GEORGE WARREN BROWN SCHOOL OF SOCIAL WORK
WASHINGTON UNIVERSITY

FALL 2019

Introduction to Agent-Based Modeling

S90 SWDT 6915

ROOM: Hillman 370 INSTRUCTOR: Ross Hammond
TIME: 1-3pm Tuesdays OFFICE: Goldfarb 222A
TA: Joe Ornstein PHONE: 935-2223
TA EMAIL: jornstein@wustl.edu EMAIL: rhammond@wustl.edu
LAB: 3:15-4:15pm Tuesdays (Goldfarb 330)

I. COURSE OVERVIEW

This class is an advanced (Ph.D. level) methods seminar providing an introduction to the methodology of agent-based modeling, with example applications drawn from social and health sciences.

II. COURSE OBJECTIVES

The overall goal of this course is to introduce the method of agent-based computational modeling (ABM) and its applications to the health, social, and policy sciences. Specific goals include:

1. To provide students with an understanding of the concepts of ABM, including what kinds of questions are appropriate for ABM analysis, and key ingredients that go into ABM development

2. To familiarize students with key application areas for ABM in public health and social science to date, with important social and health science questions that have been answered using ABM, and with canonical models in the field
3. To teach students how to use ABM effectively, including generating and interpreting results, conducting experiments and sensitivity analysis, and visualization, along with best practices for design and development of ABM.

4. To demonstrate how to use ABM software, both for the purposes of conducting analysis and for the construction of ABMs.

5. To provide students with the opportunity to build and code ABMs of their own design.

6. To describe how ABM be incorporated into an empirical research program or a policy exercise.

Students will be provided with hands-on experience using computational software to construct ABMs, and to develop a project aligned with their own research interests.

III. BROWN SCHOOL ACADEMIC POLICIES

Academic Integrity: If a faculty member or student suspects that academic or professional integrity has been violated, they are required to submit an Academic Integrity or Professional Integrity Violation form found on Inside Brown for review by the Assistant Dean of the program. The Assistant Dean or designated representative will aid in the investigation of the violation, which includes but is not limited to gathering relevant evidence; conversations with the instructor, student(s) involved, witnesses, and others as necessary. Depending on the seriousness of the case, the Assistant Dean may choose to refer the matter directly to the University Student Conduct Board. This referral procedure will generally be followed if it is believed that the penalty is likely to involve suspension or expulsion from the University. The Assistant Dean for the program or designated representative will offer to meet privately with the student(s) against whom the complaint has been made. It is the student’s responsibility to familiarize themselves with the behaviors that constitute an academic integrity violation requiring referral.

Student Handbook 2019

Accommodations: If you have a learning, sensory, or physical disability or any other diagnosis that requires accommodations and/or assistance in lectures, reading, written assignments, and/or exam taking, please work with the Disability Resource Center, a University-wide resource that provides academic accommodations support and referrals. After requesting academic accommodations by providing appropriate documentation, students approved for accommodations will provide an Accommodation Letter to the instructor and are encouraged to work directly with the instructor to discuss specific course needs. The student’s Academic Advisor and/or the Assistant Dean for Academic Affairs can support a student through this process.

Pronouns: The Brown School embraces and promotes gender expansiveness as reflective of the lived experiences of many students, staff, faculty and members of our expanded community. The correct use of an individual’s pronouns is a critical part of an individual's identity and of building
an inclusive community. Students, faculty and staff are encouraged to use pronouns during introductions, are expected to use expressed pronouns of all Brown School community members, and are encouraged to apologize when mistakes are made. Educational resources are available at: https://campuslife.wustl.edu/lgbtqia/lgbt-resources/gender-pronouns/

**English Language Proficiency**: If your English language proficiency is such that you may need special assistance in lectures, reading, written assignments, and/or exam taking, please communicate these needs to your instructor who may refer you to the Brown Communications Lab. If you would like help seeking additional English language resources, please visit the Global Programs Suite in Brown 309. You may also find the Academic Assistance resources available through the Office for International Students and Scholars to be helpful.

**Professional Use of Electronic Devices in the Classroom**: Computers or other electronic devices, including “smart pens” (devices with an embedded computer and digital audio recorder that records the classroom lecture/discussion and links that recording to the notes taken by the student), may be used by students at the discretion of the faculty member to support the learning activities in the classroom. These activities include taking notes and accessing course readings under discussion. If a student wishes to use a smart-pen or other electronic device to audio record lectures or class discussions, they must notify the instructor in advance of doing so. Permission to use recording devices is at the discretion of the instructor, unless this use is an accommodation approved by Disability Resources.

