

CSE 473: Artificial Intelligence Introduction 2

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Several slides from Luke Zettlemoyer, Dan Klein, Dan Weld,
Stuart Russell, Andrew Moore

Announcements

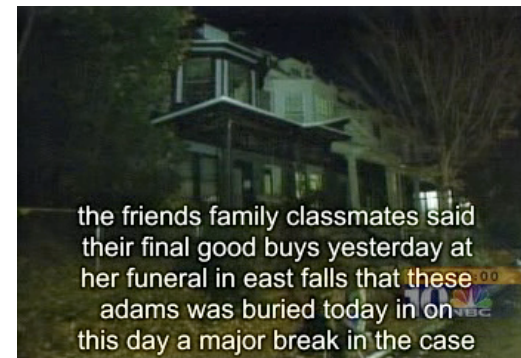
- Project 0: Python Tutorial
 - Online, but not graded
- Project 1: Search
 - On the web by Friday.
 - Start early and ask questions. **It's longer than most!**

Different Research Areas in AI

- Natural Language Processing
- Computer Vision
- Robotics
- Logic
- Decision Making
- Machine Learning
- Game Playing

Natural Language Processing

- Speech Technologies (e.g., Siri):
 - Automatic Speech Recognition (ASR)
 - Text-to-speech synthesis
 - Dialog Systems
- Language Technologies:
 - Question answering
 - Machine translation



"Il est impossible aux journalistes de rentrer dans les régions tibétaines"

Bruno Philip, correspondant du "Monde" en Chine, estime que les journalistes de l'AFP qui ont été expulsés de la province tibétaine du Qinghai "n'étaient pas dans l'illégalité".



Les faits Le dalaï-lama dénonce l'"enfer" imposé au Tibet depuis sa fuite, en 1959
Vidéo Anniversaire de la rébellion tibétaine : la Chine sur ses gardes

"It is impossible for journalists to enter Tibetan areas"

Philip Bruno, correspondent for "World" in China, said that journalists of the AFP who have been deported from the Tibetan province of Qinghai "were not illegal."



Facts The Dalai Lama denounces the "hell" imposed since he fled Tibet in 1959
Video Anniversary of the Tibetan rebellion: China on guard

- Text classification; spam filtering; etc

Vision

- Object Recognition
- Scene Classification
- Image Segmentation
- Human Activity Recognition

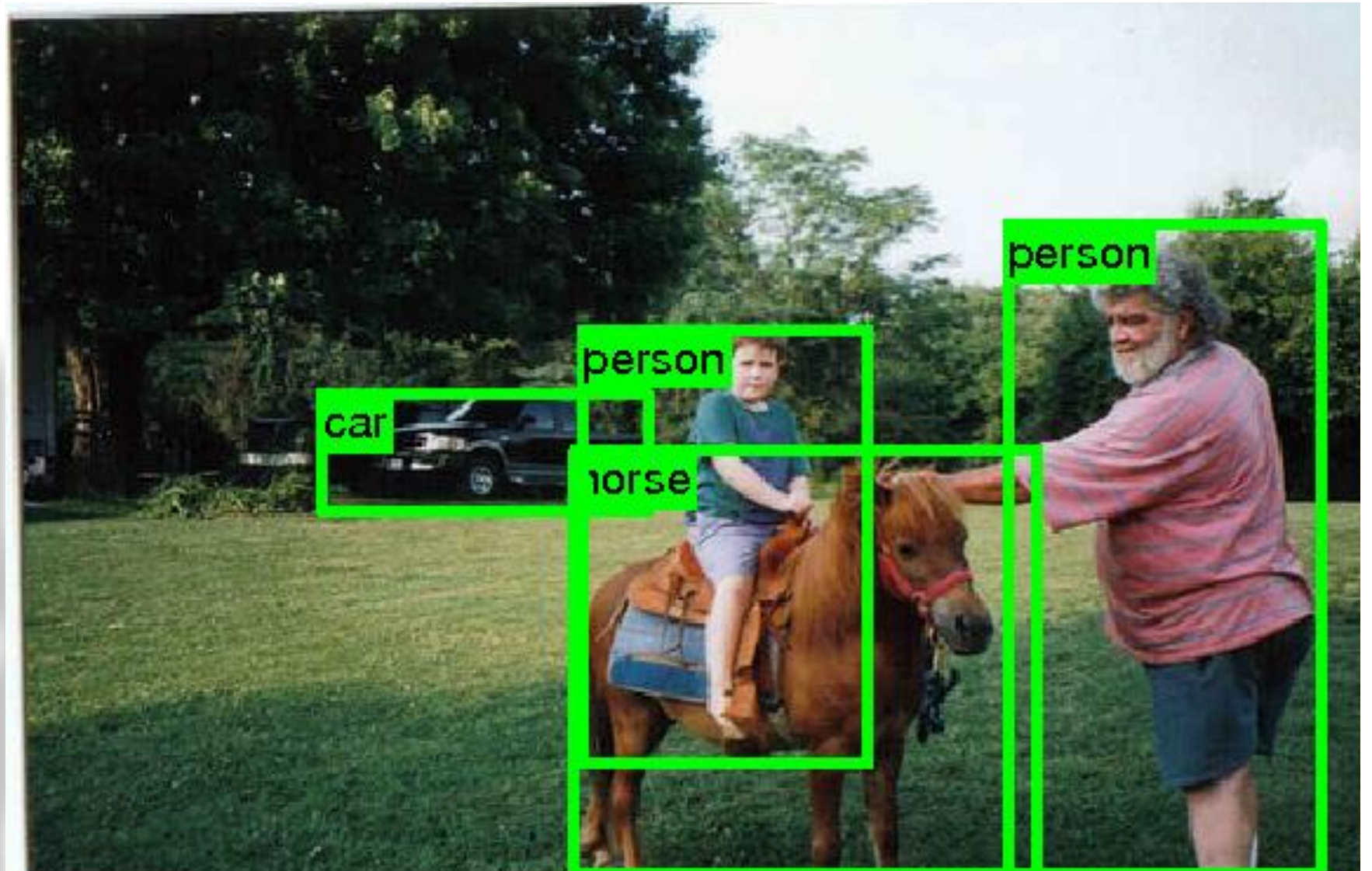
Object Recognition

Scene Segmentation



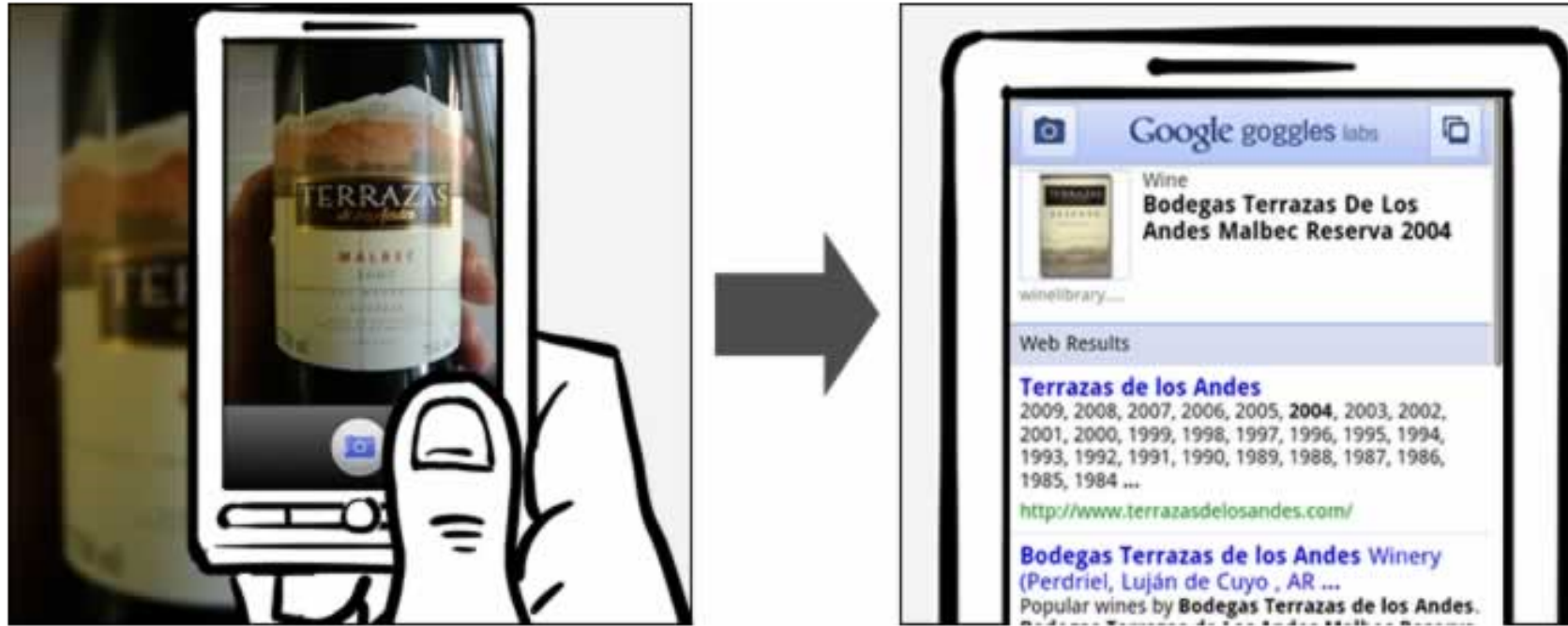
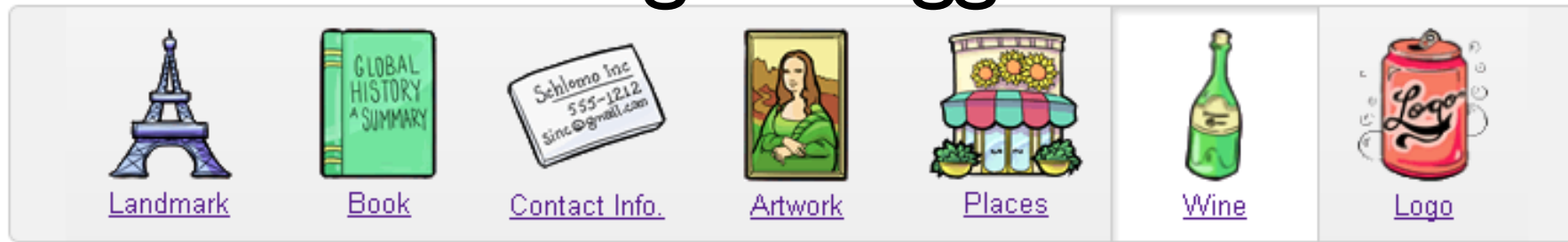
(b)

