Autonomous Multiagent Systems

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Week 13, Tuesday (11/19)

Any Questions?

Reading Overview — Opponent Modeling

- Recursive Modeling
- Team modeling in air combat
- Strategy assessment in robotic soccer

Reading Overview — Vidal and Durfee

$\boxed{\text{Recursive Modeling Method}}$

- What should I do?

Reading Overview — Gmytrasiewicz

$\boxed{\text{Recursive Modeling Method}}$

- What should I do?

- What should I do given what I think you'll do?

Recursive Modeling Method

- What should I do?
- What should I do given what I think you'll do?
- What should I think you'll do given what I think you think I'll do?

Recursive Modeling Method

- What should I do?
- What should I do given what I think you'll do?
- What should I think you'll do given what I think you think I'll do?
- etc.

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Prediction Methods

- Rely on communication
  - What to say? What to trust?
- Watch for patterns of others
  - Might have incorrect expectations, especially if environment changes
- Use deeper models
  - Includes physical *and* mental states
  - Could be computationally expensive

Types of models

$\boxed{\text{Example: rock-paper-scissors (RoShamBo)}}$

- Rock beats scissors
- Scissors beats paper
- Paper beats rock

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No-information: Random choice

Sub-intentional: Not rational

Intentional: Others use same model

Lessons

- Modeling can help
- There is a lot of useless information in recursive models
- Approximations (limited rationality) can be useful

Tracking Dynamic Team Activity

- Use your own plans to model others
- Use explicit team operators
  - Introduces challenges of role assignments, and
  - Minimum cost repair
- Assume agent is using a plan that you could use,
  - But not modeling you
- Act based on assumed actions of others

Behavior Classification

- Focusses on classification — not reaction
- Use fixed classes and features — not arbitrary models
  - Which known team is this most like?
  - Field gridded up statically
- Could be improved with more meaningful classes

Goal: adapt to current opponent

- Need to find most effective behaviors vs. each class
- Need quick, on-line classification

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Representation and Classification

- Track ball and opponent positions
- Notice passes, dribbles, and shots
- Mark with relation to a course field grid
- All time information removed - just counts

- Considered nearest neighbor for classification
- Settled on using a decision tree

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Student-led Discussion

What is a good representation for modeling opponents for the purpose of predicting their strategic decisions over the next 30 seconds or so?

Criteria

- Enough information to accurately predict strategy
- Do it fast enough to allow for counter-action
- Need to map all possible situations to limited set of strategic actions

Riley's windowing possible. What else?

Next Week's Readings – Learning

- Competitive Co-Evolution on tic-tac-toe, go
- Layered Learning