

## Course wrap up

CS 486/686  
University of Waterloo  
Lecture 24: March 29, 2012

## Outline

- Course wrap up
- Final exam info
- Other AI courses
- AI jobs
- AI research

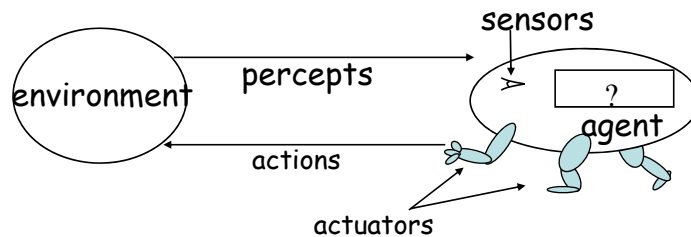
## Topics Covered

- Knowledge representation
- Search algorithms
- Probabilistic Inference
- Decision Making under Uncertainty
- Machine Learning

## Topics That We Didn't Cover

- Computer Vision
- Natural Language Processing
- Robotics
- Reinforcement Learning
- Multi-agent Systems

# Agents and Environments



Agents include humans, robots, softbots, thermostats...

The **agent function** maps percepts to actions  $f:P^* \rightarrow A$

The **agent program** runs on the physical architecture to produce  $f$

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# Rational Agents

- Recall: A rational agent "does the right thing"
- Performance measure - success criteria
  - Evaluates a sequence of environment states
- A **rational agent** chooses whichever action maximizes the **expected** value of its performance measure **given the percept sequence to date**
  - Need to know performance measure, environment, possible actions, percept sequence
- Rationality  $\neq$  Omniscience, Perfection, Success
- Rationality  $\rightarrow$  exploration, learning, autonomy

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## Bounded Rationality

- What if the best strategy given past percepts cannot be implemented with today's computers?
- We have seen many theories for rational agents but what if those theories are intractable?
- **Bounded rationality**: find best **implementable** strategy given past percepts

## Other AI courses

- CS786: Prob. Inference and Machine Learning (S12)
- CS870: Applied Optimization for Finance and ML(S12)
- CS489/689: Machine Learning (W13)
- CS498/698: Computer Vision
- CS886: Multiagent Systems
- STAT440/840: Computational Inference
- STAT441/841: Statistical Learning - Classification
- STAT442/890 Data visualization

## CS485/685: Machine Learning

- Instructors: Shai Ben David and Pascal Poupart
- Topics in the last offering (Winter 2012)
  - **Algorithms:** Decision trees, nearest neighbor, statistical learning, linear regression, linear classification, perceptrons, neural networks, Gaussian processes, support vector machines
  - **Learning theory:** Probably approximately correct (PAC) learning, learning via uniform convergence, no-free-lunch theorem, Vapnik-Chervonenkis (VC) dimension, hypothesis dependent bounds, nearest neighbor analysis, computational complexity

## CS786: Probabilistic Inference and Machine Learning

- Instructor: Pascal Poupart
- Term: Spring 2012
- Textbook: Koller and Friedman, Probabilistic Graphical Models (2009)
- Topics:
  - **Representations:** Bayesian networks, undirected graphical models, relational models, continuous models, temporal models
  - **Inference:** variable elimination, model counting, inference as optimization, lifted inference, sampling techniques, maximum a posteriori inference
  - **Learning:** parameter estimation, structure learning, partially observable data

## AI research group

- Web: [ai.uwaterloo.ca](http://ai.uwaterloo.ca)
- Professors:
  - Shai Ben David (learning theory)
  - Chrysanne DiMarco (natural language processing)
  - Peter Van Beek (constraint programming)
  - Robin Cohen (multi-agent systems, user modeling)
  - Pascal Poupart (reasoning under uncertainty, machine learning, health informatics)
  - Jesse Hoey (health informatics, computer vision)
  - Daniel Lizotte (health informatics, machine learning)
  - Kate Larson (game theory, mechanism design)
  - Richard Mann (computational vision)

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## My research projects

- Reasoning Under Uncertainty and Machine Learning
  - Partially observable Markov decision processes
  - Bayesian reinforcement learning
  - Policy Explanation
  - Maximum A Posteriori (MAP) inference
- Health Informatics
  - Smart walkers
    - Activity recognition (machine learning)
    - 3D lower limb tracking (computer vision)
  - Symptom monitoring for Alzheimer's disease
    - Speech processing

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## AI jobs

- Very few "AI companies"
- AI tends to be **embedded** in many applications
- Many companies have AI R&D groups
  - Intel, Microsoft, IBM, Google, NEC, Yahoo, HP, InTheChat
- AI is a growing industry
- Has the potential to revolutionize the computer industry!