

Illinois Institute of Technology
Department of Social Sciences
Prof. Yuri Mansury (ymansury@iit.edu)
Office hours & office: M 5-7 pm, or by appt. Siegel 200

Fall 2019
Mon & Wed, 11:25 am~12:40 pm
Meeting Room: Herman Hall 010

SSCI 385-2 Computational Social Science (revised 11/11/2019)

COURSE DESCRIPTION

The social sciences concern how societies are structured and the interactions among the institutions and individual constituents of society. In this course, students will learn how to develop computational models to explore the social interactions that give rise to wealth inequality, ethnic conflict, and war, as well as to peace, globalization, and the emergence of religions and religiosity. Computational tools offer a promising new approach to gaining insight into the micro foundations of societies and institutions. For example, what human proclivity leads to a stratified community dominated by a small number of influencers each with a large number of followers? How do political attitudes yield social movements, such as mass riots, rebellions, and collective altruism? What role do social networks play in influencing marriage age? The discussions are structured around gaining understanding of social systems as complex entities in which autonomous individuals are the elementary unit of analysis. We will then experiment with the *bottom-up* framework of agent-based modeling to gain insight on how macro-patterns—racial segregation, cultural norms, and collective actions—arise spontaneously from the interactions of the individuals making up the social system. Nation-states, cities, and markets are adaptive, self-organizing systems of individuals whose interdependent actions are the fundamental building block of our social fabric. Agent-based models (ABMs) are analytically intractable because of the heterogeneous nature of gender identities, lifestyles and other demographic characteristics, which means simulations are the only resort. Class assignments and a term paper project will focus on how to extend an existing computer model and interpret the results in the context of compelling social science research investigations. Students in the course will turn in writing assignments that are pieces of the final write-up and get back clarifying questions and comments to help revise these for the final, integrated term paper.

LEARNING OBJECTIVES

Upon completion of this course, you should be able to ...

- Explain the causes and consequences of social interactions for individuals, the social groups to which they belong, and the societies in which they dwell,
- Contribute to the discussion on the advantages and limitations of complex-systems approaches as opposed to top-down perspectives of social structures,
- Apply open source software tools to addressing a social science research question of your choice,
- Produce a research proposal that articulates a clear research question and a plan of action for investigating the question through extension of a standard model,
- Write a final term paper that interprets the results of ABM simulations in a way that is meaningful for a social science inquiry.

TEXTBOOK REQUIRED

- Wilensky, U. and W. Rand (2015). *An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo*, MIT Press (hereafter WILENSKY).

PREREQUISITES

Though previous knowledge in introductory economics, calculus and computer programming is useful, strength in one or two of these areas can more than accommodate for little or no background in one or two of the others. Also helpful is some background in intro statistics. I am not a stickler for prerequisites, however, and enthusiasm is often a substitute for preparation.

SOFTWARE PACKAGES

- NetLogo is the programming platform for agent-based modeling (ABM) in this course, and downloadable for free from <http://ccl.northwestern.edu/netlogo>

COURSE ASSESSMENTS

Your grade will be determined according to the following scheme:

- 10 percent – class attendance and participation
- 25 percent – homework assignments
- 25 percent – in-class exercises
- 10 percent – in-class presentation of term paper project proposal
- 30 percent – term paper

LEARNING PROCESS, FORMAT, AND EXPECTATIONS

- **Policy on laptops and cell phones.** Laptops may be used only for note-taking and participating in exercises during class. They should not be used for reading or sending e-mail or engaging in other diversions. Cell phones should be turned off at all times during class. No texting during class is permitted. Headphones, earbuds, Bluetooth, or other audio devices are strictly prohibited. Each time I see students using cell phones I will deduct three points from their final grade (e.g., someone who has a final average of 80 would receive a final grade of 77). I would not stop a lecture to point out that a student is using a cell phone. I would simply make a note of it and deduct the points after class.
- **Attendance.** Absences diminish everyone's experience. To get a perfect attendance grade you need to attend all lectures with only one unexcused absence. More than **four** unexcused absences will result in a zero credit for the attendance portion of the grade. NOTE that if you miss class—even for excused reasons—you will be responsible for catching up with material. I am here to provide support when I can, and always more than happy to review material during office hours.
- You are encouraged to participate actively in all class discussions, presentations, and assignments. Active participation includes raising questions, offering feedback, engaging in critical reflection, sharing ideas and collaborating with other class participants.