(c)

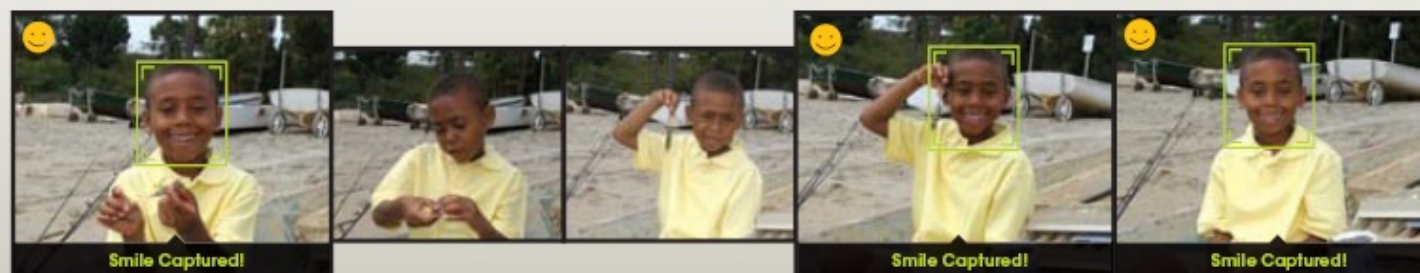
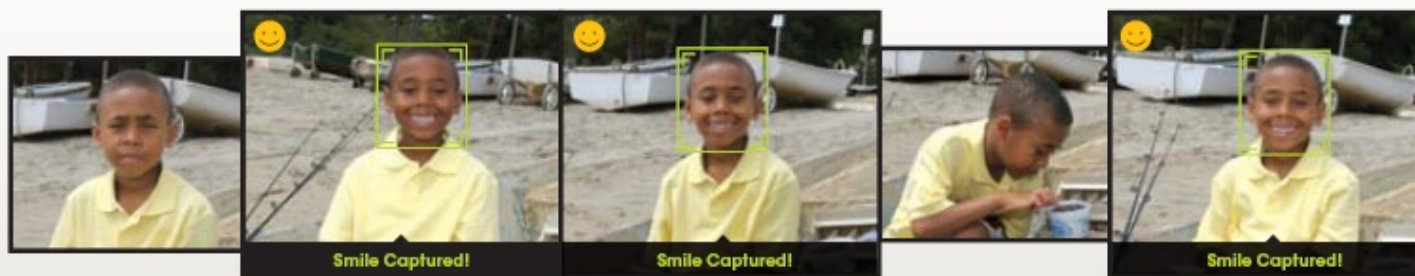


- window
- tree
- sky
- road
- pole
- car
- building
- unlabeled

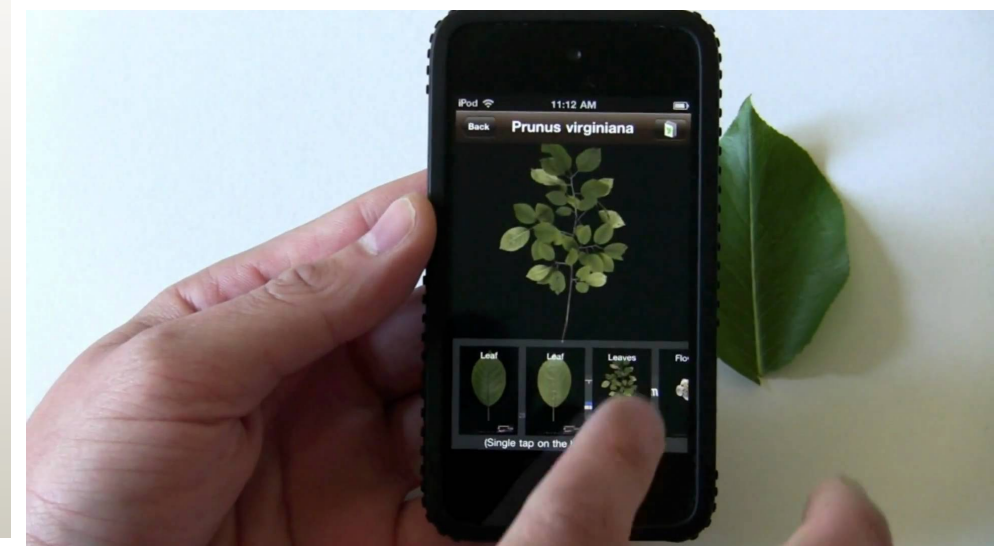
Google Goggles



Smile Detection



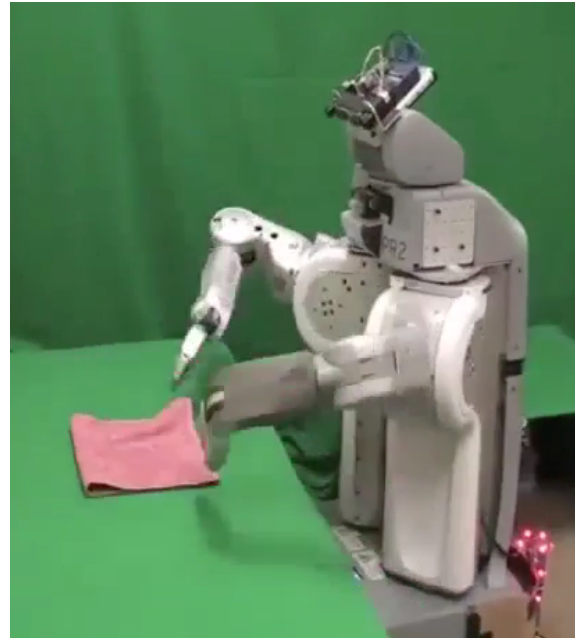
Leaf Snap



Robotics

- Robotics

- Part mech. eng.
- Part AI
- Reality much harder than simulations!

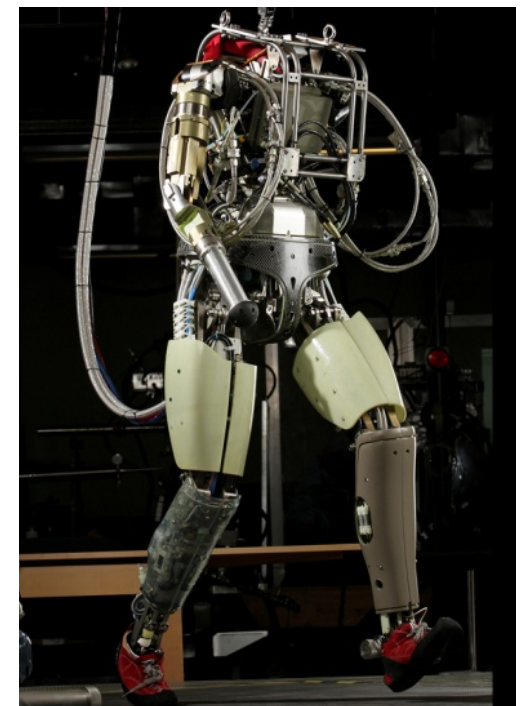


- Technologies

- Vehicles
- Rescue
- Soccer!
- Lots of automation...

