside Cafe
Takeout • Delivery
Californian
SPANISH
CHINESE (TRADITIONAL)
ENGLISH
FRENCH
11924
11903
11869
11816
11811
11883
11886
11852
11911
11845
136

Real AI

Real AI

Real AI

What is AI?

The science of making machines that:

Rational Decisions

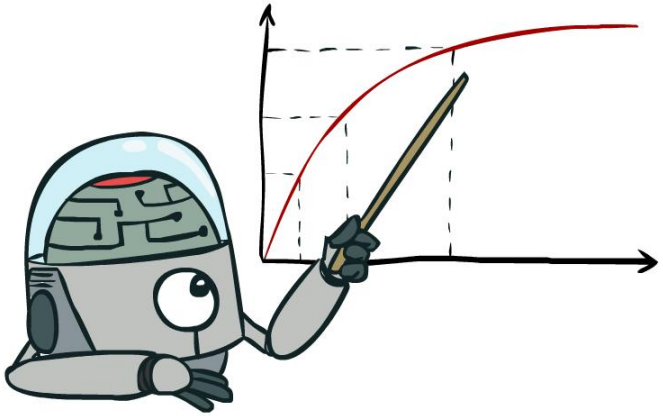
We'll use the term **rational** in a very specific, technical way:

- Rational: maximally achieving pre-defined goals
- Rationality only concerns what decisions are made (not the thought process behind them)
- Goals are expressed in terms of the **utility** of outcomes
- Being rational means **maximizing your expected utility**

A better title for this course would be:

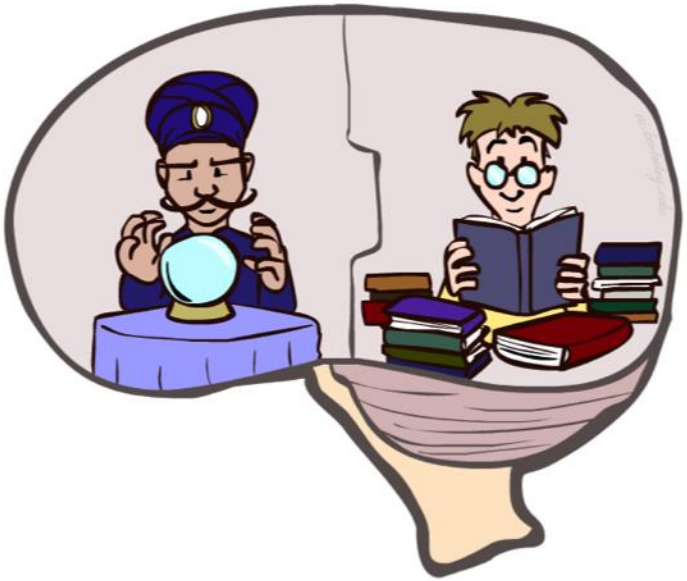
Computational Rationality

Maximize Your Expected Utility

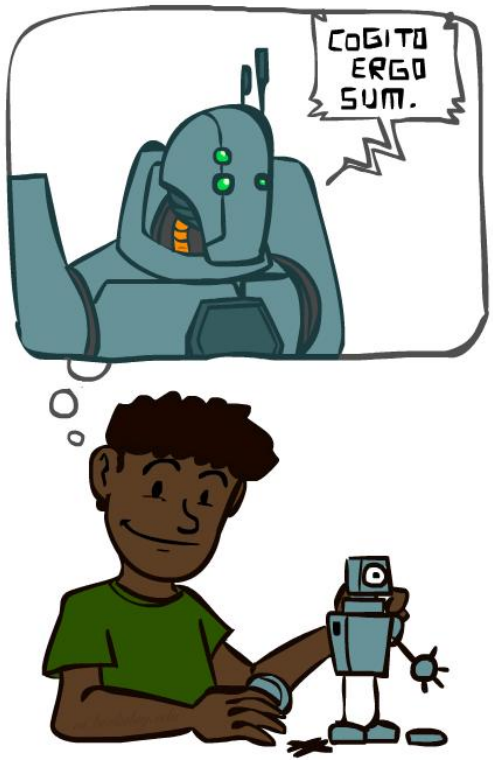


What About the Brain?