- **Homework assignments** will be assigned throughout the semester. Responses should be submitted individually unless indicated otherwise. You will have at least 1 week to complete an assignment. If you need an extension you must ask the instructor before the deadline. Late submissions are accepted, but their grades will be reduced by 5 points each day the assignment is overdue. No late submission is accepted 14 days (or more) after the deadline.
- At some point in the semester we will switch from take-home assignments to **in-class exercises**. The idea is to work through a standard model of a social phenomenon and extending the model to address a refined question during class time. In-class assignments are usually due within 48 hours after they are assigned.
- **Regrade Policy**. All regrade requests must be done in writing. Please attach to your work a note explaining why you think the grade you have received is not appropriate. Exception is request to check for arithmetic error in adding up points, which will be granted right away. Request for a regrade must be submitted within one week after an assignment is handed back.
- For the **final assignment**, you will extend/modify/refine an existing model of an emerging social phenomenon to generate new simulation results that will be reported in your term paper. The paper will be about 12-15 pages long, and will include an introduction section, literature review, a description of the design concepts and details of the ABM, interpretation of results, directions for further research, and a reference list. The paper will be due sometime during the final-exam week in December, and must be well-organized, cohesive, and free of errors. **APA citation style** is required for both in-text citations and the reference list.
- **Failing the Class**. You will fail the course for reasons that include (but not limited to):
 - (i) Absent from class without permission more than five times,
 - (ii) Failing to submit responses to assignments (homework or in-class),
 - (iii) Not submitting the term paper.

Academic integrity

Students are expected to understand and abide by IIT's Code of Academic Honesty, <https://web.iit.edu/student-affairs/handbook/fine-print/code-academic-honesty> .

- Unauthorized assistance or collaboration on assignments (no matter how little) will result in a failing grade for the assignment (no exceptions/no excuses) AND possibly for the class.
- Misrepresentation of another's work as your own (i.e. plagiarism), whether done intentionally or by omission, will result in a failing grade for the assignment (no exceptions/no excuses) and possibly for the course.
- Every instance of academic dishonesty will be reported to academichonesty@iit.edu.
- **There will be no exceptions to this policy and ignorance of the applicable rules, regulations and standards is not an excuse for violating them.**

- If you are at all unclear about what behaviors, practices or omissions constitute punishable academic dishonesty you must consult with your instructor *before* engaging in the behavior or submitting the assignment.
- You will always learn more and get a better grade by submitting your own work (no matter how weak it may be) than by stealing someone else's and calling it your own.
- Assignments on which the student commits an act of academic dishonesty cannot be retaken, rewritten or resubmitted.

Athletics and ROTC:

All students are expected to give their academic work top priority. If you have to miss class because of duties as an athlete or a member of ROTC, you are required to inform the instructor in advance, to get permission for an excused absence, and to take responsibility for making up all the missed coursework and deadlines.

Disabilities:

Reasonable accommodations will be made for students with documented disabilities. Students must obtain a letter of accommodation from the Center for Disability Resources (CDR) within the first three weeks of the semester so that arrangements can be made. The CDR website <https://web.iit.edu/cdr> has more information.

A Note on Sexual Misconduct

Our school is committed to fostering a safe, productive learning environment. Title IX and our school policy prohibits discrimination on the basis of sex. The law prohibits sexual misconduct— including harassment, domestic and dating violence, sexual assault, and stalking.

Illinois Tech encourages anyone experiencing sexual misconduct to talk to someone about what happened, so they can get the support they need and our school can respond appropriately. If you wish to speak confidentially about an incident of sexual misconduct, please contact the Title IX Coordinator through the Illinois Tech website, <https://web.iit.edu/hea-compliance/sexual-harassment-and-misconduct-prevention/title-ix-illinois-tech>.

Our school is legally obligated to investigate reports of sexual misconduct, and therefore it cannot guarantee the confidentiality of a report, but it will consider a request for confidentiality and respect it to the extent possible. As an instructor, I am also required by our school to report incidents of sexual misconduct and thus cannot guarantee confidentiality. I must provide our Title IX coordinator with relevant details such as the names of those involved in the incident.

IMPORTANT DATES

Fall Break Monday 10/07.

Instructor's Conference Trip, 11/13 – 11/16. Possible no class Wednesday 11/13.

Last Day of Class 11/25.

COURSE ACTIVITIES & ASSIGNMENTS

The following due dates are subject to change.

Assignment	Tentative due date
Homework 1	August 29
In-class presentation	November 4-11
Literature review	November 18
Write-up of preliminary analyses	November 25
Term paper	Week of December 2 nd

Homework assignments are directly related to the material presented in the classroom, and provide students with the opportunity to put their newly-acquired skills into practice. Graded assignments will be handed back with feedback usually within 10 days after the due date. In September we will switch to a mode of learning through in-class assignments designed to be completed during class time. You will be asked to complete a small programming assignment in NetLogo usually by midnight on the same day it's assigned. If you miss a class for one reason or another, you may miss out on a crucial building block for the next assignment. At the same time, you will miss out the valuable opportunity to work through the problem together with the instructor and the rest of the class. No make-ups will be offered for missing in-class exercises. The first week of November will be devoted to individual presentations of term-paper project proposals. Your proposal must clearly articulate a meaningful question in the context of a social science inquiry, and this means not merely focusing on the technical aspects of the model but, more importantly, aims to investigate the causes and consequences of a social phenomenon of your choice. In the last 3 weeks of the semester, you will turn in several writing assignments—including a review of the relevant literature and a draft of the analysis—that are all pieces of the final write-up. For each of the writing assignments, you will receive suggestions and comments to help revise the draft for the integrated term paper.