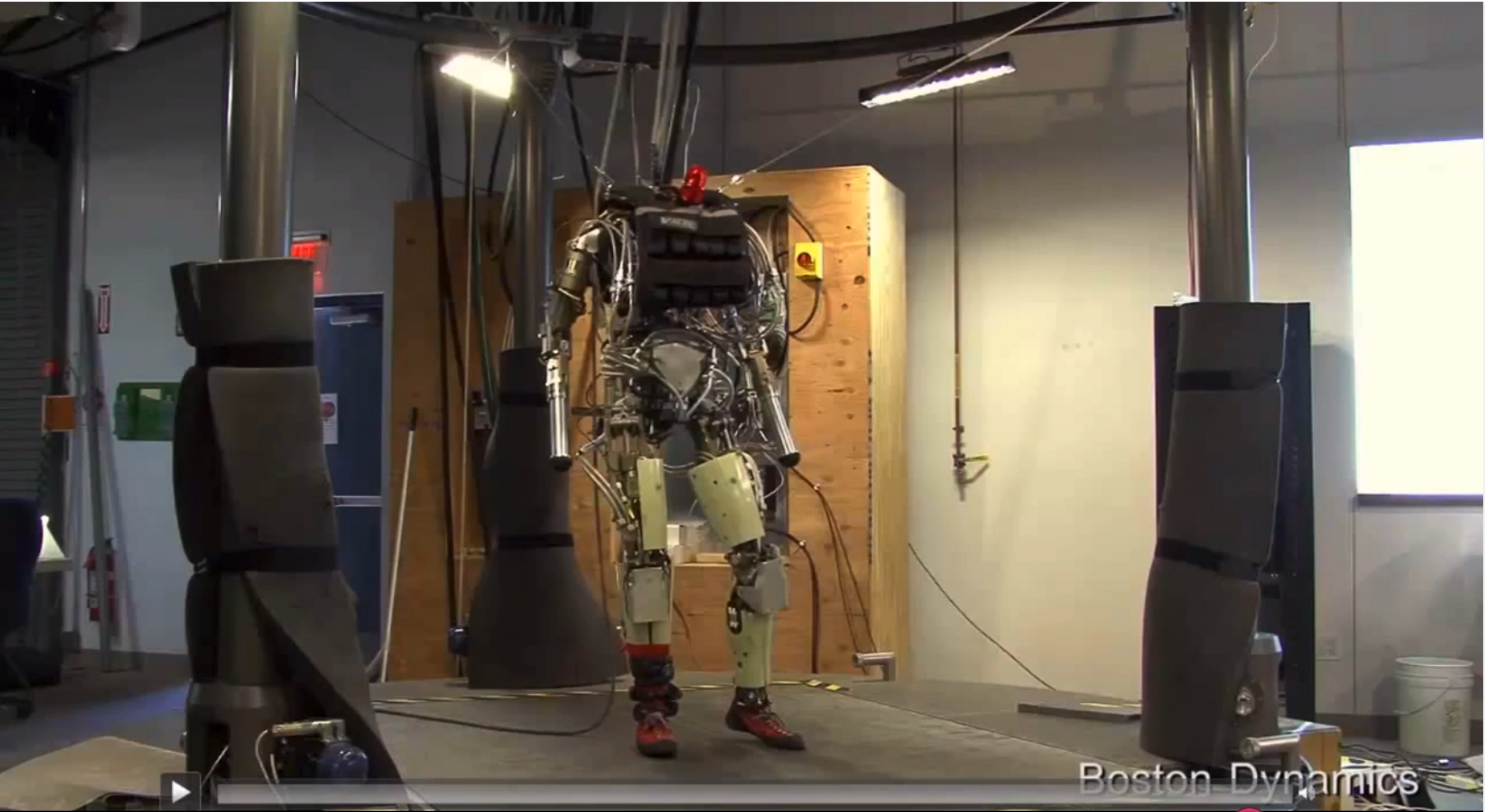
- In this class:

- We ignore mechanical aspects
- Methods for planning
- Methods for control



Images from UC Berkeley, Boston Dynamics, RoboCup, Google





Boston Dynamics

Logic

- Logical systems
 - Theorem provers
 - NASA fault diagnosis
 - Question answering
- Methods:
 - Deduction systems
 - Constraint satisfaction
 - Satisfiability solvers (huge advances!)

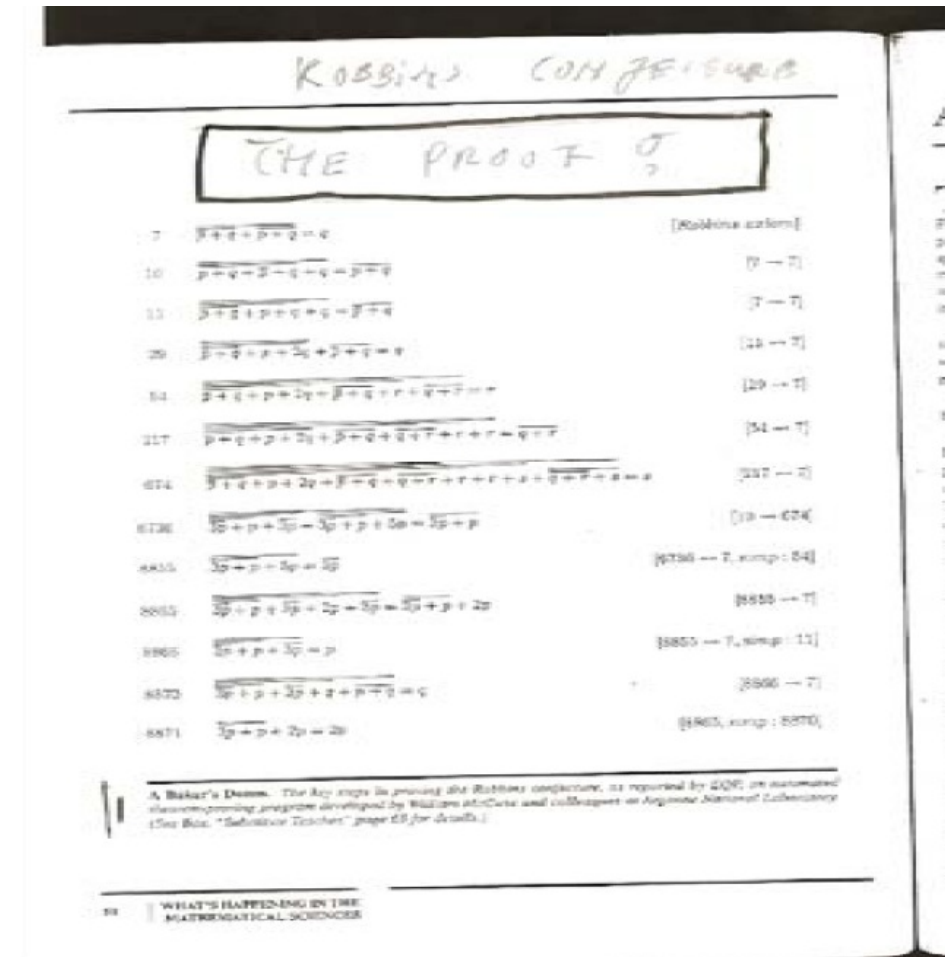


Image from Bart Selman

Decision Making

- Scheduling, airline routing
- Route planning
- Medical diagnosis
- Web search
- Spam classification
- Automated help desks
- Fraud detection
- Product recommendation
- ... Lots more!

Machine Learning

- Most current AI systems

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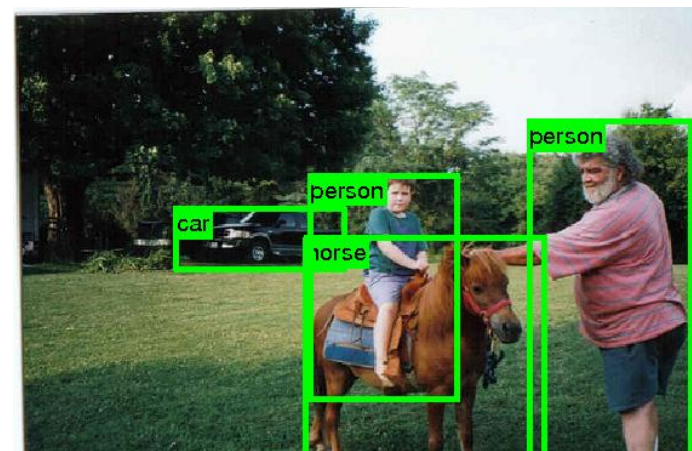