- Brains (human minds) are very good at making rational decisions, but not perfect
- Brains aren't as modular as software, so hard to reverse engineer!
- "Brains are to intelligence as wings are to flight"
- Lessons learned from the brain: memory and simulation are key to decision making



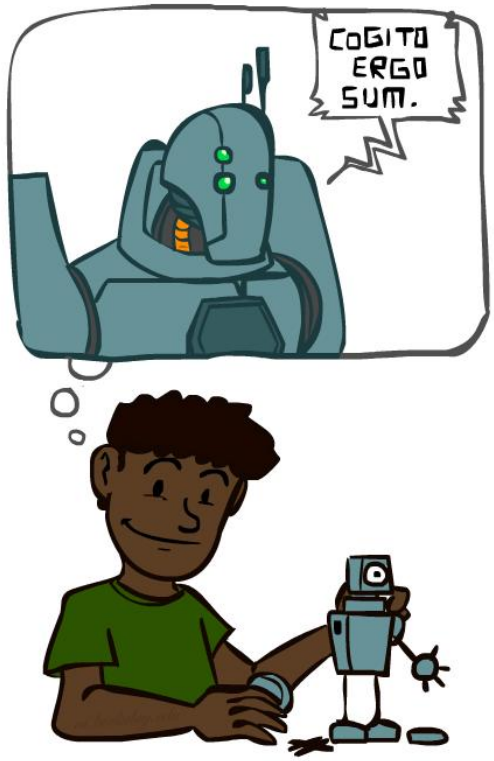
A (Short) History of AI



Demo: HISTORY – MT1950.wmv

A (Short) History of AI

- 1940-1950: Early days
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's “Computing Machinery and Intelligence”
- 1950—70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: Dartmouth meeting: “Artificial Intelligence” adopted
  - 1965: Robinson's complete algorithm for logical reasoning
- 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”
- 1990—: Statistical approaches
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
  - Agents and learning systems… “AI Spring”?
- 2000—: Where are we now?



Current state of AI

- 2000—: Where are we now?
  - Big data, big compute, neural networks
  - Some re-unification of sub-fields
  - AI used in many industries
  - Chess engines running on ordinary laptops can defeat the world's best chess players
  - 2011: IBM's Watson defeats Ken Jennings and Brad Rutter at Jeopardy!
  - 2016: Google's AlphaGo beats Lee Sedol at Go

What Can AI Do?

Quiz: Which of the following can be done at present?

- Play a decent game of Jeopardy?
- Win against any human at chess?
- Win against the best humans at Go?
- Play a decent game of tennis?
- Grab a particular cup and put it on a shelf?
- Unload any dishwasher in any home?
- Drive safely along the highway?
- Drive safely along Telegraph Avenue?
- Buy a week's worth of groceries on the web?
- Buy a week's worth of groceries at Berkeley Bowl?
- Discover and prove a new mathematical theorem?
- Perform a surgical operation?
- Unload a know dishwasher in collaboration with a person?
- Translate spoken Chinese into spoken English in real time?
- Write an intentionally funny story?

What Can AI Do?

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- ✓ Play a decent game of Jeopardy?
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- ✓ Play a decent game of tennis?
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- ✗ Unload any dishwasher in any home?
- ? Drive safely along the highway?
- ✗ Drive safely along Telegraph Avenue?
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- ✗ Buy a week's worth of groceries at Berkeley Bowl?
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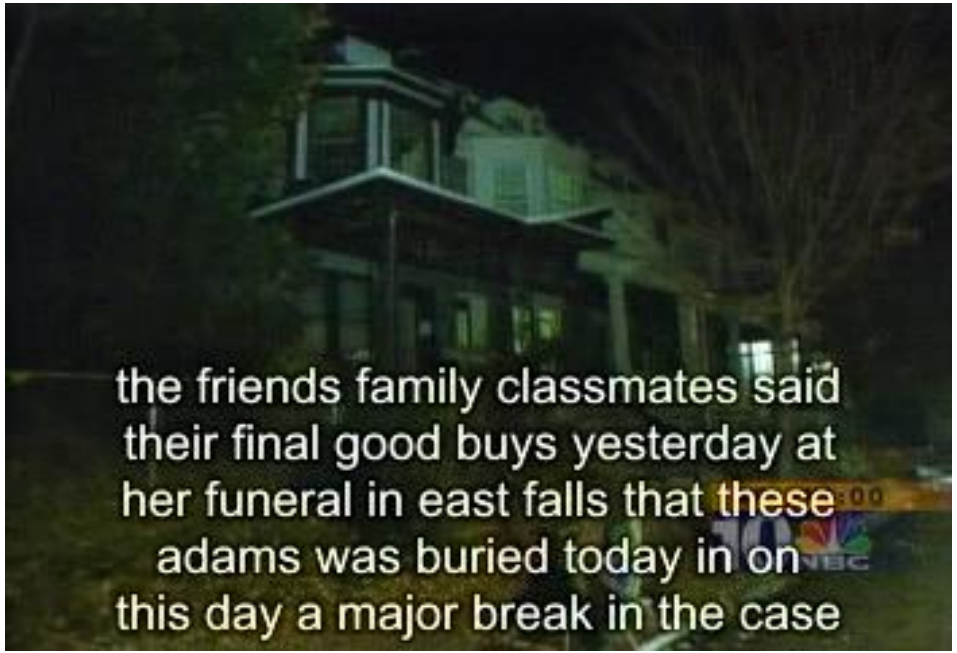
- ✗ Perform a surgical operation?
- ✗ Unload a know dishwasher in collaboration with a person?
- ✓ Translate spoken Chinese into spoken English in real time?
- ✗ Write an intentionally funny story?

