Autonomous Multiagent Systems

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Week 4, Tuesday (9/17)

Any Questions?

Overview of the Readings

- Sycara: Multiagent Systems – an overview
  - Stone and Veloso: another overview focussed on ML (optional)
- Mataric: Pushing Brooks' approach to MAS
- CMUnited-98 champion team – skills

Multiagent Systems

- Offer modularity

- Study, behavior, construction of **possibly preexisting** autonomous agents that interact with each other.

  - incomplete information for agents

  - no global control

  - decentralized data

  - asynchronous computation

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Some Definitions

Distributed Computing : Processors share data, but not control. Focus on low-level parallelization, synchronization.

Distributed AI : Control as well as data is distributed. Focus on problem solving, communication, and coordination.

Distributed Problem Solving : Task decomposition and/or solution synthesis

Multiagent Systems : Behavior coordination or behavior management.

- No necessary guarantees about other agents.
- Individual behaviors typically simple relative to interaction issues.

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Why Multiagent Systems?

- Some domains require it. (Hospital scheduling)
- Interoperation of legacy systems
- Parallelism.
- Robustness.
- Scalability
- Simpler programming.
- "Intelligence is deeply and inevitably coupled with interaction." – *Gerhard Weiss*

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Issues and Challenges

- How to break down and resynthesize the problem among agents
- **Communication/interaction protocols**
- Maintain coherence, stability: guarantees?
  - Coherence is a global property
- Representation by agents of each other and interactions
- Reconciling different points of view
- Engineering

Individual Agents

$\boxed{\text{What did she say about reactive vs. deliberative agents?}}$

Individual Agents

- Purely reactive agents have disadvantages
  - Can't react to nonlocal info or predict effects on global behavior
  - hard to engineer
- Hybrid approach better
- Hard to evaluate agent architecture against one another

Communication

- Middle agents (brokers)

- Standard languages

- Ontologies

$\boxed{\text{More next week}}$

Exercise

- Multiagent Systems vs. Single agent applications
  - registering for classes, allocating classes, corporate scheduling
  - internet search, communication satelites, travel agents
  - Taxi dispatching, mail courier
  - Map uncharted terrain, deep space exploration
  - room cleaning system
  - larger-scale manufacturing, business
  - operating system
  - climate control

What's the single agent?

Student-led Discussion

- Build a taxonomy of MAS!

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Some Examples

- map uncharted terrain
- communication satellites (same company)
- room cleaning system
- RoboCup
- nerd herd
- air traffic controller
- persuader (models unions, companies)
- YAMS yet another manufacturing system
- Sumpy (Franklin and Graesser) - unix utility
- pigeon feeding
- hunting behavior
- single predator vs. prey

Next Week's Readings

- Textbook chapter 8 – agent communication (or similar article)

- Current state of agent communication languages

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