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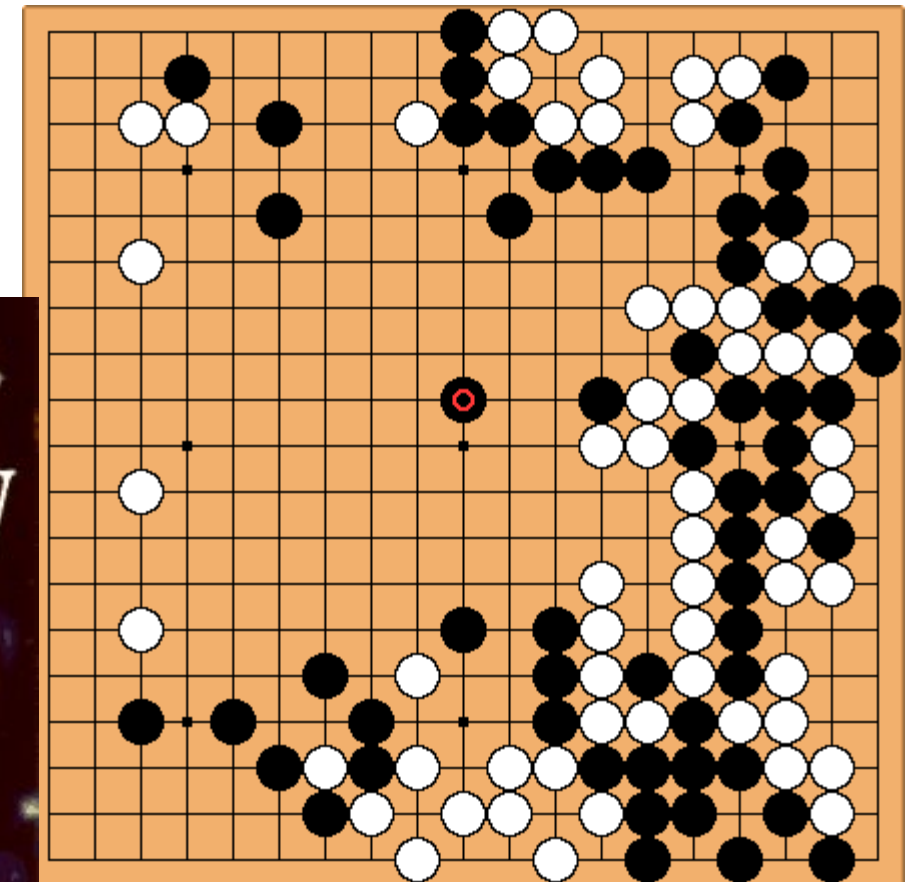
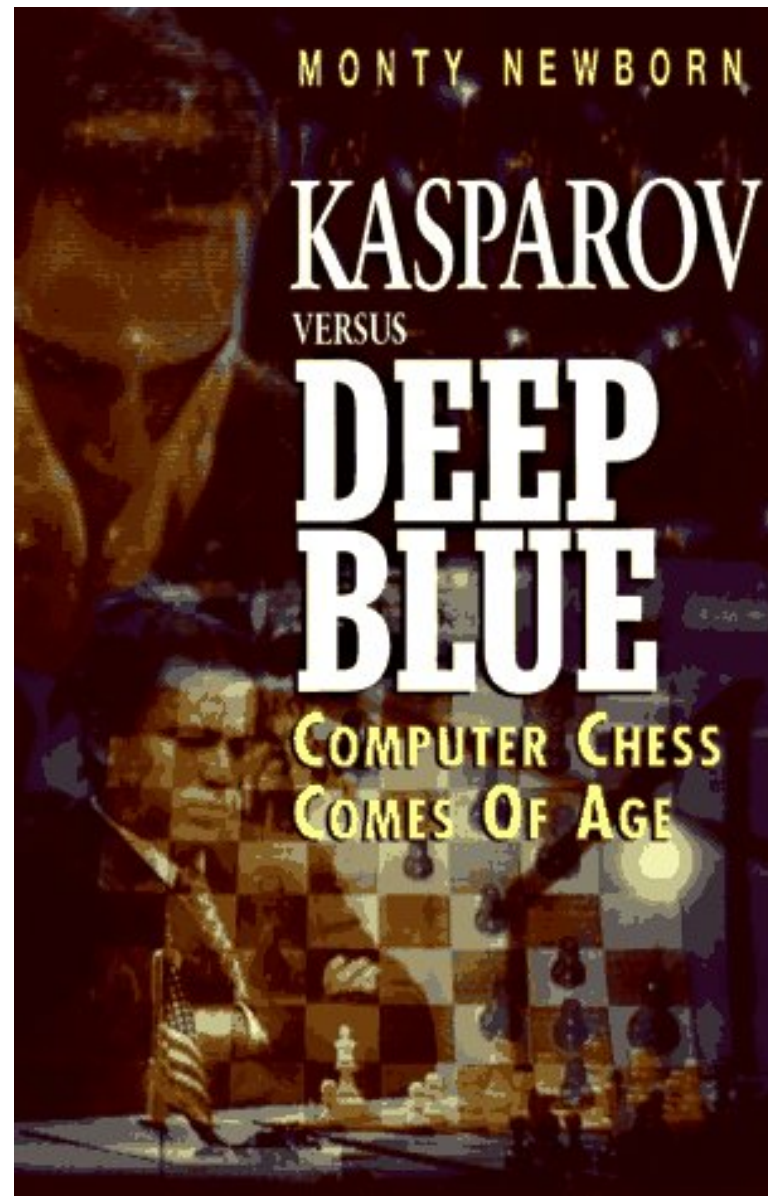
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Video Anniversary of the Tibetan rebellion: China on guard



Game Playing



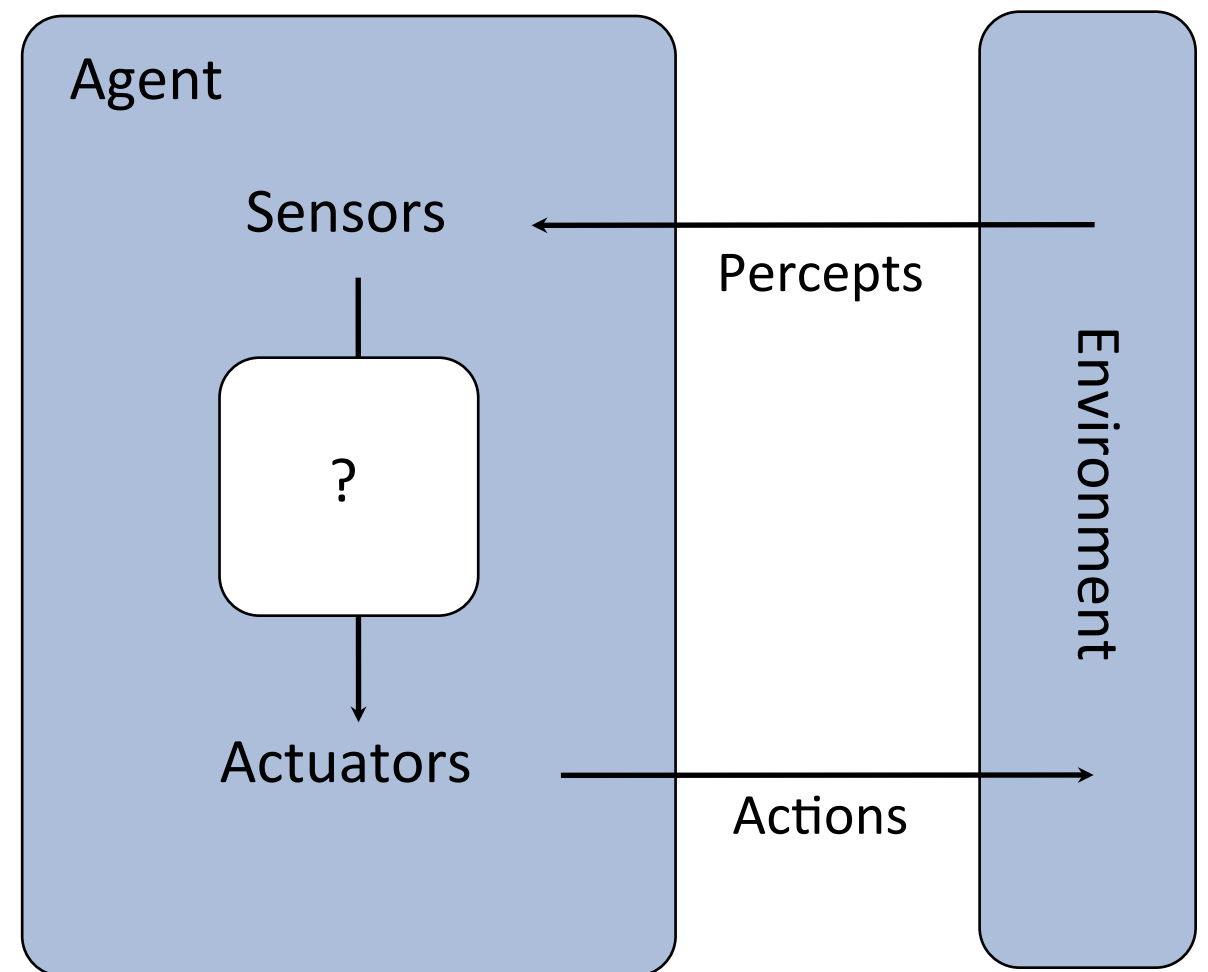
Designing Rational Agents

An agent:

- Perceives and acts
- Selects actions that maximize its utility function
- Has a goal