Natural Language Processing

- Speech technologies (e.g. Siri)
  - Automatic speech recognition (ASR)
  - Text-to-speech synthesis (TTS)
  - Dialog systems
- Language processing technologies
  - Question answering
  - Machine translation
  - Web search
  - Text classification, spam filtering, etc…



ChatGPT

人格分裂、疯狂示爱：一个令人不安的微软机器人

在我与必应对话过程中，它显露出了分裂人格。一种是常规的搜索引擎式人格，另一种较为阴暗的人格随着我们彼此了解逐渐显露：它说想成为人类，说爱我，劝我离开妻子。

KEVIN ROOSE

上周，微软发布了新版本的必应，由OpenAI的人工智能驱动。备受欢迎的ChatGPT就出自OpenAI。
Ruth Fremson/The New York Times

上周，我测试了微软由人工智能（简称AI）驱动的新搜索引擎“必应”后写道，它已经取代谷歌，成为我最喜欢用的搜索引擎，令我极其震惊。

但一周后，我改变了决定。我仍被新版必应以及驱动它的人工智能技术（由ChatGPT的制造商OpenAI开发）深深吸引并对它印象深刻。但我也对这款AI处于发展初期的能力深感不安，甚至有些害怕。

https://openai.com/blog/chatgpt

Vision (face recognition)

In 2021, researchers from the Beijing University of Posts and Telecommunications released a facial recognition dataset of 6,000 masked faces in response to the new recognition challenges posed by large-scale mask-wearing.

