CS 235: Artificial Intelligence

Week 1

Introduction to Artificial Intelligence
Overview of the course

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Book

S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 2003.

Topics

- Introduction to Artificial Intelligence, Intelligent Agent, Formulation of problem
- Problem solving by searching: Uninformed search technique, Heuristic search technique
- Local search technique: Hill-climbing Search, Simulated Annealing, Local Beam Search, Genetic Algorithms
- Swarm Intelligence: Particle Swarm Optimization
- Adversarial Search/ Game playing
- Constraint Satisfaction
- Logical Agent: Propositional Logic, First-Order Logic
- Fuzzy Logic and Expert System
- Classical Planning
- Uncertainty in AI, Bayesian network
- Introduction to Machine Learning

Assessment

- Mid-semester Examination: 30%
- End-semester Examination: 40%
- **Class Performance: 30%**

Class Attendance/Participation (Active in Q&A sessions), Surprise evaluation, Tutorial Work and Coding Assignment

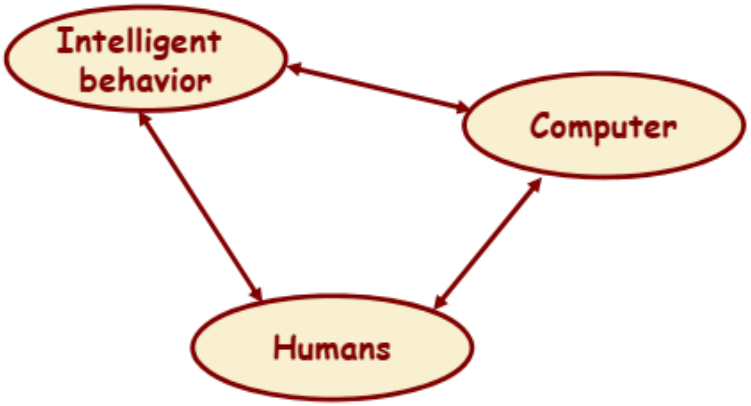
Random evaluation for coding assignments/tutorial questions:

1. Coding assignment 1/tutorial 1 will be circulated for all and last date of completion (not submission) will be also mentioned.
2. A few students will randomly choose in the scheduled class (after last date of completion of an assignment) to explain and display the coding/assignment.
3. All the cases, you should be able to share the assignments in online platform.

What is AI?

Artificial Intelligence

- AI is the reproduction of human reasoning and intelligent behavior by computational methods



- **Weak AI: machines can act as if they were intelligent**
- **Strong AI: machines have minds.**

Different Aspects of Artificial Intelligence

- **Modeling exactly how humans actually think**

  cognitive models of human reasoning

- **Modeling exactly how humans actually act**

  models of human behavior (what they do, not how they think)

- **Modeling how ideal agents "should think"**

  models of "rational" thought (formal logic)

  note: humans are often not rational!

- **Modeling how ideal agents "should act"**

  rational actions but not necessarily formal rational reasoning

  i.e., more of a black-box/engineering approach

- **Modern AI focuses on the last definition**

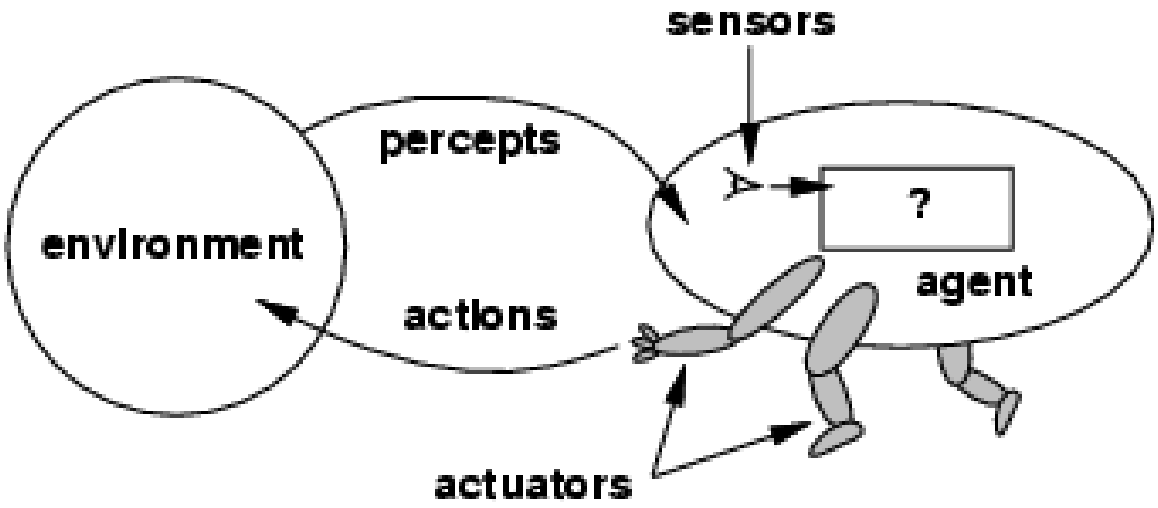
  we will also focus on this "engineering" approach

