International Relation and Political Sciences (IRPS)
Academic Year 2019 - 2020

Advanced Quantitative Methods: Agent-based Computational Modeling
RI-SP076 – Spring 2020 - 3 ECTS

Course Description
The course “Advanced Quantitative Methods: Agent-based Computational Modeling” aims to familiarize participants with the methods of computational agent-based modeling (ABM). Computational modeling techniques are commonly not part of the standard repertoire of quantitative analyses in the social sciences. They have increasingly gained prominence though as powerful techniques that can effectively compliment more standard approaches such as regression analyses, in particular, in settings characterized by complex systemic interactions. The course will first introduce the theoretical foundations of the technique in the field of complexity theory. Students will then learn the methodology of agent-based modeling. The course covers classical examples such as Schelling’s model of segregation and then familiarizes students with more complex recent models. Students will then learn about the state-of-the-art approach of evidence-driven modeling, i.e., embedding and validating agent-based models using empirical data. The course places a particular emphasis on highlighting strengths and weaknesses of computational modeling approaches for quantitative analyses and will carefully place the methods in the context of other quantitative techniques more commonly used in the social sciences. Students will also gain first-hand experience in implementing and applying the methods learned through practical programming assignments and a coding project in Python or R. The course therefore assumes that students have some programming background.

Note that the course will be taught in four intensive sessions throughout three weeks at the end of February and in early March 2020. Specifically, it takes place on Thursday February 20 12:00 – 14:00 and 18:00 – 20:00, Wednesday February 26 12:00 – 14:00 and 18:00 – 20:00, Thursday February 27 08:00 – 10:00 and 12:00 – 14:00 and Wednesday March 4 12:00-14:00.

Syllabus
Course Requirements
Attendance in all sessions of the course is required and students are expected to engage with the recommended readings and/or online resources in preparation for the course. Students will be required to complete a computational modeling project implemented in either Python or R and document their work in a written project report. The coding project and report are due 4 weeks after the last course session, i.e., on April 01, 2020.

Course Evaluation
Performance in the course depends both on active participation and the coding project with written project report. Evaluation will be based on:

1. Active participation and contribution to the course 10%
2. Coding project and written project report 90%
Course Material

Recommended scientific readings and/or online resources for individual sessions are provided with stable links in the course schedule below. The following book recommended for anyone interested in a more in-depth introduction to the topic of complexity and agent-based computational modeling.


Course Schedule

Session 1: Introduction – Modeling Complex Systems
Thursday, February 20th 12:00 – 14:00, Room?
- Introduction to Complexity and Modeling
- Agent-Based Modeling

Session 2: Agent-Based Models in Social Science
Wednesday, February 26th 12:00 – 14:00 & 18:00 – 20:00, Room?
- Classical Models: Schelling and Beyond
- Evidence-Driven Modeling

Session 3: Agent-Based Models in Practice
Thursday, February 27th 08:00 – 12:00, Room?
- Implementation of Agent-Based Models
- Best Practices and Pitfalls

Session 4: Coding Project
Wednesday, March 4th 12:00 – 14:00, Room?
- Presentations of Project Ideas

Software

The practical exercises of the course and the coding project require implementing and running agent-based models. Students may use one of two programming languages:

- Python
- R

The course assumes some programming background in either of the languages. Please make sure to install and familiarize yourself with the appropriate software packages prior to the class.
Required Readings


Recommended Readings