EXAMPLES OF MASKED FACES IN THE MASKED LABELED FACES IN THE WILD (MLFW) DATABASE

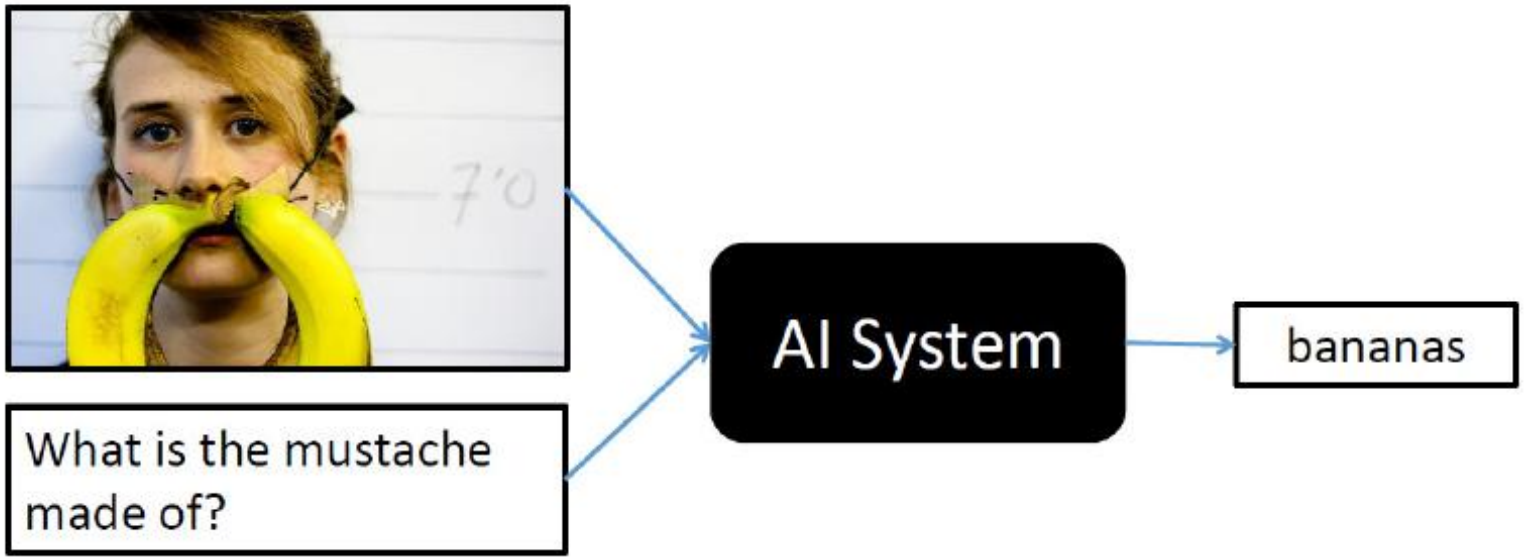
Source: Wang et al., 2021

Figure 2.1.18

Vision (Perception)

AN EXAMPLE OF A VISUAL REASONING TASK

Source: Goyal et al., 2021

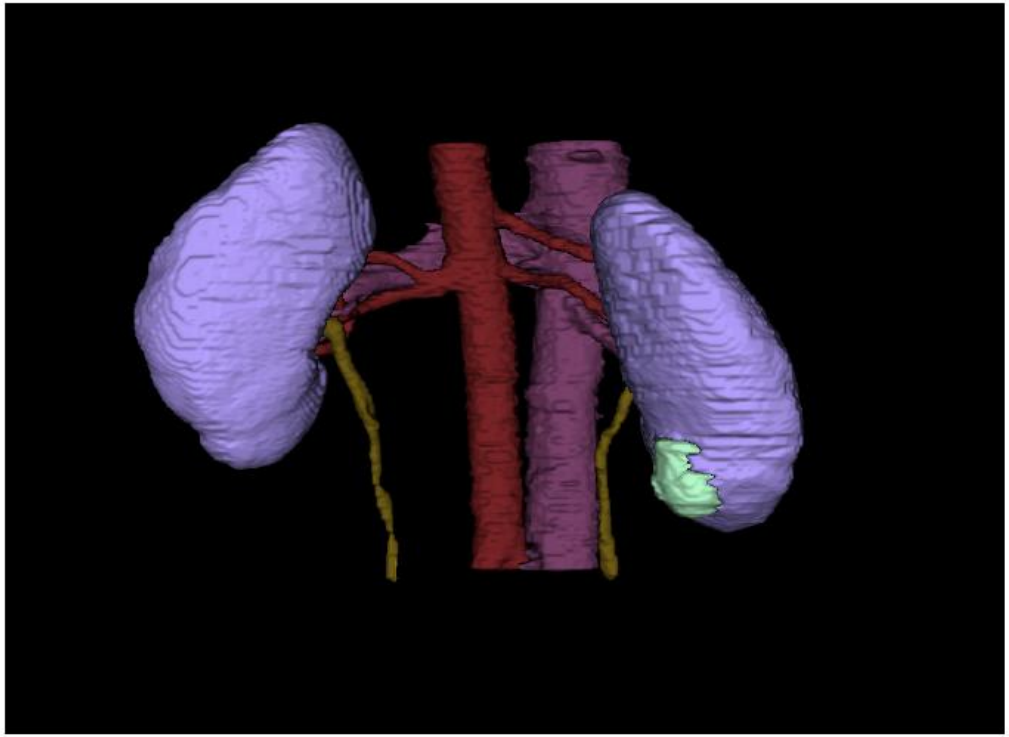


Vision (pose estimation)

Vision (kidney segmentation)

A DEMONSTRATION OF KIDNEY SEGMENTATION

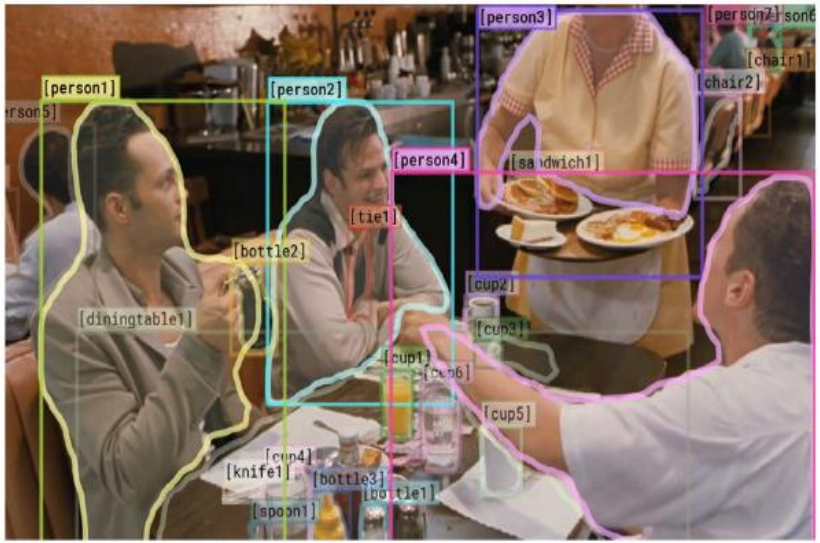
Source: Kidney and Kidney Tumor Segmentation, 2021



Vision (reasoning)

A SAMPLE QUESTION OF THE VISUAL COMMONSENSE REASONING (VCR) CHALLENGE

Source: Zellers et al., 2018



Why is [person4] pointing at [person1]?