Nonacademic use of laptops and other devices and use of laptops or other devices for other coursework is distracting and seriously disrupts the learning process for other people in the classroom. Neither computers nor other electronic devices are to be used in the classroom during class for nonacademic reasons or for work on other coursework. Nonacademic use includes emailing, texting, social networking, playing games, instant messaging, and use of the Internet. Work on other coursework may include, but is not limited to, use of the Internet, writing papers, using statistical software, analyzing data, and working on quizzes or exams. The nonacademic use of cell phones during class time is prohibited, and they should be set on silent before class begins. In the case of an emergency, please step out of the room to take the call. The instructor has the right to hold students accountable for meeting these expectations, and failure to do so may result in a loss of participation or attendance points, a loss of the privilege of device use in the classroom, or being asked to leave the classroom.

**Religious Holidays**: The Brown School recognizes the individual student’s choice in observing religious holidays that occur during periods when classes are scheduled. Students are encouraged to arrange with their instructors to make up work missed as a result of religious observance, and instructors are asked to make every reasonable effort to accommodate such requests.

IV. **WASHINGTON UNIVERSITY ACADEMIC SUPPORT POLICIES**

**Accommodations based upon relationship or sexual violence, including sexual harassment and stalking**: The University is committed to offering reasonable accommodations to students who are victims of relationship or sexual violence. Students are eligible for accommodations
regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such accommodations may include but are not limited to implementation of a no-contact order, emergency housing, course/classroom assignment changes, assignment extensions and other academic support services. If you need to request such accommodations, please direct your requests to rsvpcenter@wustl.edu or call directly to 314-935-3445.

There are four licensed RSVP counselors who serve as confidential resources. However, to implement requests for accommodations, limited information will be shared with the appropriate university administrator and/or faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to me to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as a faculty member of Washington University, I am required to immediately report it to my Department Chair or Dean or directly to Ms. Jessica Kennedy, the University’s Title IX Director. If you would like to speak with directly Ms. Kennedy directly, she can be reached at (314) 935-3118, jwkennedy@wustl.edu, or by visiting the Title IX office in Umrah Hall. Additionally, you can report incidents or complaints to the Office of Student Conduct and Community Standards or by contacting WUPD at (314) 935-5555 or your local law enforcement agency. See: Title IX

You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling (314) 935-3445 for an appointment or visiting the 4th floor of Seigle Hall. See: RSVP Center

Bias Reporting: The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University’s Bias Report and Support System (BRSS) team. See: brss.wustl.edu.

Mental Health: Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See Mental Health Resources.

Center for Diversity and Inclusion (CDI): The Center of Diversity and Inclusion (CDI) supports and advocates for undergraduate, graduate, and professional school students from underrepresented and/or marginalized populations, creates collaborative partnerships with campus and community partners, and promotes dialogue and social change. One of the CDI's strategic priorities is to cultivate and foster a supportive campus climate for students of all backgrounds, cultures and identities. See: diversityinclusion.wustl.edu/

Additional Issues or Concerns: If you feel that you need additional supports in order to be successful in your time at Brown, beyond the mentioned accommodations, please contact your
Academic Advisor or Danielle Bristow, Assistant Dean for Academic Affairs. They can assist you in navigating a myriad of concerns.

V. TEXTS and SOFTWARE

Required:

Class readings are all available via electronic journals and are listed below for each week of the course. There is no required textbook, although the books listed below may be helpful.

For the lab section of the course, the free software NetLogo is required. You can download NetLogo version 6.1.0 at this website: https://ccl.northwestern.edu/netlogo/download.shtml. For in-class exercises during the lab session, desktop computers equipped with NetLogo will be available in Goldfarb 330. However, you may want to bring a laptop to class in order to avoid transferring files from one machine to another.

Optional additional reading:


VI. ROLE OF INSTRUCTOR AND STUDENTS

Instructor: This class is designed to provide appropriate introductory information, skills, and context for students wanting to incorporate agent-based modeling into their research. We will cover the most critical steps and best practices involved and students will be well positioned to pursue a path to the mastery of these tools. Class meetings will be primarily lecture/discussion format with occasional in-class exercises and lab sessions led by the Teaching Assistant. I will hold office hours weekly and special appointments as needed, but also encourage students to use e-mail to ask questions, make suggestions, or provide feedback about the course. I will endeavour to respond to emails by the end of the following business day after receipt; students are encouraged to plan ahead to avoid last-minute requests. I will also use Canvas to update students about the class.