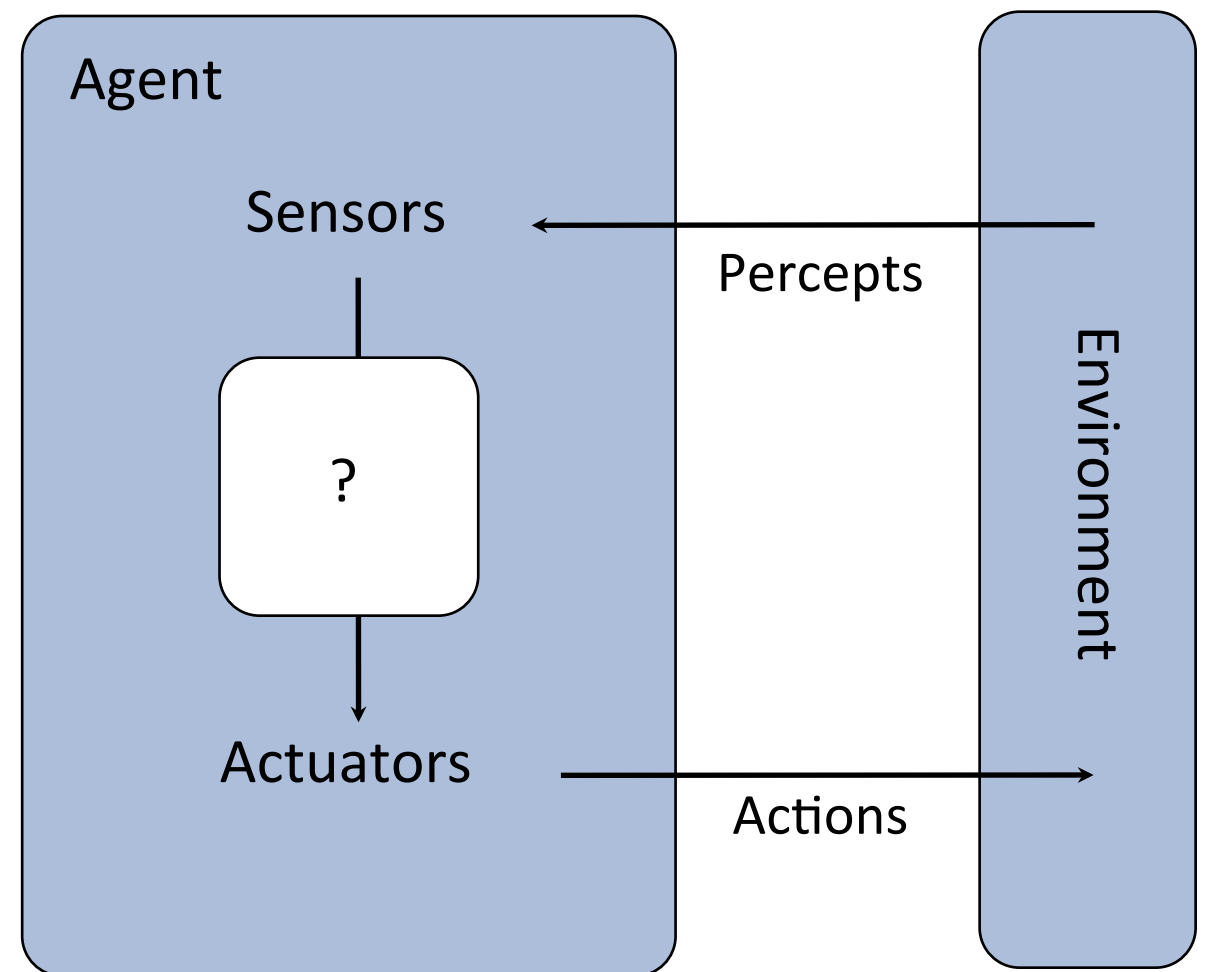
Environment:

- Input and output to the agent



Designing Rational Agents

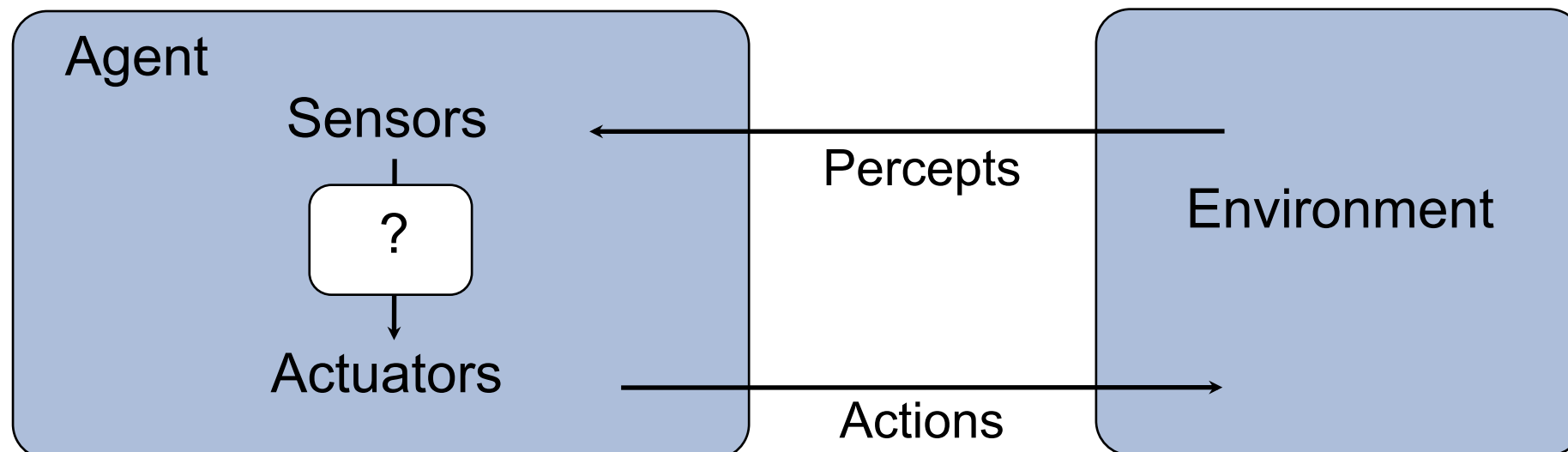
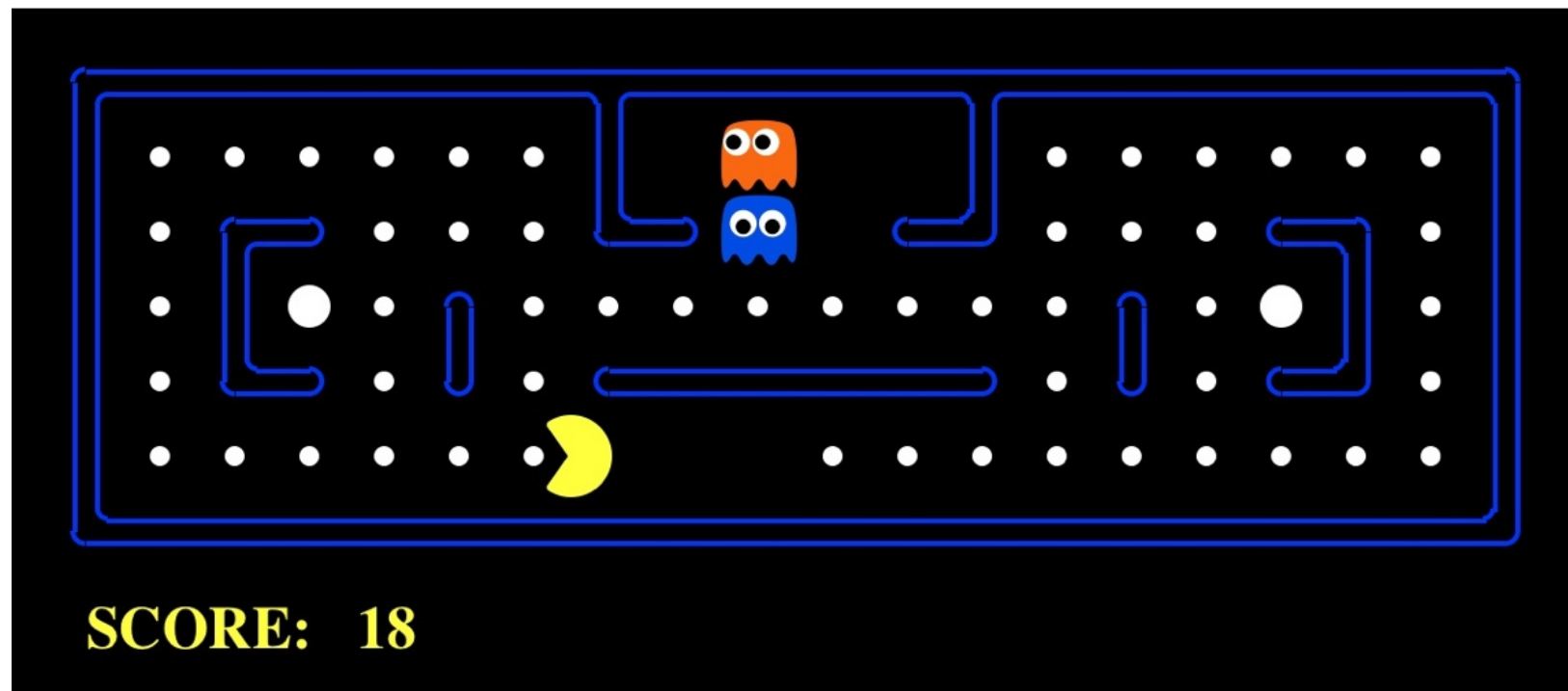
Characteristics of the percepts, environment, and action space dictate techniques for selecting rational actions.