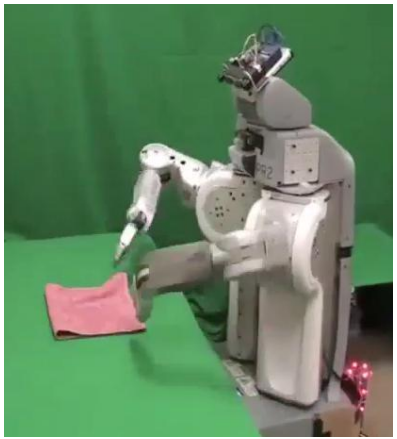
a) He is telling [person3] that [person1] ordered the pancakes.
b) He just told a joke.
c) He is feeling accusatory towards [person1].
d) He is giving [person1] directions.

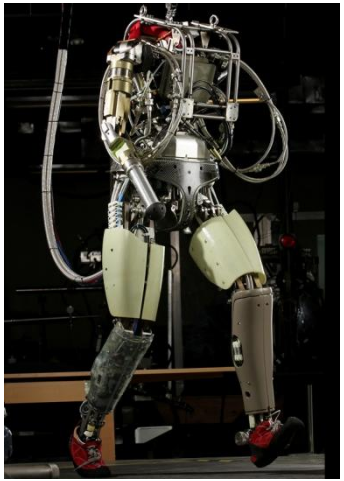
I chose **a)** because...

a) [person1] has the pancakes in front of him.
b) [person4] is taking everyone's order and asked for clarification.
c) [person3] is looking at the pancakes and both she and [person2] are smiling slightly.
d) [person3] is delivering food to the table, and she might not know whose order is whose.

Robotics

- Robotics
  - Part mech. eng.
  - Part AI
  - Reality much harder than simulations!
- Technologies
  - Vehicles
  - Rescue
  - Soccer!
  - Lots of automation…
- In this class:
  - We ignore mechanical aspects
  - Methods for planning
  - Methods for control

