CS344M
Autonomous Multiagent Systems

Prof: Peter Stone

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The University of Texas at Austin
Good Afternoon, Colleagues

Are there any questions?
Logistics

- All readings up
Logistics

• All readings up
  – Next Tuesday: guest lecture
Logistics

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  - Responses also to Shivaram Kalyanakrishnan
Logistics

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- More reflections on peer reviews?
Logistics

• All readings up
  – Next Tuesday: guest lecture
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• More reflections on peer reviews?

• Final projects due in 2 weeks!
Recursive Modeling Method

- What should I do?
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.
Prediction Method

- Rely on communication
Prediction Method

- Rely on communication
  - What to say? What to trust?
Prediction Method

- Rely on communication
  - What to say? What to trust?

- Watch for patterns of others
Prediction Method

• Rely on communication
  – What to say? What to trust?

• Watch for patterns of others
  – Might have incorrect expectations, especially if environment changes
Prediction Method

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• Use deeper models
  – Includes physical and mental states
Prediction Method

- 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

Example: pursuit task

No-information: Random choice
Types of models

Example: pursuit task

No-information: Random choice

Sub-intentional: Not rational
Types of models

Example: pursuit task

**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
Tracking Dynamic Team Activity

- Use your own plans to model others
- Use explicit team operators
Tracking Dynamic Team Activity

- Use your own plans to model others
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  - Introduces challenges of role assignments, and
  - Minimum cost repair
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- Assume agent is using a plan that you could use,
  - But not modeling you
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
Other papers you read

• Dustin: “Opponent Behavior Recognition for Real-Time Strategy Games”
Other papers you read

- Dustin: “Opponent Behavior Recognition for Real-Time Strategy Games”
- Aaron: “Distinguishing Between Intentional and Unintentional Sequences of Actions”
Where do Models Come From

Observation:

- Tambe and RMM: use existing model
  - No building a model
Where do Models Come From

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What if we can’t build a full model in advance?
Where do Models Come From

Observation:

- Tambe and RMM: use existing model
  - No building a model

What if we can’t build a full model in advance?

- What are some incremental approaches for building a predictive model?
Play me at RoShamBo

- Rock beats scissors
- Scissors beats paper
- Paper beats rock
Play me at RoShamBo

- Rock beats scissors
- Scissors beats paper
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- What is your strategy before modeling me?
Play me at RoShamBo

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- What is your strategy before modeling me?
- What is your strategy after modeling me?
Play me at RoShamBo

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- What is your strategy before modeling me?
- What is your strategy after modeling me?
- Am I modeling you?
Play me at RoShamBo

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- What is your strategy before modeling me?
- What is your strategy after modeling me?
- Am I modeling you?
- Would your end strategy change if I can?
## Stackelburg Game

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<thead>
<tr>
<th>Player 1</th>
<th>Action 1</th>
<th>Action 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 1</td>
<td>1,0</td>
<td>3,2</td>
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<tr>
<td>Action 2</td>
<td>2,1</td>
<td>4,0</td>
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<th>Player 2</th>
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Peter Stone
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- Nash equilibrium?
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- Action 2 is dominant for Player 1. End of story?
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- **Threats** can stabilize a non-equilibrium strategy
- Change the **best response** of the other agent
Stackelburg Game

| Player 2 | 
| --- | --- |
| Action 1 | Action 2 |
| Action 1 | 1,0 | 3,2 |
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Threats slides