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

Pacman as an Agent



Types of Environments

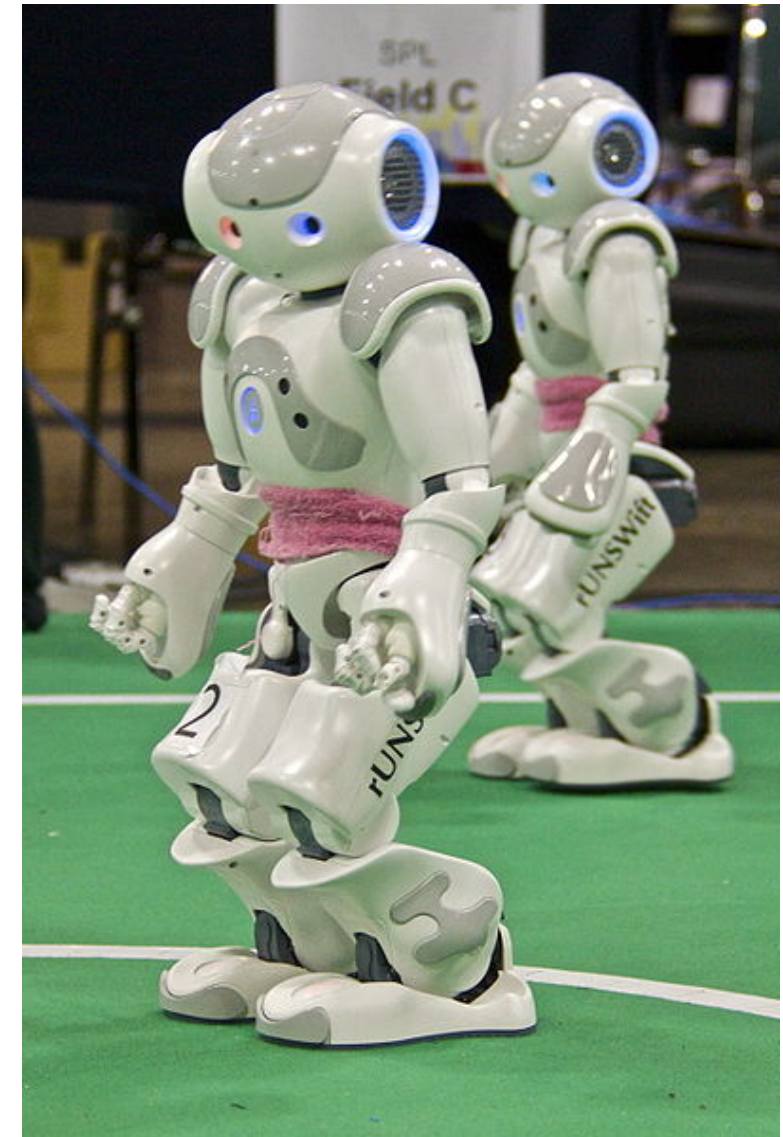
- Fully observable *vs.* partially observable
- Single agent *vs.* multiagent
- Deterministic *vs.* stochastic
- Static *vs.* sequential
- Discrete *vs.* continuous

Fully observable vs. Partially observable

Can the agent observe the complete state of the environment?



VS.



Single agent vs. Multiagent

Is the agent the only thing acting in the world?



vs.

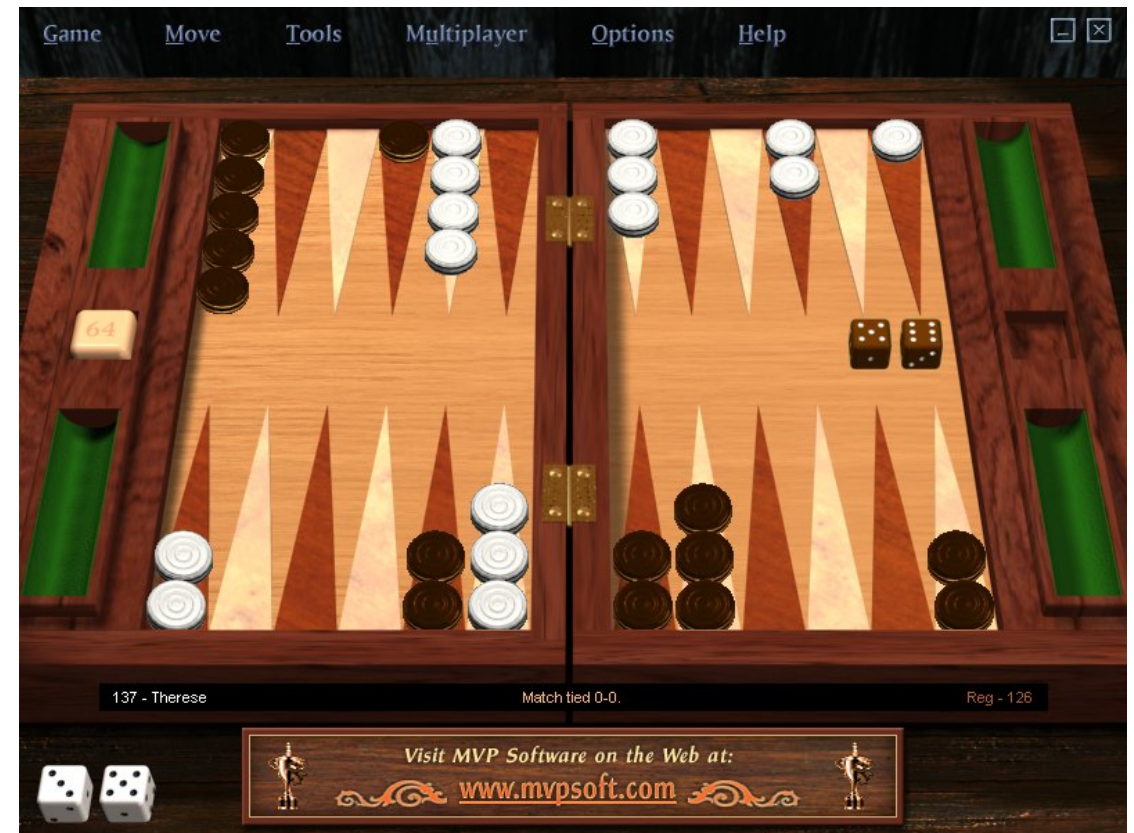


Deterministic vs. Stochastic

Is there uncertainty in how the world works?

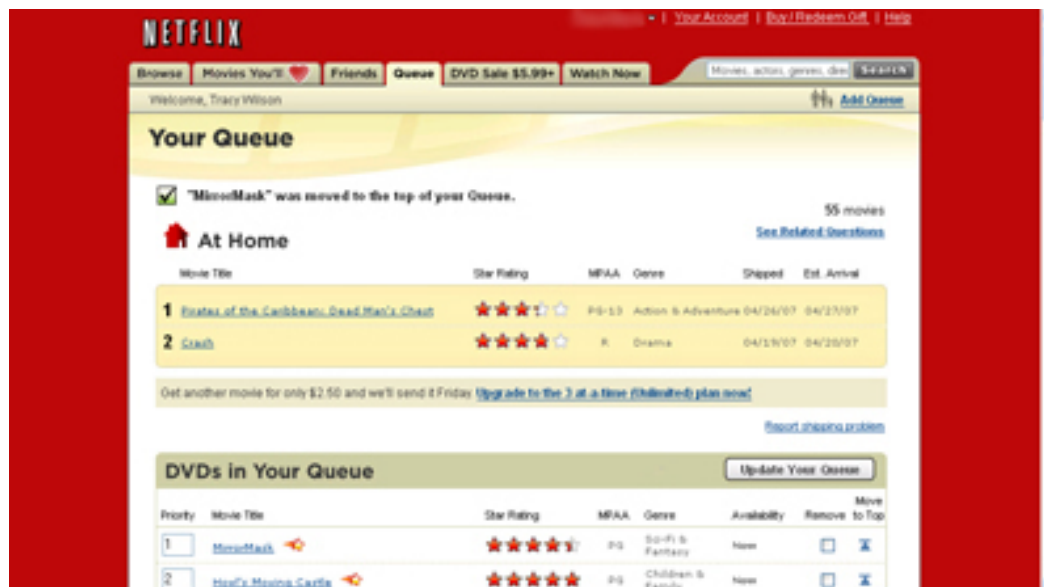


vs.

