Introduction

Traditional stochastic or econometric models of political & economic phenomena are being supplanted by dynamic simulation methods drawn from multidisciplinary perspectives including politics, economics, sociology, business as well as the physical sciences. For researchers and practitioners alike, no longer is it sufficient to rely on one particular methodology or discipline. Agent based models offer a new methodological bridge across various theoretical disciplines to test recent Noble laureate Thomas Schelling’s notions of the micro motivation for macro behavior. More importantly, they allow us to model and simulated complex phenomena for policymakers, researchers and practitioners alike. Agent based models allow for various theories and approaches to be tested in a mutually inclusive environment, focusing on understanding the interactive behavior of agents given certain properties. These micro agent interactions give rise to macro emergent behavior to help explain & predict various social phenomena. Thus agent-based and computational approaches are truly transdisciplinary, spanning politics, economics, sociology, business, public policy, mathematics, computer science as well as the physical sciences.

The goals of this course are to survey ABMs and their methodological foundations across several disciplines so students can build their own ABM. Today, teams of scientists are banding together to produce new computational models of phenomena where previously a single researcher could spend an entire career just to create and implement the same model. Subsequently, new skill sets are necessary not only to create ABMs de novo, but also just to assess the utility of modeling from an informed perspective. As simulation is a relatively recent subfield that draws on several other disciplines, you will work in teams to evaluate and create simulation models. This allows students to learn from each other and produce a superior team product compared to individual contributions.

Expectations

The applied pedagogy is grounded in an interactive, participatory and product oriented philosophy. The course is designed to quickly introduce ABM simulation & modeling concepts and then prepare students to design, build & evaluate their own ABM in politics or economics. Thus class attendance, participation and readings are critical. As such, this course is designed for advanced graduate students familiar quantitative computational social science, including but not limited to game theory, econometrics, formal modeling and computational analytic methods.

Course Outline

1. Computational Foundations
2. Transdisciplinary Domains
   a. Political
   b. Economic
   c. Media & Society
   d. Energy & Environment

3. Selected Applications
   a. Political
   b. Business & Society
   c. Economics
   d. Energy & Environment

4. Designing Policy for Impact

5. Applied ABM Project
   a. Choosing the research question & problem set
   b. Framing & evaluating theories
   c. Engineering an ABM
   d. Programming in NetLogo
   e. Implications of simulation results

Requirements

Course grades are determined by several components:
1. Course Participation (5%)
2. Homework (15%)
3. Quizzes (10%)
4. Applied ABM Project
   a. Executive Brief (20%)
   b. 25 page modeling paper (40%).
5. Team Evaluation (10%)

Articles & Books

Most required articles will be made available in SAKAI in either pdf or word format. In addition, the following books are required & available at the bookstore.


Introduction to ABMs


2. Gilbert
   a. Chapter 1 The Idea of Agent-Based Modeling
   b. Chapter 2 Agents, Environments, & Timescales

3. Gilbert & Troitzsch
   a. Chapter 2 Simulation as a Method

4. Taber & Timpone
   a. Chapter 1 Introduction
   b. Chapter 2 Dynamic Simulation Models


   http://www.economist.com/node/16636121/print


Developing Multi-Agent Structures

1. Kott & Citrenbaum
   a. Chapter 1 Introduction
   b. Chapter 2 Emerging Techniques & Tools

2. Gilbert
   a. Chapter 4 Designing & Developing Agent-based Models
   b. Chapter 3 Using Agent Based Models in Social Research

3. Gilbert & Troitzsch
   a. Chapter 8 Multi Agent Models
b. Chapter 9 Developing Multi Agent Models


Recommended


Complex Adaptive Systems


4. Gilbert & Troitzsch, Chapter 10 *Learning & Evolutionary Models*

5. Taber & Timpone, Chapter 4 *Models of Machine Learning*


**Transdisciplinary Context**

*Politics*


*Economics*


**Selected Applications**


**Politics**

   a. http://ccl.northwestern.edu/netlogo/models/Rebellion

   b. EINSTEIN User Guide.pdf


   Business & Society


   Economics

   a. http://ccl.northwestern.edu/netlogo/models/ElFarol

11. JAMEL: Java Agent Based MacroEconomic Laboratory. http://p.seppcher.free.fr/jamel/


   Energy & Environment

   “Realistic Electricity Market Simulator for Energy and Economic Studies” Electric Power  
   Systems Research, 77:46-54.

   Markets for Electricity” The Energy Journal, 21:3.


   Competitive Energy Markets.” IEEE.

22. Stefano Balbi and Carlo Giupponi, 2009. “Reviewing Agent Based Modeling of Socio-  
   Ecosystems: A Methodology for the Analysis of Climate Change Adaptation and  
   Sustainability” Ca’ Foscari University of Venice Working Paper no. 15.

   Modeling & Simulation of Rice Production and Labor Migrations in Northeast Thailand”  

24. Paul Waddell, UrbanSim: Modeling Urban Development for Land Use, Transportation and  
   Environmental Planning. University of Washington, Department of Urban Design and Planning,  


Visualization

1. David Jonker & William Wright, Visualization & Comprehension Chapter 10 in Kott &  
   Citrenbaum.

2. Parsons Institute for Information Mapping http://piim.newschool.edu/


   Representation: Identifying Images with Icon Schematics.” Parsons Institute for Information  
   Mapping, Paper 01 Part 3.

   Aesthetic Oscillation.” Parsons Institute for Information Mapping, Paper 05.


   Importance of Aesthetic Sizzle.” Oculus Info, Inc.

ABM Evaluation

1. Taber & Timpone, Chapter 5 Evaluating Computational Models.

2. Dean Hartley & Stuart Starr Verification & Validation Chapter 11 in Kott & Citrenbaum.


Designing Policy for Impact


