CS344M
Autonomous Multiagent Systems
Spring 2008

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Good Afternoon, Colleagues

Are there any questions?

Some Definitions

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- **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.

Multiagent Systems

- Study, behavior, construction of **possibly preexisting** autonomous agents that interact with each other.
  - incomplete information for agents
  - no global control
  - decentralized data
  - asynchronous computation

Why Multiagent Systems?

(7)

- 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*

Organizations

- **Hierarchy:** authority from above
- **Community of Experts:** specialists, mutual adjustment
- **Market:** bid for tasks and resources; contracts
- **Scientific community:** full solutions (perhaps with varying information) combined

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

Dimensions and issues

- cooperative vs. competitive
- communication
- trust
- recursive modeling
- coalititions
- game theory

$\boxed{\text{Convoy example}}$

Individual Agents

What did Sycara 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

Conflicts, Resources

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- Negotiation, game theory

Multiagent Planning

- Complex individual agents
- Teamwork modeling
  - Modeling of teammates and opponents
- Recent: emphasis on flexibility in dynamic environments

Communication

- Middle agents (brokers)
- Standard languages
- Ontologies

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

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- Hit a complexity limit?
  - (Subsumption or 3T more prevalent?)

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- Example: locomotion
  - Safe-wandering, following, dispersion, aggregation, homing
  - What 2 multiagent architectures does she compare?
  - Anything special about this domain? Or could it apply just as well to others?

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- Can human behavior be thought of as arising from a set of basis behaviors?
- What kinds of basis behaviors would they be?
- Would they be the same as the ones Mataric listed?
- Are there others?

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- Another version
  - One person makes an offer
  - Other accepts, rejects, or counters
  - If counters, $.05 lost
  - Game ends with an accept or reject