Agents & Environments
Chapter 2

Mausam

(Based on slides of Dan Weld, Dieter Fox, Stuart Russell)
Outline

• Agents and environments
• Rationality
• PEAS specification
• Environment types
• Agent types
Agents

• An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators

• Human agent:
  – eyes, ears, and other organs for sensors
  – hands, legs, mouth, and other body parts for actuators

• Robotic agent:
  – cameras and laser range finders for sensors
  – various motors for actuators
Intelligent Agents

- Have sensors, effectors
- Implement mapping from percept sequence to actions

• Performance Measure

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Rational Agents

• An agent should strive to **do the right thing**, based on what it can perceive and the actions it can perform. The right action is the one that will cause the agent to be most successful.

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

• E.g., performance measure of a vacuum-cleaner agent could be amount of dirt cleaned up, amount of time taken, amount of electricity consumed, amount of noise generated, etc.
Ideal Rational Agent

“For each possible percept sequence, does whatever action is expected to maximize its performance measure on the basis of evidence perceived so far and built-in knowledge.”

• Rationality vs omniscience?
• Acting in order to obtain valuable information
PEAS: Specifying Task Environments

• PEAS: Performance measure, Environment, Actuators, Sensors

• Must first specify the setting for intelligent agent design

• Example: the task of designing an automated taxi driver:
  – Performance measure
  – Environment
  – Actuators
  – Sensors
• Agent: Automated taxi driver

• Performance measure:
  – Safe, fast, legal, comfortable trip, maximize profits

• Environment:
  – Roads, other traffic, pedestrians, customers

• Actuators:
  – Steering wheel, accelerator, brake, signal, horn

• Sensors:
  – Cameras, sonar, speedometer, GPS, odometer, engine sensors, keyboard
PEAS

• Agent: Medical diagnosis system

• Performance measure:
  – Healthy patient, minimize costs, lawsuits

• Environment:
  – Patient, hospital, staff

• Actuators:
  – Screen display (questions, tests, diagnoses, treatments, referrals)

• Sensors:
  – (entry of symptoms, findings, patient's answers)
Properties of Environments

- Observability: full vs. partial vs. non
- Deterministic vs. stochastic
- Episodic vs. sequential
- Static vs. Semi-dynamic vs. dynamic
- Discrete vs. continuous
- Single Agent vs. Multi Agent (Cooperative, Competitive, Self-Interested)
RoboCup vs. Chess

- Static/Semi-dynamic
- Deterministic
- Observable
- Discrete
- Sequential
- Multi-Agent

- Dynamic
- Stochastic
- Partially observable
- Continuous
- Sequential
- Multi-Agent

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More Examples

• Poker
  – Static – Stochastic – Partially Obs – Discrete – Seq – Multi-agent

• Medical Diagnosis

• Taxi Driving
Simple reflex agents

AGENT

Sensors

what world is like now

Condition/Action rules

what action should I do now?

Effector

ENVIRONMENT

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Reflex agent with internal state

What world was like

How world evolves

Condition/Action rules

what world is like now

what action should I do now?

Sensors

Effectors
Goal-based agents

**ENVIRONMENT**

**Sensors**

- What world was like
- How world evolves
- What my actions do

**AGENT**

- Goals

**Effectors**

- what world is like now
- what it’ll be like if I do actions A1-An
- what action should I do now?
Utility-based agents

- What world was like
- How world evolves
- What my actions do

Utility function

Sensors

what world is like now
what it’ll be like if I do acts A1-A_n
How happy would I be?
what action should I do now?

Effectors

AGENT

ENVIRONMENT

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Learning agents

What world was like
Learn how world evolves
Learn what my actions do
Learn utility function

what world is like now
what it’ll be like if I do acts A1-A_{n}
How happy would I be?
what action should I do now?

What world was like

Feedback
Sensors

Effectors