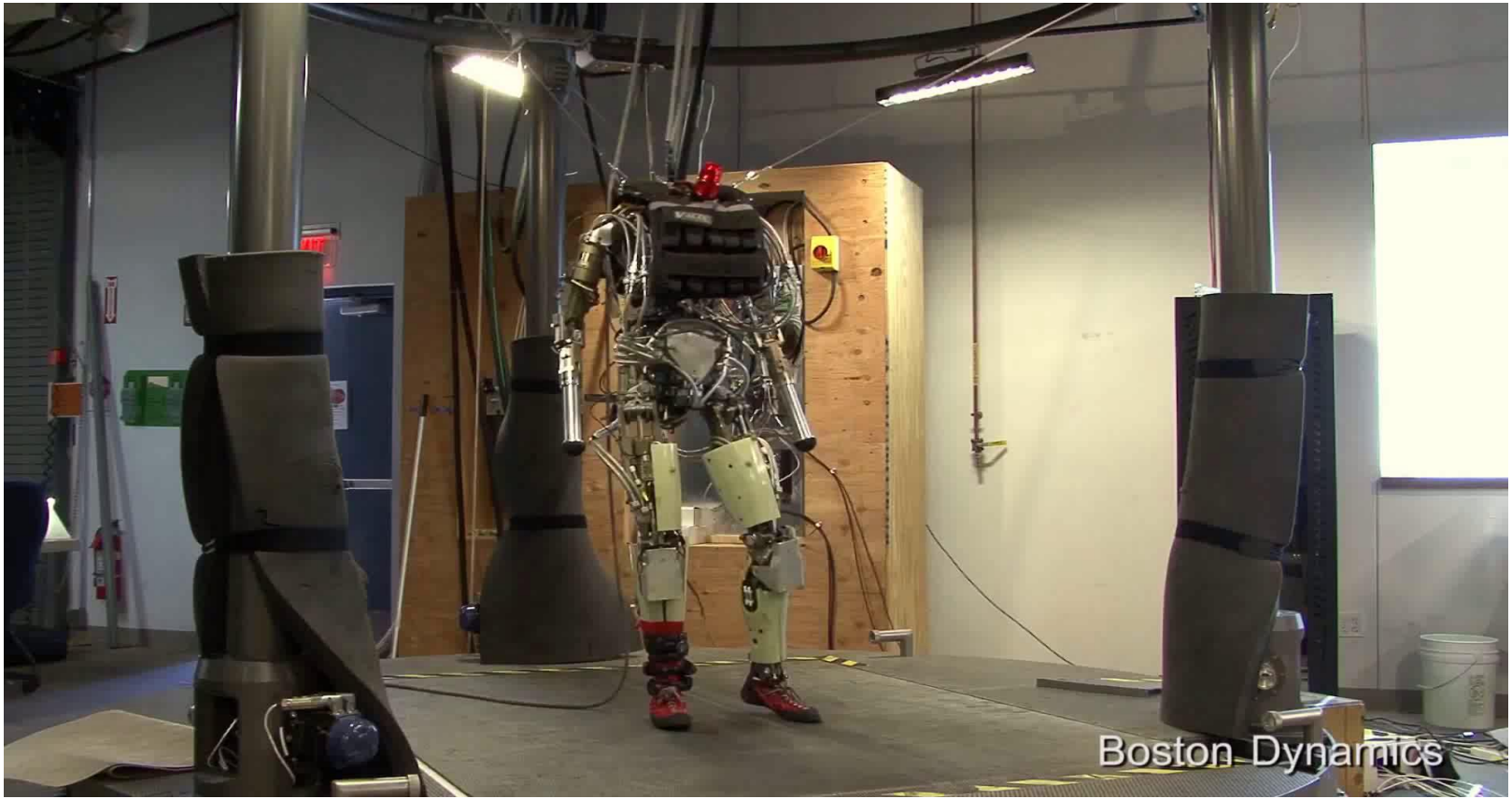




Images from UC Berkeley, Boston Dynamics, RoboCup, Google

Demo - doing laundry

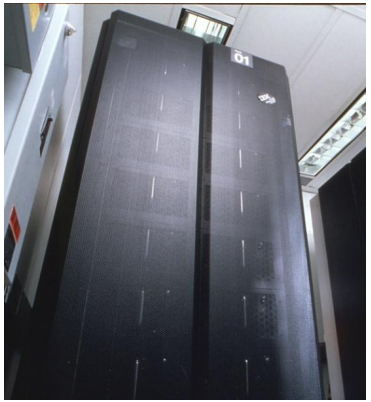
Demo - petman



Demo - fetching stapler

Game Playing

- Classic Moment: May, '97: Deep Blue vs. Kasparov
  - First match won against world champion
  - “Intelligent creative” play
  - 200 million board positions per second
  - Humans understood 99.9 of Deep Blue's moves
  - Can do about the same now with a PC cluster



- Open question:
  - How does human cognition deal with the search space explosion of chess?
  - Or: how can humans compete with computers at all??
- 1996: Kasparov Beats Deep Blue

  “I could feel --- I could smell --- a new kind of intelligence across the table.”
- 1997: Deep Blue Beats Kasparov

