Graduate Student Research Project

EES 4760/5760 Agent- and Individual-Based Computational Modeling

Proposal due Sept. 23.
Model analysis due Oct. 7.
ODD for extending the model due Nov. 1.
Draft model code due Nov. 15.
Presentations Dec. 2–4.
Written Report due Dec. 6

You will choose a research area, find an existing agent-based model relevant to that area, study the model, develop a new research question and modify the model to address it, and perform and analyze experiments with your modified model.

The project is broken into the following steps:

Project Proposal: By the end of the day Monday, Sept. 23, turn in a one-to-two page (double-spaced) proposal describing the topic you want to work on and identifying a published open-source model you want to work with and how you think you might want to extend it.

You should consult the textbook, the Model Library in NetLogo, the reading and computational tools resource I handed out on the first day of class (also on Brightspace), and the repositories of models listed in that handout.

The supplementary textbook, *Modeling Social Behavior*, by Paul Smaldino, also includes a number of interesting models that you could adapt for research projects.

Model Analysis: Study the ODD and the code of the model (if the model does not have a published ODD, try to write your own to describe what it does). Play with the model and run some BehaviorSpace experiments to examine its output. **By the end of the day Oct. 7 (before midnight), turn in a 3–5 page (double-spaced) write-up about the model**:

- Describe the purpose of the model, the important features about its design and structure.
- Discuss whether there are weaknesses in the model design and whether you might have represented the system differently if you were writing a model from scratch.
- Present the output from the model (Behaviorspace or interactively playing with it) and discuss what you learn about the system from that.
- Discuss something that you don't learn from the model that you would like to study by extending the model.

Extending the Model: By Nov. 1, turn in an ODD for extending the model to ask new questions and begin to edit the model to implement your new ODD.

By the end of the day Fri. Nov. 15, turn in a draft model that runs, together with a description of what you are satisfied with and what problems you are still struggling with. It is not necessary that the model be perfect. This due date is to get you to check in with me so I can give you feedback on how things are going and make suggestions.

Running Model Experiments: Once your model is running and passes your tests, you should use it to explore the research questions in your proposal. You should think about the topics we read about in sections III and IV ("Pattern-Oriented Modeling" and "Model Analysis") in *Agent-Based and Individual-Based Modeling*.

Analyzing and Interpreting Results: What do you learn from your model? Graphing output or performing statistical analysis with Excel or other tools, consider what you learned. Pay special attention to patterns and emergence. Did the interesting phenomena you observed only occur for specific values of parameters, or did they occur for broad ranges of those parameters?

Presentation and Report: You will make a five-minute presentation about your model. There will not be time to go into details, so focus on the big question you were addressing, a short description of the approach you took to writing a model to address that question, and what you learned from running the model.

By the end of the day Friday December 6, turn in a written report about your research project. Your report should follow the model of a research Report in *Science* magazine:

Title: Maximum of 90 characters

Author: Your full name. If this is a team project, the full names of all the authors.

Abstract A one-paragraph abstract that explains to a general reader why you did this project and why the results were important.

Text Up to 2500 words (around ten pages, double-spaced), not including the abstract, references, notes, or captions. Up to four figures or tables.

Your paper should have the following sections:

- **Introduction** Describe your research question and say something about why it's interesting.
- **Methods**
  - Describe the model you started with and how you changed it to answer your research question
  - Describe the experiments you ran with the model
  - Describe what outputs you measured.
- **Results** What did you see (graphs of output, screenshots of turtles on patches, etc.)
- **Discussion and Conclusions**
  - What did you learn from the resulte of your model experiments?
  - If you had more time, what would you do next with your model?
  - Do you think these results point to possible uses or applications of your model?

References: Citations should use an author-date style, and references can be in any standard bibliographic format.

Supplementary Materials The detailed description of your model (ODD and NetLogo code) should not be part of the paper. You should submit these as a separate file or group of files called "Supplementary Materials." (The ODD can be either a separate document or you can put it in the "Info" tab of your model).

Your supplementary materials can also include additional figures, tables, or text that will not fit in the paper.

The main text (the paper) should stand alone in describing the problem, the general approach you took with your model, what you found, and why it's significant.

The supplementary materials should include any details that someone would need in order to test and reproduce your results, but which are not crucial for a non-expert to understand the big picture. The supplementary materials should also include your model, any data files you used as input for running your model, and any computer code or spreadsheets you used to analyze your model output. Supplementary materials can also include additional text describing details that did not fit in the main paper.

- The main paper should be in a Word or PDF document with the filename `<lastname>_<firstname>_final_paper.docx` or `<lastname>_<firstname>_final_paper.pdf` (with your own name in place of `<lastname>` and `<firstname>`).
- Make a ZIP file called `supporting_material.zip`, containing your supporting materials (ODD, NetLogo model, etc.) and upload your paper along with the supporting materials to Brightspace.

  There are many free software apps for creating and working with ZIP files, including 7Zip on Windows and Keka on MacOS.