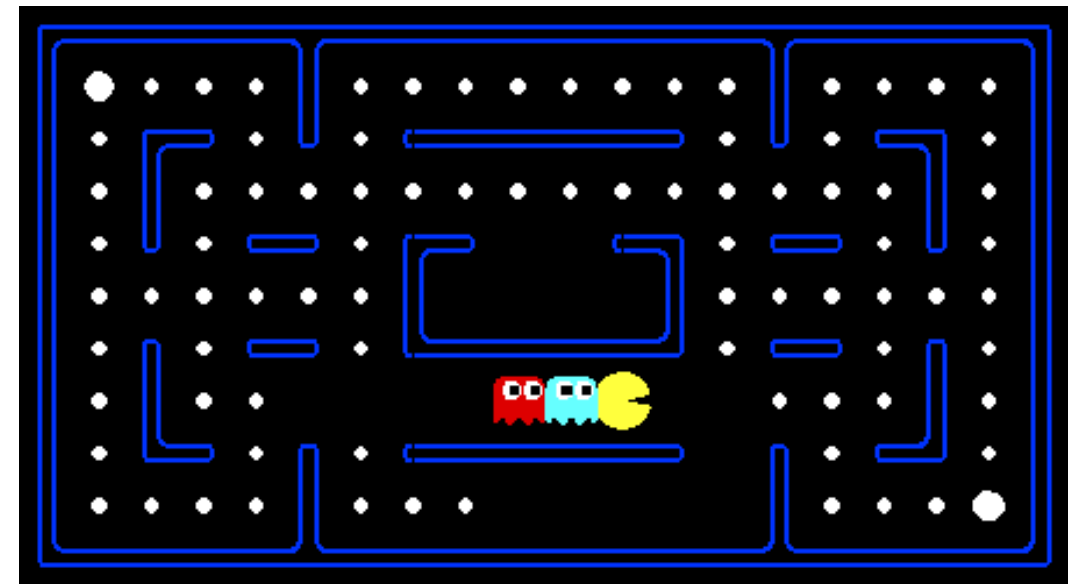


Static vs. Sequential

Does the agent take more than one action?



VS.

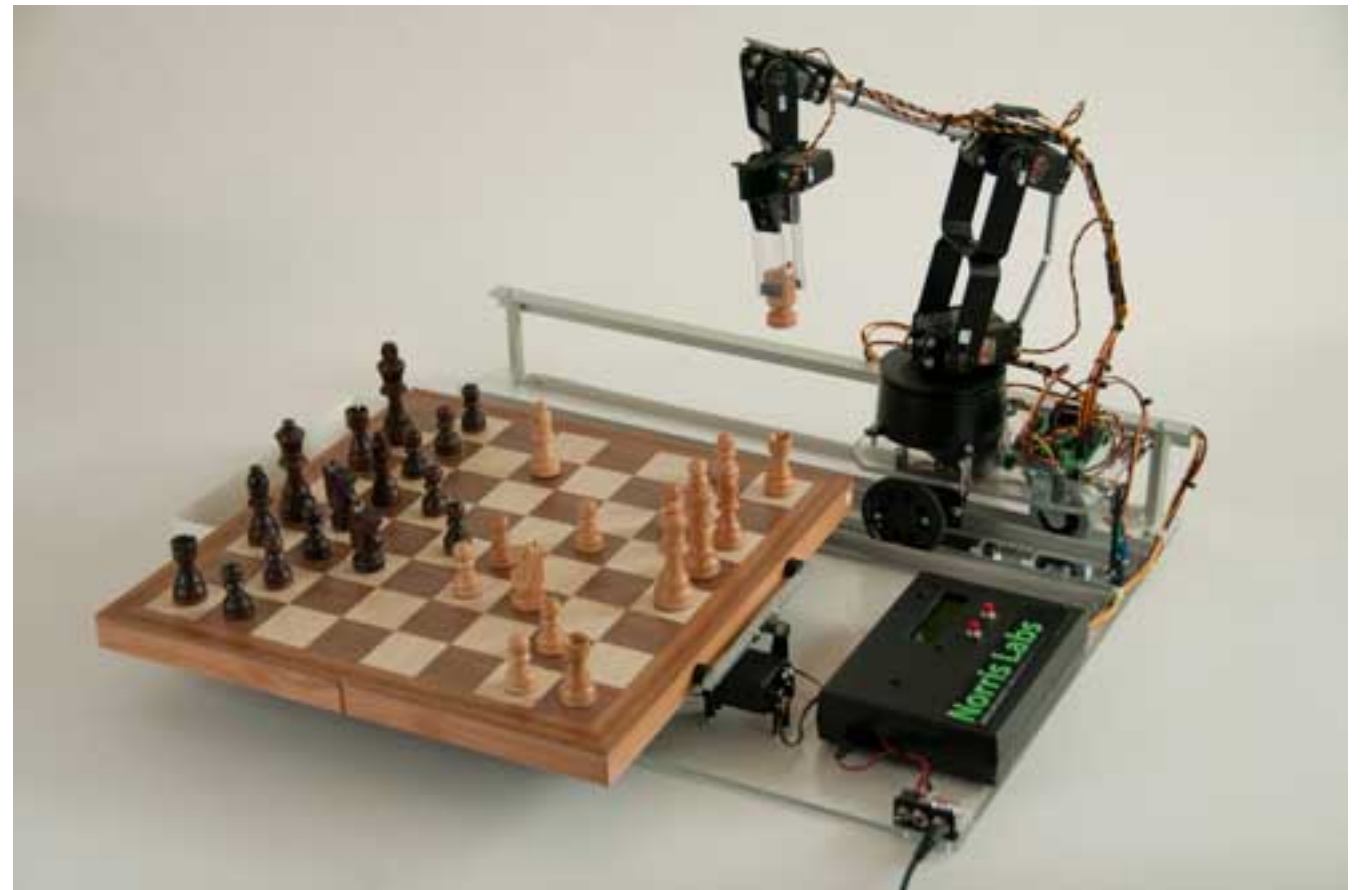


Discrete vs. Continuous

Is there a finite (or countable) number of possible environment states?



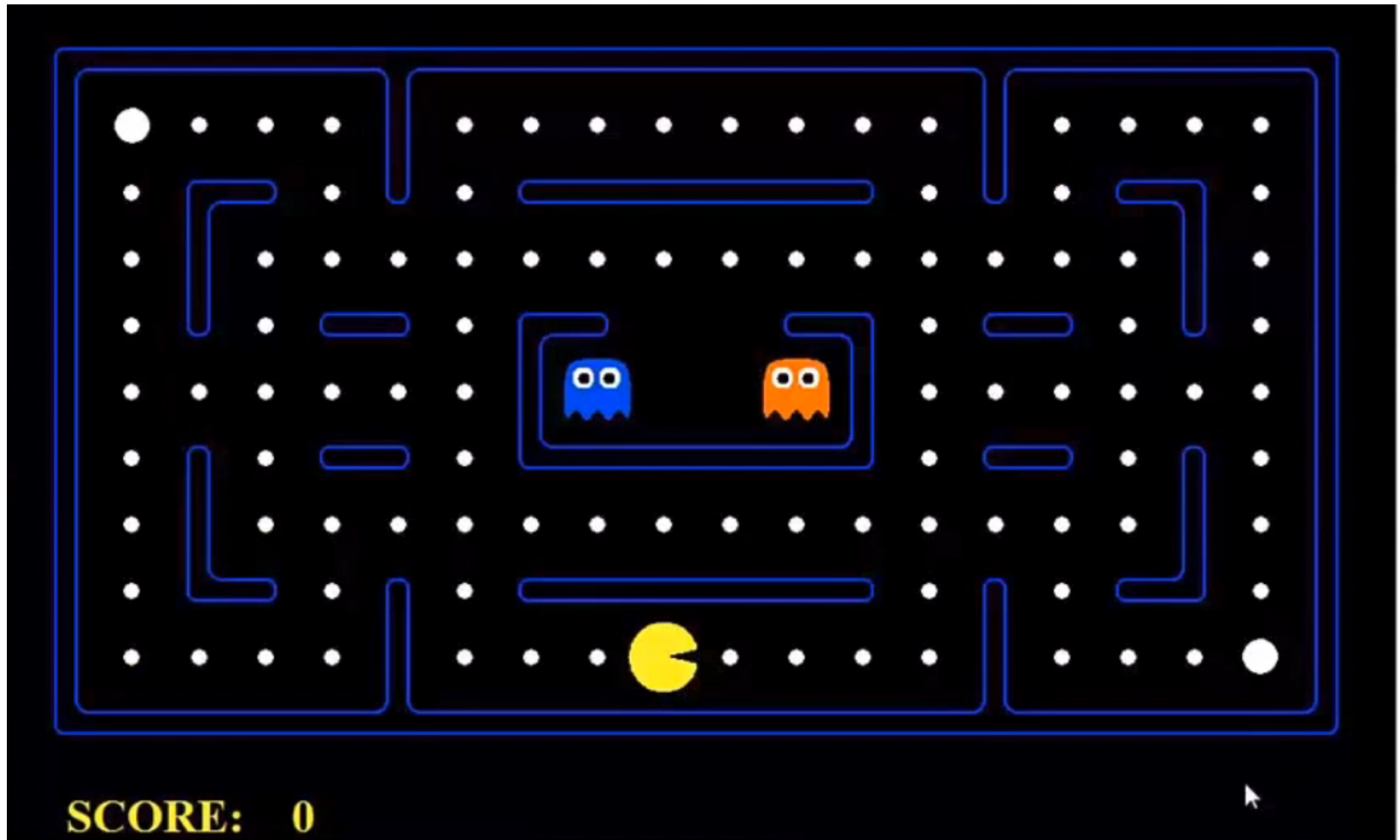
vs.



