Course Overview

CMPUT 654:
Modelling Human Strategic Behaviour

Strategic Modelling

This course is about modelling human strategic behaviour:

- **Modelling:** Constructing formal, predictive models of action

- **Strategic:** Outcomes that an agent cares about depend on:

    1. Agent's **own** actions

    2. Actions of **other** agents, with **independent** goals and priorities

- **Human:** Primarily concerned with modelling behaviour by **people**, not by algorithms (e.g., border gateway protocol)

    - Actual, **empirical** behaviour, not **ideal** behaviour

Framework

This course uses three main tools:

1. Game theory

2. Behavioural Game Theory

3. Data

4. Machine learning

1. Game Theory

- Solution concepts follow from **assumptions**

- We use the **representations and models** of game theory, usually not **solution concepts**

- Need to know the solution concepts anyway!

  - Interpretation of solutions and models

  - Understanding differences from the standard model

2. Behavioural Game Theory

- **Inductive** models, not just implications of assumptions

- Models are typically cognitively inspired

- Standard behavioural game theory often aims to **explain anomalies**

  - We'll take a much more **predictive** approach

- Much less conceptually unified than standard game theory

3. Data

Experimental data

- Most existing behavioural research

- Old-school: In-person experiments, small n

- Recent: often Mechanical Turk

Field data

- Rare but out there

- Much more exciting for ML modelling

Lecture Outline

1. Overview

2. Logistics

3. Course Topics

4. Introductions

Course Essentials

Course webpage: jrwright.info/bgtcourse/

- This is the **main source** for information about the class

- Slides, readings, assignments, deadlines

Contacting me:

- Discussion board: piazza.com/ualberta.ca/winter2019/cmput654/
  for **public** questions about assignments, lecture material, etc.

- Email: james.wright@ualberta.ca
  for **private** questions (health problems, inquiries about grades)

- Office hours: After every lecture, or by appointment

Prerequisites

- Prior knowledge of game theory is **NOT REQUIRED**

- Need to be able to follow/construct formal **proofs** and **mathematical arguments**

- Basic knowledge of **probability** (random variables, expectations, conditional probability, Bayes' rule)

Evaluation

Grade breakdown

- Assignments: 30%

- Midterm exam: 25%

- Research survey: 20%

- Survey presentation: 15%

- Survey peer review: 10%

Late assignments

- 20% deducted per day

Missed assignments or exams

- Provide a note from doctor, academic advisor, etc.

- Assignments score will be reweighted to exclude missed assignments

- If the midterm exam is missed, the marks from the research survey and assignments will be used in its place

  - i.e., grade will be 42.5% assignments, 57.5% research survey

Assignments

There will be **three** assignments (not weighted equally)

You are **encouraged to discuss** assignment questions with other students:

1. You **may not** share or look at each other's **written work**

2. You must **write up** your solutions individually

3. You must **list** everyone you talked with about the assignment.

Research survey

Final part of the class is driven by a small **research project**

- Survey of literature of sub-area we did not cover in class

    - Could be an **application** area, specific **subset** of an area we did cover,

    - Ideally: Propose direction for **new research**
      (especially if you are considering working with me)

    - Novel research results **NOT REQUIRED** (but may get bonus marks)

- Deliverables:

    1. One-page outline

    2. Presentation to class

    3. Peer review of others' presentations

    4. Survey paper

- Can work in **groups**

    - Individually is better if you are considering working with me

Academic Conduct

- Submitting someone else's work as your own is **plagiarism**.

- So is helping someone else to submit your work as their own.

- I report **all cases** of academic misconduct to the university.

- The university takes academic misconduct **very seriously**. Possible consequences:

  - Zero on the assignment or exam (virtually guaranteed)

  - Zero for the course

  - Permanent notation on transcript

  - Suspension or expulsion from the university

Readings

For Part 1 (Game theory)

- Yoav Shoham and Kevin Leyton-Brown,
  <u>Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations</u>

For Part 2 (Behavioural game theory):

- Original papers from the literature

- Possibly lecture notes-style summaries

For Part 3 (Research surveys):

- Self-directed readings from the literature

  - But feel free to ask me for pointers!

Enrollment

How many people present today are:

- Enrolled?

- Auditing with the hope of enrolling?

- Auditing without intending to enrol?

Course Topics

Game theory

Date	Topic	Readings & Milestones
Tue, Jan 8	Course overview	
Thu, Jan 10	Utility theory	S&LB §3.1
Tue, Jan 15	Game theory intro	S&LB §3.2–3.3.3
Thu, Jan 17	Mixed strategies	S&LB §3.2–3.3.3 Add/Drop deadline Jan 18
Tue, Jan 22	Alternative solution concepts	S&LB §3.4 Assignment 1 released
Thu, Jan 24	Perfect-information extensive-form games	S&LB §5.1
Tue, Jan 29	Imperfect-information extensive-form games	S&LB §5.2–5.2.2
Thu, Jan 31	Repeated games	S&LB §6.1
Tue, Feb 5	Bayesian games	S&LB §6.3 Assignment 1 due
Thu, Feb 7	Social choice	S&LB §9.0–9.4 (*excluding Arrow's Theorem proof*)
Tue, Feb 12	Mechanism design	S&LB §10.0–10.2 Assignment 2 released
Thu, Feb 14	Midterm exam	

Behavioural game theory

Date	Topic	Readings & Milestones
Tue, Feb 26	Behavioural economics intro	Assignment 2 due
Thu, Feb 28	Experimental design; presentation scheduling	Survey outlines due
Tue, Mar 5	Single-shot interactions	
Thu, Mar 7	Salience and focal points	
Tue, Mar 12	Fairness and social preferences	Assignment 3 released
Thu, Mar 14	Repeated interactions	
Tue, Mar 19	No-regret learning	
Thu, Mar 21	Behavioural macroeconomics/ finance (*)	

Research surveys

Date	Milestones
Tue, Mar 26	Assignment 3 due
Thu, Mar 28	
Tue, Apr 2	
Thu, Apr 4	
Tue, Apr 9	
Thu, Apr 11	Research survey due

Survey Topics

The ideal project is a **proposal** for novel work and a survey of the relevant **related work**

1. Predictive Models

- Feedback and Dynamic Behaviour

- Interpretability

- Characterizing Nonstrategic Behaviour

- Robust Learning in Continuous Domains

2. Agent Design

- Game Play

- Strategic Malware Detection

- Behavioural Macroeconomic Forecasting

3. Policy Design

- Peer Grading Platforms

- Misinformation in Social Networks

- Traffic Optimization

Introductions

Let's get to know each other!

Each person in the room, please introduce yourself by telling us:

- Your name

- Your academic background (undergrad, current year, etc.)

- What you work on or hope to work on in your research

- Why you are taking the class

- Anything else that you'd like us to know

ABGT Reading Group

Topics related to algorithmic and behavioural game theory

Approximately 60-90 minutes per week

Starting in late January

Webpage: jrwright.info/abgt.html

Email me if you are interested in participating!

Summary

- **Course webpage:** jrwright.info/bgtcourse/

- Data-driven behavioural modelling using lens of **game theory**

- Research survey

- Reading group: jrwright.info/abgt.html