CS 798: Multiagent Systems

Kate Larson

Cheriton School of Computer Science
University of Waterloo

January 4, 2010

Outline

Outline

Introduction

- Kate Larson
  - Faculty Member in CS
  - Member of the AI research group
- Research Interests: Multiagent Systems
  - Strategic Reasoning
    - bounded rationality/limited resources
    - argumentation
  - Electronic market design

Introduction

- Focus of this course is *self-interested* Multiagent Systems
  - aka competitive Multiagent Systems
- Study of autonomous agents
  - Diverging information
  - Diverging interests
- Issues
  - Cooperation
  - Coordination
  - Overcoming self-interest of agents in order to achieve system-wide goals

Introduction

- Growth in settings where there are multiple *self-interested* interacting parties
  - Networks
  - Electronic markets
  - Game playing...
- To act optimally, participants must take into account how other agents are going to act
- We want to be able to
  - Understand the ways in which agents will interact and behave
  - Design systems so that agents behave the way we would like

Introduction

- Growth in settings where there are multiple *self-interested* interacting parties
  - Networks
  - Electronic markets
  - Game playing...
- To act optimally, participants must take into account how other agents are going to act
- We want to be able to
  - Understand the ways in which agents will interact and behave
  - Design systems so that agents behave the way we would like

Introduction

- Growth in settings where there are multiple *self-interested* interacting parties
  - Networks
  - Electronic markets
  - Game playing...
- To act optimally, participants must take into account how other agents are going to act
- We want to be able to
  - Understand the ways in which agents will interact and behave
  - Design systems so that agents behave the way we would like

Outline

Two Communities

Economics

- Traditional emphasis on game theoretic rationality
- Describing how agents should behave
- Multiple self-interested agents

Computer Science

- Traditional emphasis on computational and informational constraints
- Building agents
- Individual or cooperative agents

New Research Problems

- How do we use game theory and mechanism design in computer science settings?
- How do we resolve conflicts between game-theoretic and computational constraints?
- Development of new theories and methodologies

Explosion of Research

Explosion of research in the area (Algorithmic game theory, computational mechanism design, Distributed algorithmic mechanism design, computational game theory,...)

- Papers appearing in AAAI, AAMAS, UAI, NIPS, PODC, SIGCOMM, INFOCOMM, SODA, STOC, FOCS, ...
- Papers by CS researchers appearing in Games and Economic Behavior, Journal of Economic Theory, Econometrica,...
- Numerous workshops and meetings,...

This Course

- Introduction to game theory, social choice, mechanism design
- Study how they are used in computer science (in particular in AI)
- Study computational issues that arise

Course structure

- Lectures
- Current research papers

This Course

- Introduction to game theory, social choice, mechanism design
- Study how they are used in computer science (in particular in AI)
- Study computational issues that arise

Course structure

- Lectures
- Current research papers

Prerequisites

- **No formal prerequisites**
- Students should be comfortable with mathematical proofs
- Some familiarity with probability
- Ideally students will have an AI course but I can provide background material when needed
- **I will cover the game theory and mechanism design required**

Grading

- Assignments on game theory and mechanism design: 15%
- In class presentation(s): 15%
- Class participation: 10%
- Paper reviews: 20%
- Research project: 40%

Presentations

Every student is responsible for presenting a research paper in class

- Short survey + a critique
- Everyone in class will provide feedback on the presentation
- Marks given on coverage of material + organization + presentation

Class Participation

You must participate!

- Before each class (before 6:00 am the day of the presentation) you must submit a review of one of the papers being discussed
  - What is the main contribution?
  - Is it important? Why?
  - What assumptions are made?
  - What applications might arise from the results?
  - How can it be extended?
  - What was unclear?
  - . . .

Projects

The goal of the project is to develop a deep understanding of a topic related to the course.

- The topic is open
  - Theoretical, experimental, *in-depth* literature review,...
  - Can be related to your own research
  - If you have trouble coming up with a topic, come and talk to me
- Proposals due February 24th
- Final projects due April 5th[1]
- Students will present projects in class

[1] I will be flexible with this.

Projects

The goal of the project is to develop a deep understanding of a topic related to the course.

- The topic is open
  - Theoretical, experimental, *in-depth* literature review,...
  - Can be related to your own research
  - If you have trouble coming up with a topic, come and talk to me
- Proposals due February 24th
- Final projects due April 5th[1]
- Students will present projects in class

[1] I will be flexible with this.

Projects

The goal of the project is to develop a deep understanding of a topic related to the course.

- The topic is open
  - Theoretical, experimental, *in-depth* literature review,...
  - Can be related to your own research
  - If you have trouble coming up with a topic, come and talk to me
- Proposals due February 24th
- Final projects due April 5th[1]
- Students will present projects in class

[1] I will be flexible with this.

Projects

The goal of the project is to develop a deep understanding of a topic related to the course.

- The topic is open
  - Theoretical, experimental, *in-depth* literature review,...
  - Can be related to your own research
  - If you have trouble coming up with a topic, come and talk to me
- Proposals due February 24th
- Final projects due April 5th[1]
- Students will present projects in class

[1] I will be flexible with this.

Projects

The goal of the project is to develop a deep understanding of a topic related to the course.

- The topic is open
  - Theoretical, experimental, *in-depth* literature review,...
  - Can be related to your own research
  - If you have trouble coming up with a topic, come and talk to me
- Proposals due February 24th
- Final projects due April 5th[1]
- Students will present projects in class

[1] I will be flexible with this.

Other Information

- Class times: Monday-Wednesday 10:00-11:30
- Office Hours: By appointment (just send me email or talk to me after class to set up an appointment)
- Course website
  - `http://www.cs.uwaterloo.ca/~klarson/teaching/W10-798`