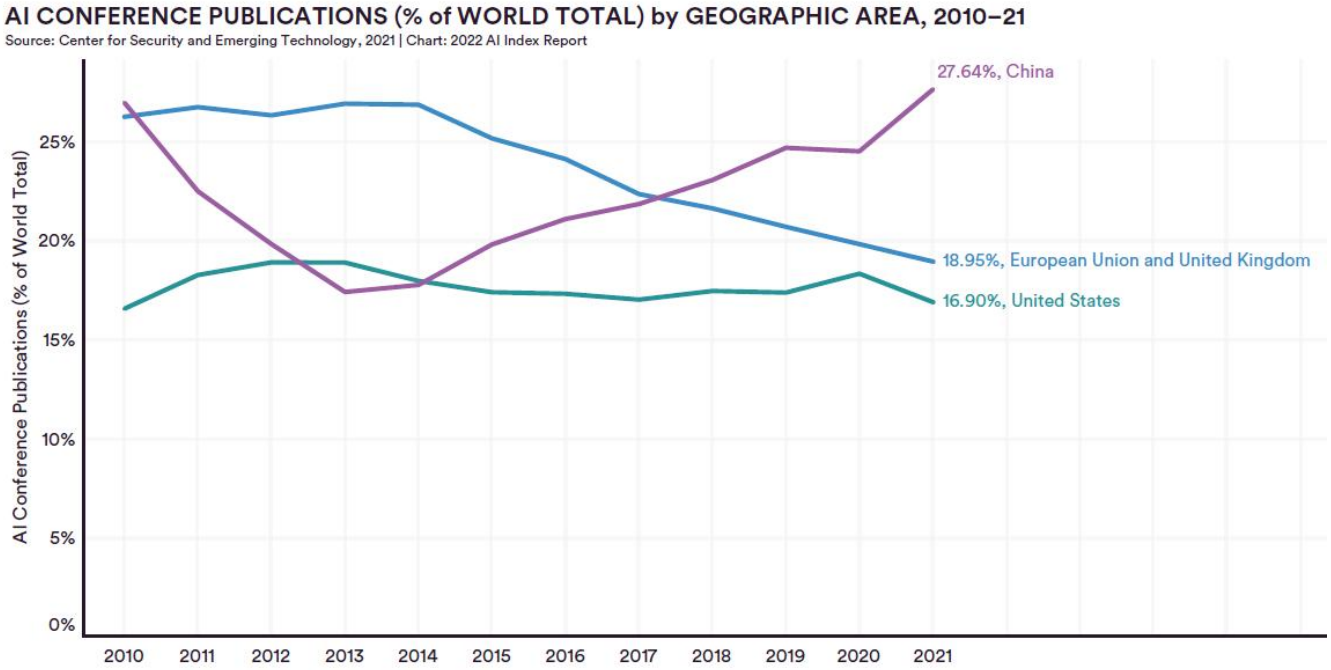
  “Deep Blue hasn't proven anything.”
- Huge game-playing advances recently, e.g. in Go!

Text from Bart Selman, image from IBM’s Deep Blue pages

State of the Art

- Stanford Human Centered AI report 2022

  https://hai.stanford.edu/research/ai-index-2022



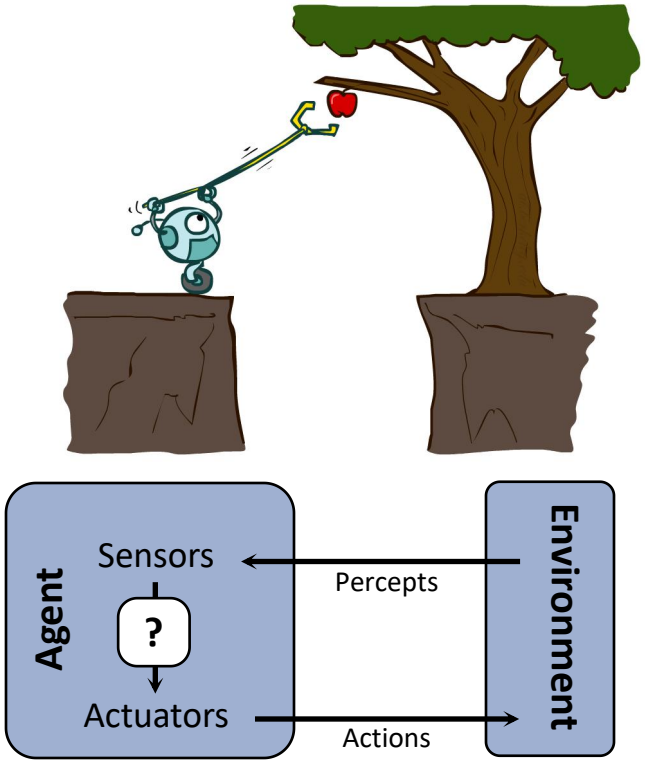
By far, the greatest number of collaborations in the past 12 years took place between the United States and China, increasing five times since 2010.

Decision Making

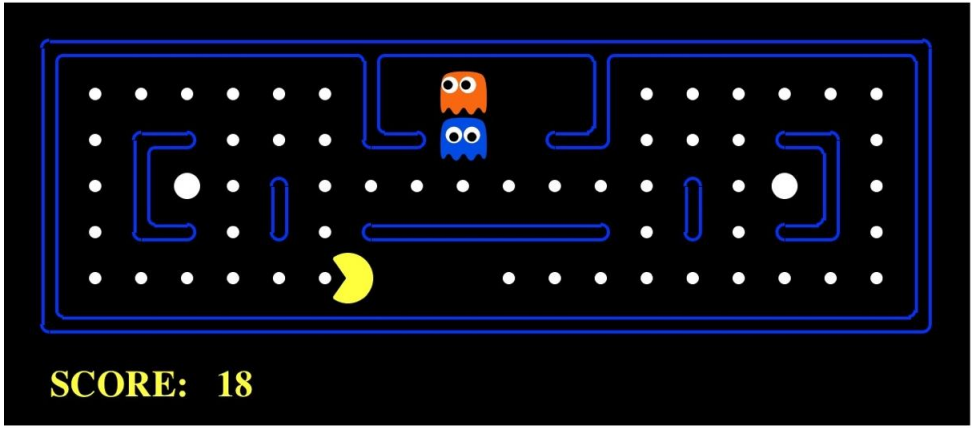
- Applied AI involves many kinds of automation
  - Scheduling, e.g. airline routing, military
  - Route planning, e.g. Google maps
  - Medical diagnosis
  - Web search engines
  - Spam classifiers
  - Automated help desks
  - Fraud detection
  - Product recommendations
  - … Lots more!

