

# Agent Architectures

Jane Hsu

## Outline

- Abstract Agent Architectures
- Enabling AI Technologies
- Concrete Agent Architectures

## Abstract Agent Architectures

- Purely Reactive Agents
- Perception-limited Agents
- Agents with Internal State

## Concrete Agent Architectures

- Logic-based Architectures
- Reactive Architectures
- Belief-Desire-Intention Architectures
- Layered Architectures

## Logic-Based Architectures

Decision making is realized through logical deduction.

It is the *traditional AI* (e.g. symbolic AI) approach ; intelligent behavior can be created in a system that manipulates symbols.

- Physical Symbol System Hypothesis
- Agents as theorem provers.

## Deliberate Agents

Internal state: a database of FOL formulae

Open(valve221)  
Temperature(reactor4726, 321)  
Pressure(tank776, 28)

Decision making is modeled as deduction rules.

see:  $S, P$   
next:  $D \times P, D$   
action:  $D, A$

## Vacuum World

A small robotic agent that will clean up a house.

Sensor:  $In(x,y)$ ,  $Dirt(x,y)$ ,  $Facing(d)$

Actions: Suck-up-dirt, move, turn

To define the *next* function:

- ; Current percept
- ; Remove old or irrelevant information
- ; New location & orientation of the agent

## Reactive Architectures

Decision making is implemented in some form of direct mapping from situation to action.

- ; Rejection of symbolic representations
- ; Intelligent behavior is NOT disembodied ; it has to be a product of the interaction the agent maintains with its environment.
- ; Intelligent behavior emerges from the interaction of various simpler behaviors.

## BDI Architectures

Decision making depends upon the manipulation of data structures representing the beliefs, desires, and intentions of the agent.

Practical reasoning

- ; Deliberation: what goals we want to achieve
- ; Means-ends analysis: how to achieve those goals
- ; E.g. What are you going to do after college?

## Intentions

Intentions drive means-ends reasoning.

Intentions constrain future deliberation.

Intentions persist.

Intentions influence beliefs upon which future practical reasoning is based.

## The BDI Model

Belief revision function

Beliefs

Generate options

Desires

Filters

Intentions

Actions

## Layered Architectures

Decision making is realized via various software layers, each of which is more-or-less explicit reasoning about the environment at different levels of abstraction.