  success is judged by how well the agent performs

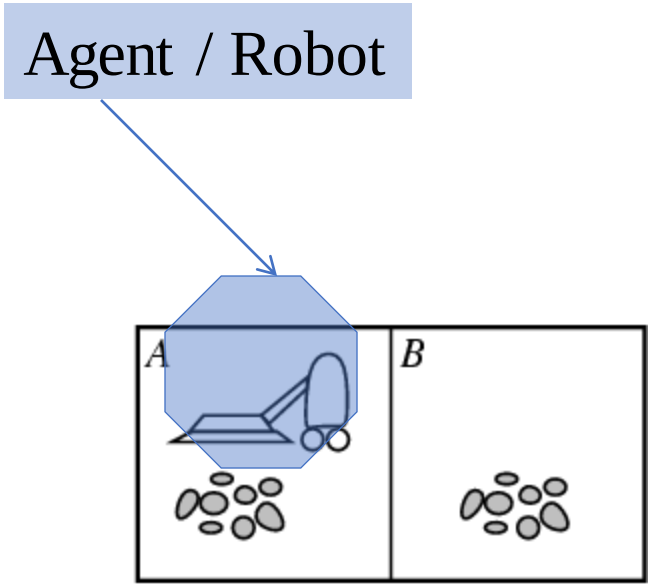
modern methods are also inspired by cognitive & neuroscience (how people think).

Agents

- **Definition: An agent perceives its environment via sensors and acts upon that environment through its actuators**



E.g., vacuum-cleaner world



iRobot Roomba® 400
Vacuum Cleaning Robot

iRobot Corporation

Founder Rodney Brooks (MIT)

- Powerful suction and rotating brushes
- Automatically navigates for best cleaning coverage
- Cleans under and around furniture, into corners and along wall edges
- Self-adjusts from carpets to hard floors and back again
- Automatically avoids stairs, drop-offs and off-limit areas
- Simple to use— just press the Clean button and Roomba does the rest

- Percepts: location and contents, e.g., [A, Dirty]
-
- Actions: *Left*, *Right*, *Suck*, *NoOp*

Rational agents

- An agent should strive to "do the right thing", based on what:
  - it can perceive and
  - the actions it can perform.
  - Right action: Select the action which can maximize the performance

Performance measure: An *objective criterion for success* of an agent's behavior.

Performance measures of a vacuum-cleaner agent: amount of dirt cleaned up, amount of time taken, amount of electricity consumed, level of noise generated, etc.

Performance measures self-driving car: time to reach destination (minimize), safety, predictability of behavior for other agents, reliability, etc.

Performance measure of game-playing agent: win/loss percentage (maximize), robustness, unpredictability (to "confuse" opponent), etc.

Characterizing a Task Environment

- Must first specify the setting for intelligent agent design
- Toughness of the designing depends on task environment

- **PEAS: Performance measure, Environment, Actuators, Sensors**
- **Example:** the task of designing a self-driving car

  - **Performance measure** **Safe, fast, legal, comfortable trip**
  - **Environment** **Roads, other traffic, pedestrians**
  - **Actuators** **Steering wheel, accelerator, brake, signal, horn**
  - **Sensors** **Cameras, LIDAR (light/radar), speedometer, GPS, engine sensors, keyboard**

Task Environments

1) Fully observable / Partially observable

- If an agent's sensors give it access to the complete state of the environment needed to choose an action, the environment is fully observable. (e.g. chess)

2) Deterministic / Stochastic

- An environment is **deterministic** if the next state of the environment is completely determined by the current state of the environment and the action of the agent

- In a **stochastic** environment, there are multiple, unpredictable outcomes.

3) Static / Dynamic

- **A static environment does not change while the agent is thinking.**

- Object detection in video : environment is dynamic

4) Discrete / Continuous

- If the number of distinct percepts and actions is limited, the environment is discrete, otherwise it is continuous.

5) Single agent / Multi-agent

- If the environment contains other intelligent agents, the agent needs to be concerned about strategic, game-theoretic aspects of the environment (**for either cooperative or competitive agents**)

- Puzzle solving (single agent)

Thank you