Agent-based Computational Economics

Tentative Syllabus for SPRING 2017

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Class Time: TBA
Class Room: TBA

Overview

- Agent-based Computational Economics is the computational study of economic processes modeled as dynamic systems of interacting agents who do not necessarily possess perfect rationality and information (definition from Preface to Handbook of Computational Economics Volume 2, editors Leigh Tesfatsion and Kenneth Judd).

- The two main goals of this course are:
  1. To provide a foundation for implementing agent-based simulations in Python.
  2. To use agent-based approach to explain and/or complement findings from human subject experiments.

- The course will have two parts: The first part will provide numerical and simulation tools that are necessary to conduct simulation experiments. The second part will be devoted to applications of these tools in a variety of problems in experimental and computational economics such as the study of learning, repeated games, and market design.

Recommended Text:


Course Materials:

Slides from class will be posted on blackboard. Other relevant links and information will be posted on the course resources page: http://web.ics.purdue.edu/~yrosokha/comp_econ_2017.html

Course Requirements:

1. **Written responses to the readings (10%) [Starting the second week of class]:**
   By 9pm on the night before class, everyone must submit a brief question or comment about the readings via email. **Use the subject line "Econ690 readings for [due date]". Credit will be**
based on evidence that you have done the readings carefully. Acceptable responses include (but are not limited to):

- Insightful questions and critiques
- Clarification questions about ambiguities
- Possible extensions or related studies
- Thoughts on the paper's importance
- Summaries of the most important things you learned

2. **Class participation (10%)**:  
Students are expected to be present and participate actively in the discussions.

3. **Oral presentation/discussion moderation (20%)**:  
Each student will be expected to lead a discussion on one of the readings. The discussion can begin with a brief summary/overview of the important points in the readings, but the assumption is to be that everyone has already completed the readings. The student may either present material related to the readings (perhaps from an outside source) or moderate a class discussion about the readings. In the latter case, the student must be prepared to keep the conversation flowing.

4. **Preliminary programming/simulation exercises (5) (20%)**:  
Each student will be required to complete five weekly programming assignments of his/her own choosing. Use the subject line "Econ690 HW[#]". It is recommended that one exercise will be completed in conjunction with the student's oral presentation/discussion/moderation.

Grading criteria for programming assignments:

- 8 - Good job, but there is room for improvement
- 9 - Good analysis, results well presented
- 10 - Excellent, with interesting research issues identified. Doing more than what has been asked.

5. **Final project (40%)**:  
A more extensive final project, along with written report, will be due on the last day of class. Students will be expected to agree with the instructor on the topic of the project by about halfway through the module. Please email a copy of your code, your final report, and any relevant data by TBA.

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<td>Final Project</td>
<td>40%</td>
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<tr>
<td>5 Exercises</td>
<td>20%</td>
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<tr>
<td>Class Participation</td>
<td>10%</td>
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<tr>
<td>Written Response to the Readings</td>
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<tr>
<td>Presentation</td>
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[Tentative] Schedule:

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<th>Class Contents</th>
<th>Readings</th>
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<td>Week 1</td>
<td>Overview of Agent-based Computational Economics. Introduction to Python. Monte Carlo Simulations.</td>
<td>1</td>
<td>HW0</td>
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<td>---------------------- Spring Vacation ----------------------</td>
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<td>Week 2</td>
<td>Reinforcement Learning. Temporal Difference Methods.</td>
<td>2</td>
<td>HW1</td>
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<td>Week 3</td>
<td>Evolutionary Algorithms</td>
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<td>HW2</td>
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<td>Quantal Response Equilibrium</td>
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<td>Week 5</td>
<td>Networks</td>
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<td>Week 6</td>
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<td>HW5</td>
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<td>Week 7</td>
<td>Selected Topics</td>
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<tr>
<td>Finals Week</td>
<td>Final Project Due (No Later Than 11.59pm on TBA)</td>
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Reading List

Week 1. Introduction

A. Agent-based Computational Economics Overview

Read:

B. Introduction to Python

Resources:
- Main Website: https://www.python.org/
- Download: Anaconda (free Python distribution that includes many packages)
- Install: Jupyter (IDE supporting Python, R, and other programming languages)

C. Monte Carlo Simulations

Read:

D. Zero Intelligence Agents

Read:

More on Experimental-Computational Complementarities

More on Zero-Intelligence Agents and Market Design


Week 2. **Reinforcement Learning**

A. **Reinforcement Learning in Economics**

Read:

B. **Reinforcement Learning in Computer Science**

Read:

Could be interesting for discussion:


More Experiments on Learning


Feltovich, Nick. “Reinforcement-Based vs. Belief-Based Learning Models in Experimental Asymmetric-Information Games.” *Econometrica* 68, no. 3 (May 1, 2000): 605–41.

**Week 3. Evolutionary Algorithms**

**A. Genetic Algorithms**

Read:

**Week 4. Computing Equilibria**

**A. Nash Equilibria**

Read:

**B. QRE**

Read:

**C. Equilibrium Distribution**

Read:

**Week 5. Networks**

Read:
More (Computational) Experiments on Networks

Week 6. **Repeated Games**

A. **Repeated Prisoner’s Dilemma**

Read:

B. **TBD**

Week 7. **Selected Topics**

C. **TBD**

Read:
- **TBD**