Course Introduction
Modeling Human Strategic Behavior

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Lecture Overview

Course Logistics

Course Overview

Student Introductions

Fun games

Course Description

This course will focus on **models for predicting human strategic behavior**. You will work in groups to identify a strategic setting (e.g., from your own research area) which you will study throughout the course. We will learn about how to analyze strategic settings from the perspective both of classical game theory and of machine learning, and you will apply such analysis (both mathematical and computational) to your chosen domain. The last part of the course will focus on student presentations of mock thesis proposals on your chosen topics.

Prerequisites

The course has no formal prerequisites. As a graduate topics course, it will survey current research literature and expect students to be able to **read, summarize, and form critical opinions** of this material. **Data analysis and basic coding** will be required. Students may find it useful to have background in machine learning and in microeconomics and game theory; however, we expect that many students will not have all of this background. (Particularly, we recognize that most CS students may not have previous exposure to economics.) Additionally, an ability to **speak, read and write fluently in English, and a willingness to participate actively in class discussions**, is essential for success in the class.

Academic Honesty

Plagiarism is a serious offence and will be dealt with harshly. We consider plagiarism to be the unattributed use of an external source (e.g., another student, a web site, a book) in work for which a student takes credit, or the inappropriate use of an external source whether or not attribution is made. The seriousness of the offence depends on the extent to which the student relied upon the external source. Assignments and midterms will include an "honour code" statement which you will be required to sign, specifying forms of collaboration and reference to non-course materials that are acceptable. For presentations, you must cite all external sources that you use, and the vast majority of the slides must be written in your own words. Any text that you take verbatim from another source must be in quotation marks and followed by a citation.

Grading Scheme

Item	Amount
Participation	10 %
Three Assignments	24 %
Midterm	16 %
Proposal Presentation	15 %
Peer Review of Other Students' Presentations	10 %
Proposal Document	25 %

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High Level Overview

The course will consist of four major units:

1. Modeling Strategic Situations
2. Game Theoretic Analysis
3. Modeling Strategic Behavior as a Machine Learning Problem
4. Project Presentations

1. Modeling Strategic Situations

Topics Covered

We will begin by exploring **what is meant by a strategic situation**: roughly, an environment in which multiple self-interested actors interact, and in which their satisfaction with the resulting state of the world is based on the decisions that both they and the other actor(s) chose. We will consider a variety of models of such interactions *(simultaneous moves; sequential moves, with both perfect and imperfect information; finite or infinite repetitions; Bayesian uncertainty)*. We will also consider what makes a setting inappropriate for consideration as strategic *(e.g., decision-theoretic settings exhibiting weak or no coupling between agents' payoffs)*.

Deliverables

You will **identify a strategic domain** that you propose to study for the remainder of this course. We strongly encourage you to choose a domain related to your existing research interests and/or expertise. You will ultimately be required to work in a group for your project proposal. You're welcome to submit this assignment as part of a group or to work alone for this assignment and determine your group afterwards, adjusting your topic if necessary.

1. Modelling Strategic Situations: Lectures

January 11	Introduction and overview
January 13	Utility and foundations
January 18	Normal form games
January 20	Canonical game theoretic domains
January 25	Workshopping domains
	Assignment 1: pick and justify a domain/problem

https://www.cs.ubc.ca/~kevinlb/teaching/cs532l/#Schedule

2. Game Theoretic Analysis

Topics Covered

This unit will survey the classical game theoretic question: **How should strategic agents behave?** We will learn various game theoretic answers to this question, such as best response, Nash equilibrium, dominant and dominated strategies, minimax strategies, and minimax regret strategies. We will learn how to apply these answers in a variety of game formalisms, including normal-form, extensive-form games with both perfect and imperfect information, Bayesian games, and repeated games.

Deliverables

You will identify various games modeling aspects of your target domain and making use of different game formalisms. For each, you will identify game theoretic solution concepts, and will argue which is most appropriate for understanding your domain.

2. Game Theoretic Analysis: Lectures

January 27	Nash
February 1	Alternate solution concepts
February 3	Extensive form games
February 8	Extensive form games
February 10	Repeated Games
February 15	Bayesian Games
February 17	GT spillover topic 1
	Assignment 2: make & analyze some games about your domain

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3. Modeling Strategic Behavior as a Machine Learning Problem

Topics Covered

Unfortunately, humans often behave differently from the way game theory predicts. In this unit, we will consider **an alternate approach to modeling human behavior in strategic settings, leveraging techniques from machine learning**. We will consider a variety of candidate model families, including the Level-k, Cognitive Hierarchy, Quantal Response, and Quantal Level-k models from the behavioral game theory literature, and will also learn why traditional machine learning model families are often inappropriate for use in this setting. We will learn how to design experiments, obtain training data from human play of games, fit models to this training data, and detect and avoid overfitting these models.

Deliverables

You will play each others' games from the previous unit and gather training data. You will use this data to fit different model families, and will argue which is most appropriate to your domain.

3. Modeling Strategic Behavior as a Machine Learning Problem: Lectures

March 1	Play each other's games
March 3	BGT as an ML problem
March 8	BGT as an ML problem
March 15	**Midterm**
	Assignment 3: fit ML models to data from Mar 1

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4. Project Presentations

Topics Covered

The last unit will focus on **research proposals for cutting-edge projects on modeling human behavior** by combining methods from behavioral game theory and machine learning. We will begin with sample proposals from the instructors and TAs, and then will move on to proposals by groups of students in the class. You will have the opportunity to give and receive feedback on each others' proposals to inform the content of your final written submission.

Deliverables

At the end of the course, student groups will hand in a hypothetical thesis proposal putting forward a research program for modeling human strategic behavior in their chosen domain. Like a real thesis proposal, this will explain why the problem is important, survey related literature, present initial results, and describe promising avenues for further exploration.

4. Project Presentations: Lectures

March 10	Example presentations #1
March 17	Example presentations #2
March 22	Student Proposal Presentations
March 24	Student Proposal Presentations
March 29	Student Proposal Presentations
March 31	Student Proposal Presentations
April 5	Student Proposal Presentations
April 7	Student Proposal Presentations

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Lecture Overview

Student Introductions

Please introduce yourself by saying:

- what country you grew up in
- where you did your undergrad
- your current research interests
- something fun about you (your favourite band, book, flavour of ice cream, or anything else you'd like...)

Lecture Overview

Fun games

- Let's buy and sell some money...