Topics in This Course

- Introduction
- Search
- Game Playing (minimax, alpha beta, expectimax)
- Markov Decision Processes
- Reinforcement Learning
- Constraint satisfaction
- Uncertainty, Bayesian networks, HMMs
- Supervised Machine Learning
- Logic & Planning
- Applications: Natural Language Processing, Computer Vision

Assignments: Pac-man



Originally developed at UC Berkeley:

<http://www-inst.eecs.berkeley.edu/~cs188/pacman/pacman.html>

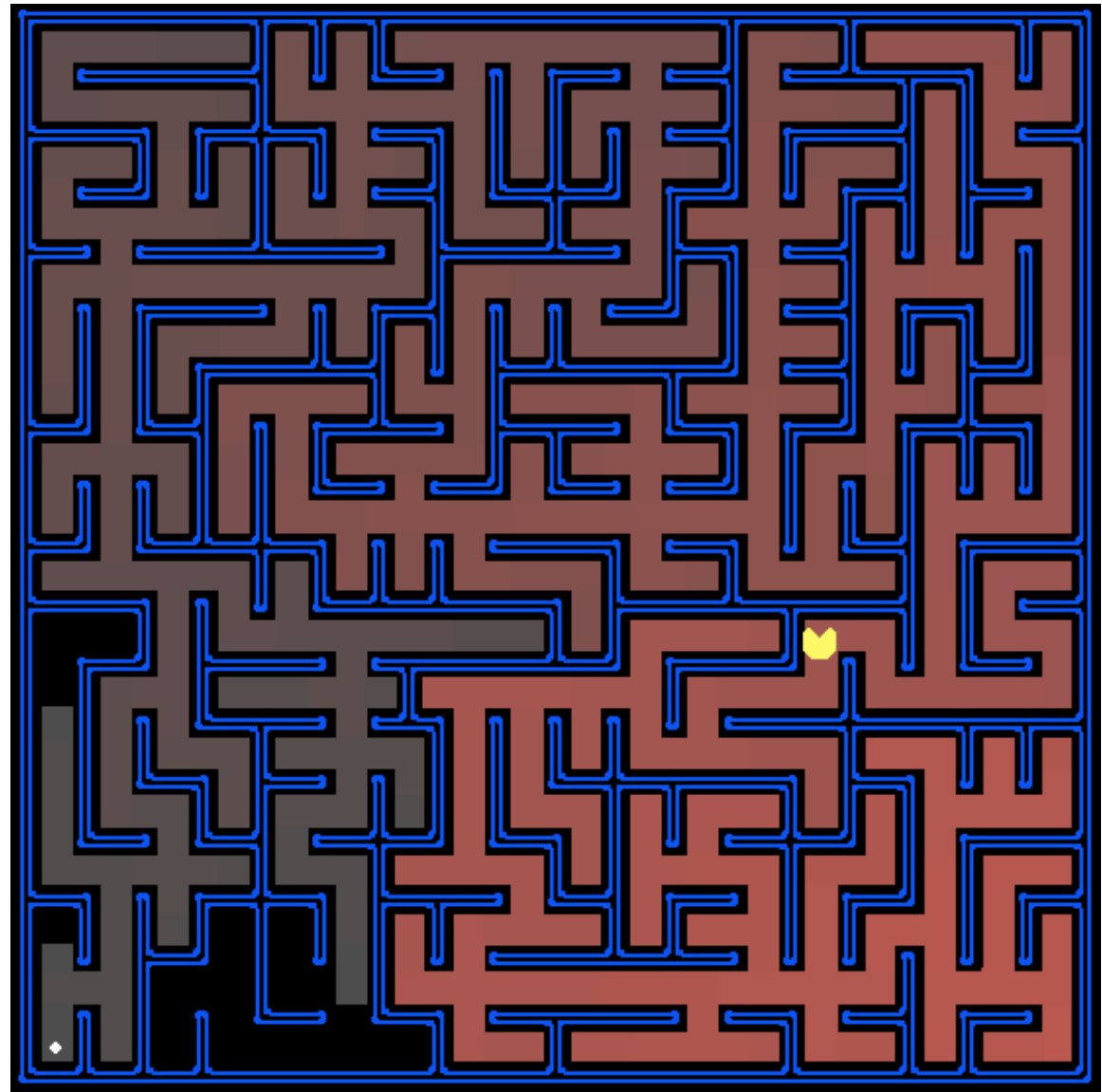
PS1: Search

Goal:

- Help Pac-man find his way through the maze

Techniques:

- Search: breadth-first, depth-first, etc.
- Heuristic Search: Best-first, A^* , etc.



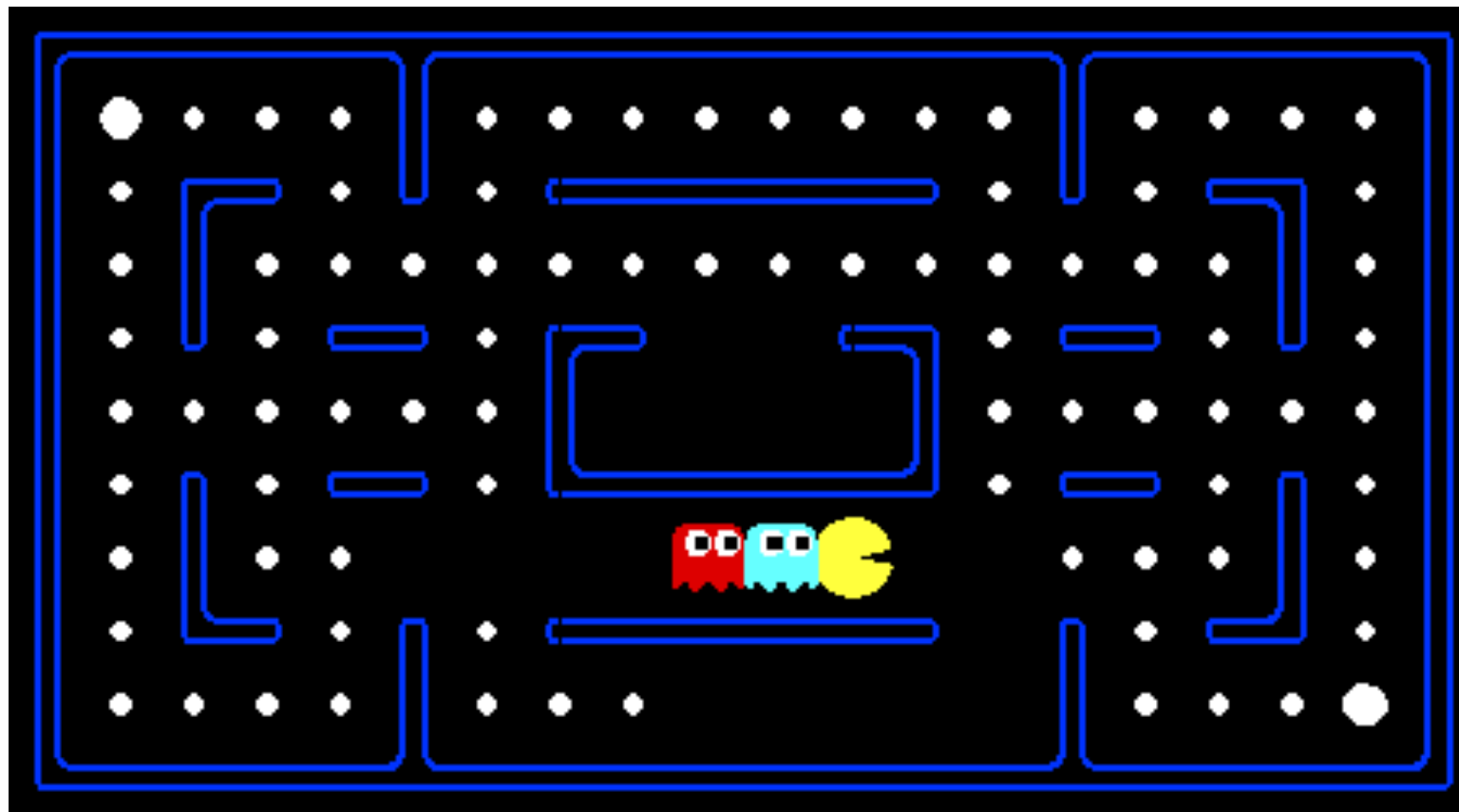
PS2: Game Playing

Goal:

- Play Pac-man!

Techniques:

- Adversarial Search: minimax, alpha-beta, expectimax, etc.



PS3: Planning and Learning

Goal:

- Help Pac-man learn about the world

Techniques:

- Planning: MDPs, Value Iterations
- Learning: Reinforcement Learning



PS4: Ghostbusters

Goal:

- Help Pac-man hunt down the ghosts

Techniques:

- Probabilistic models: HMMS, Bayes Nets
- Inference: State estimation and particle filtering