Students: This is an applied methods course that requires significant attention to out-of-class activities as well as readings. The class presentations and discussions are important, but in and of themselves will not lead to mastery of agent-based modeling. As with many Ph.D. level courses, students will get out of the class what they put into it. Agent-based modeling is an innovative and powerful approach to research, but it relies on unfamiliar ideas and techniques. Time spend outside of class working on the problem sets, class project, and readings is an essential part of the learning the course will provide. Students are expected to seek guidance and clarification as needed from the instructor and teaching assistant to assure adequate progress. If
you are unable to attend a class, please inform the instructor prior or immediately following the absence and make arrangements to obtain notes. Students are encouraged to work together in small formal or informal work groups as they learn the material; peer feedback may be especially useful for class projects. However, all individually evaluated class activities are expected to reflect the work of the individual student. If you have any questions about this, please contact me. Students are expected to produce written work that is professionally prepared, as much as possible. All assignments should be typed, be proofread and employ good grammar, and use professional scientific guidelines for citation.

VII. GRADING CRITERIA AND ASSIGNMENTS

Students are expected to complete all assignments by their due dates.

Class Participation includes readings as assigned, and participation in a number of informal exercises during class sessions.

Problem Sets will be assigned during five Lab sessions and will be given clearly indicated due dates. Assignments handed in late will receive a reduction in the grade for that assignment. Assignments handed in more than one week late will not receive a grade. Specific formatting and presentation requirements will be discussed in class.

Class Project During the semester students will identify an agent-based modeling project they would like to work on. Students are encouraged to work on a project that is relevant for their own academic and career interests. By the end of the course, students will prepare a project presentation, model design document, and code for grading. Specific expectations for the project will be described during the course.

Weighting for final course grade:

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<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>20%</td>
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<tr>
<td>Problem sets (lab)</td>
<td>40%</td>
</tr>
<tr>
<td>Class Project</td>
<td>40%</td>
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VIII. ORGANIZATION OF COURSE AND COURSE OUTLINE

The class is organized as a mix of didactic presentation, in-class activities, TA lab sessions, and outside of class readings and exercises. Although there will be some opportunity in class to work on individual projects, it is expected that much of the application of the course material will be done outside of class.

Week 1 – Introduction and Context

• Introduction to course, instructors, and logistics
• Context and Background: complex systems science and its role in public health and social
science research
• Getting started with NetLogo

Readings


**Week 2 – Framing and Developing a Focus**

• Why build models, and types and uses of modeling
• How ABM fits into a broader context of science
• Developing a clear question to model

LAB: NetLogo orientation and hands-on

Readings


**Week 3 – ABM in detail, Contagion models**

• Components of agent-based models
• Designing, building and using an agent-based model: overview of the process
• Application area overview #1: ABMs of contagion

LAB: Hands-on with contagion models

Readings


Week 4 – Networks and ABM, Tobacco models

• Brief primer on networks and network science in agent-based modeling
• Application area overview #2: ABMs of social diffusion and retailer-based policy in tobacco control

LAB: Hands-on with social diffusion models

Readings


**Week 5 – Sorting models**

- Application area overview #3: ABMs of segregation, preferential attachment, and homophily

LAB: Hands-on with diffusion and sorting models

*Readings*


**Week 6 – Obesity etiology and prevention models**

- Brief primer on multi-level ABMs
- Application area overview #4: ABMs of social norms, neuroscience, and community prevention in obesity

LAB: Hands-on with obesity etiology models

*Readings*


**Week 7 – Ethnocentrism and ethnic conflict models**

- Brief primer on “evolutionary game” ABMs
- Application area #5 overview: ABMs of the evolution of ethnocentrism, and of ethnic conflict

LAB: Hands-on with ethnocentrism and evolutionary ABMs

*Readings*


**Week 8 – ABM methodology Part 1**

- Best practices and skills for Design and Specification steps in an ABM project

LAB: NetLogo Programming

*Readings*

Week 9 – ABM methodology Part 2

• Best practices and skills for Implementation and Testing steps in an ABM project

LAB: Netlogo Programming, Part 2

Readings


Week 10 – ABM methodology Part 3

• Best practices and skills for Experiments and Interpretation steps in an ABM project

LAB: Hands-on mentoring for individual class projects

Readings


Week 11 – ABM methodology part 4

• Best practices and skills for Presenting, Publishing, and Funding steps in an ABM project

LAB: Hands-on mentoring for individual class projects

Readings


Week 12 – Student presentations part 1

• Presentations by individual students of class projects, feedback from peers and instructors
LAB: Hands-on mentoring for individual class projects

**Week 13 – Student presentations part 2**

- Presentations by individual students of class projects, feedback from peers and instructors

LAB: Documenting, storing, and sharing your model

**Week 14 - Wrapup**