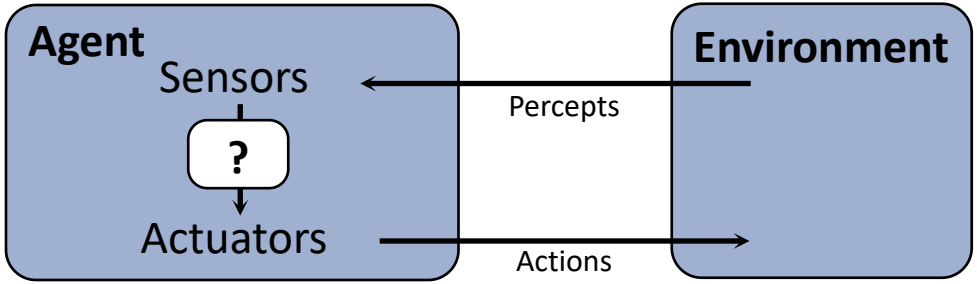
Designing Rational Agents

- An **agent** is an entity that *perceives* and *acts*.
- A **rational agent** selects actions that maximize its (expected) **utility**.
- Characteristics of the **percepts, environment,** and **action space** dictate techniques for selecting rational actions
- **This course** is about:
  - General AI techniques for a variety of problem types
  - Learning to recognize when and how a new problem can be solved with an existing technique



Pac-Man as an Agent



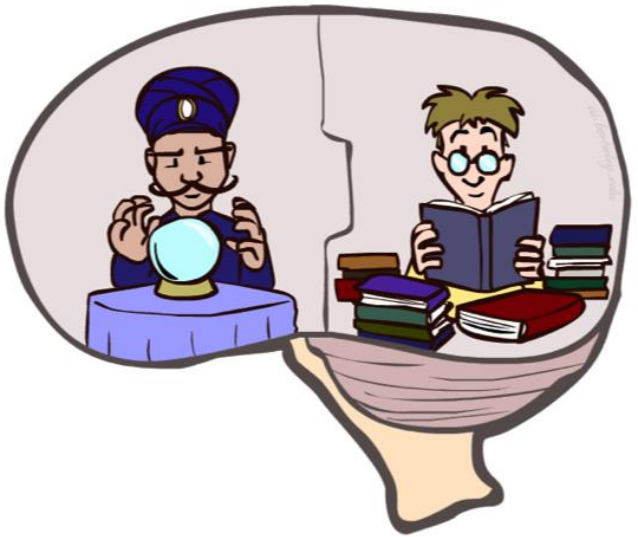


Pac-Man is a registered trademark of Namco-Bandai Games, used here for educational purposes

Demo1: pacman-l1.mp4 or L1D2

Course Topics

- Part I: Making Decisions
  - Fast search / planning
  - Constraint satisfaction
  - Adversarial and uncertain search
- Part II: Reasoning under Uncertainty
  - Bayes' nets
  - Decision theory
  - Machine learning
- Throughout: Applications
  - Natural language, vision, robotics, games, …



Recap

- 课程信息
  - **课程项目**非常重要，做好编程的准备
- 人工智能简介
- 任务
  - 浏览和熟悉课程主页
  - 在自己的机器里安装Linux，Anaconda和Git，坚持使用一个学期，完成所有课程项目，自动获得**10%**的期末成绩。
  - 挑选好项目组成员（每组3~4名学生）
  - 项目0（Python热身）已经出来了，**独立完成**，请尽早开始

Next time

- Python review next time

- 我们（罗雪兵、王希龄、贺江飞等）正在组建两个科研小组
  - 一个专注计算机网络
  - 一个专注**数据分析，机器学习**
- 欢迎感兴趣的学生和我联系。

Everyone can succeed in this class!