COURSE OUTLINE

I reserve the right to modify the course content, including the sequencing of topics and reading materials, as the semester progresses.

Week 1: Overview

August 19

Syllabus and class overview. Introduction to the course—background material on complex systems in the social sciences.

Readings:

- Cioffi-Revilla, C. (2014). *Introduction to Computational Social Science*. Berlin/New York: Springer. Chapter 1.

August 21

What is a complex system?

Readings and video material:

- Santa Fe Institute video tutorials on complex system.
- Weaver, W. (1948). "Science and Complexity," *American Scientist* 36: 536.
- Miller, J.H. and S.E. Page (2007). *Complex Adaptive Systems*. Princeton University Press. Chapters 1 & 2.

Week 2: Intro Agent-Based Modeling

August 26

Emergence: the disconnect of individual intention from the aggregate outcome. Spontaneous emergence of aggregate behavior that is not the original intent of the individuals making up the larger social structures.

Readings:

- Schelling, T.C. (2006). *Micromotives and Macrobehavior*. WW Norton & Company. Chapters 1 and 2.

August 28

How agent-based modeling can contribute to a social science inquiry. Getting started with NetLogo: Party & Traffic Basic models.

Readings:

- WILENSKY. Chapter 0.

Week 3: What Is Agent-Based Modeling?

September 04

A simple example of turtles circling model.

Reading:

- WILENSKY. Chapter 0.

Week 4: Creating Simple Agent-Based Models in NetLogo

September 09 and 11

Model of economic inequality and social stratification: the rise of the super wealthy and the poor majority.

Reading:

- WILENSKY. Chapter 2.

Weeks 5~6: Model of Neighborhood Segregation

September 16, 18, 23 and 25

Implementing a model of racial segregation in NetLogo.

Reading:

- Schelling, T.C. (1971). Dynamic models of segregation. *Journal of Mathematical Sociology*, 1(2): 143-186.

Week 7: GIS & File Input-Output

September 30

Does space matter? Integrating geographic information system (GIS) maps into Schelling's model.

October 02

Using I/O (input/output) to interact with outside files.

Week 8~9: Exploring & Extending Agent-Based Models

October 09 and 14

Introducing diversity seekers. How preference for different-group neighbors contributes to the existing pattern of segregation.

October 16

NetLogo's anonymous procedure.

Reading:

- WILENSKY. Chapter 3.

Week 10: The ODD Protocol

October 21

Describing and formulating an agent-based model: The overview, design concepts, and details (ODD) protocol.

October 23

Identifying the key process driving changes in social structures.

Reading:

- Grimm, V., Berger, U., DeAngelis, D.L., Polhill, J.G., Giske, J., & Railsback, S.F. (2010). The ODD protocol: a review and first update. *Ecological Modelling*, 221(23): 2760-2768.

Week 11: Special Topics

October 28

Hubnet & participatory simulation. Engaging participants to contribute to simulations of group behavior in real time.

Reading:

- Wilensky. Chapter 8

October 30

Models of social networks. How preferential attachment yields a network structure characterized by a small number of influencers each with a large number of followers.

Reading:

- Barabási, A.-L. & Albert, R. (1999). Emergence of scaling in random networks. *Science*, 286:509-512.

Week 12: Class Presentations

November 04 and 06

Presentations of term-paper research proposal, which includes statement of purpose, the social science question that will be addressed, and a plan of action for investigating the question through extension of a standard model.

Week 13: Literature Review

November 11

Term paper outline. The recommended format and content of the final term paper.

November 13

How to search for peer-reviewed articles (guest presenter: Yi Han). Questions addressed include: What is a peer-reviewed article? How to synthesize sources for a literature review, constructing a search strategy based on the research question, and overview of the APA citation format.

Venue: Galvin Library's Learning Center

Week 14: Analyzing Agent-Based Models

November 18 & 20

Behavior space. Analyzing the output of an agent-based model in a systematic way to address a social science research question.

Reading:

- WILENSKY. Chapter 6.

Week 15: Wrap-Up

November 25

Have we achieved integrative and differential understanding of institutions and societies? Patterns, connectivity, and social movements as a social system's macro-behavior and individual rules as the micro-motives.

Reading:

- Mansury, Y., & Gulyás, L. (2007). The emergence of Zipf's Law in a system of cities: An agent-based simulation approach. *Journal of Economic Dynamics and Control*, 31(7): 2438-2460.

LINKS & WEBSITES

NetLogo

<http://ccl.northwestern.edu/netlogo/>

Wilensky & Rand textbook official website

<http://www.intro-to-abm.com/>

Complex Systems

<http://www.complexityexplorer.org/>