

AGENT-BASED MODELLING

A presentation by **Hans Emmanuel Hernandez** (2020-11387)

OBJECTIVES

In this activity, we perform a simple agent-based modeling task. Specifically, we have the following objectives:

- Simulate the interaction of each agents given a two-dimensional grid
- Implement the Von Neumann neighborhood algorithm
- Plot the time evolution of the model for increasing iterations
- Animate time evolution for a single run of the model

01

RESULTS AND ANALYSIS

FOREST FIRE MODELING

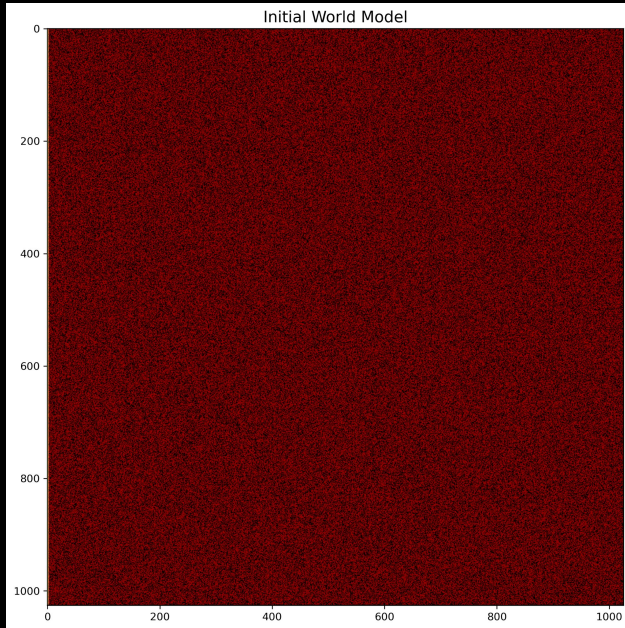


Figure 1. Initial 1026 x 1026 grid filled with ground, fire, and tree cells.

For this model, we set arbitrary values to three agents:

- 1) **ground = 0 (black pixels in colormap)**
- 2) **tree = 1**
- 3) **fire = 5**

We set the following initial conditions to the grid:

- 1) first column is set to fire cells (5)
- 2) zeroth and last column are set to ground cells (0)
- 3) zeroth and last row are set to ground cells (0)

AGENT RULES



Figure 2. Agents: tree (1), fire (5), and ground (0)

1. A tree cell evolves to a fire cell if it has at least one fire neighbor (Von Neumann neighborhood)
2. A fire cell evolves to a ground cell
3. If a tree cell has no fire neighbors, it remains as a tree cell
4. A ground cell remains as a ground cell

TIME EVOLUTIONS OF THE FOREST FIRE MODEL

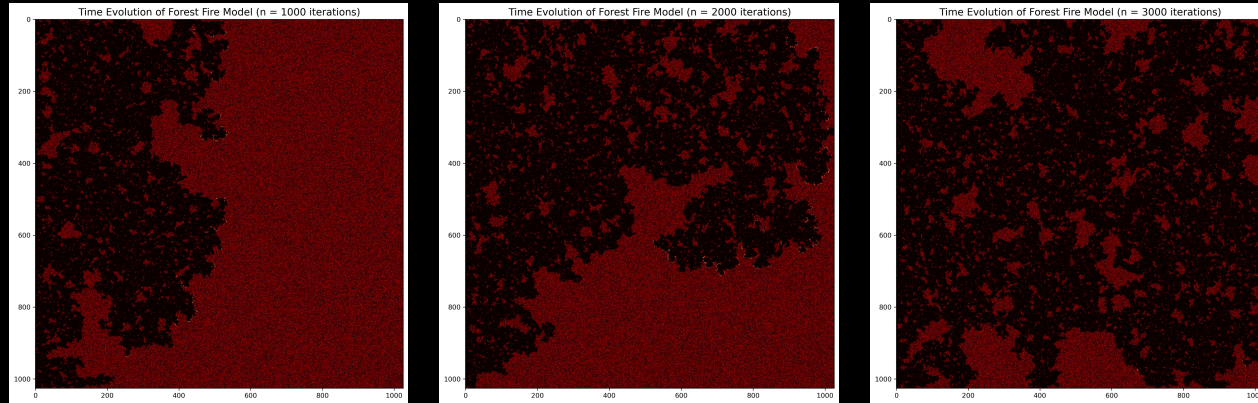


Figure 3. Time evolutions of the forest fire model after increasing iterations.

As we can see above, we have successfully implemented the interaction between the three agents in the forest fire model. **Given the initial condition of fire cells in the first column, the fire cells were able to spread throughout the grid and turned the tree cells into ground cells.** We can also see that some of the tree cells survived and were evidently missed by the fire cells given the previous conditions.

FOREST FIRE MODEL ANIMATION

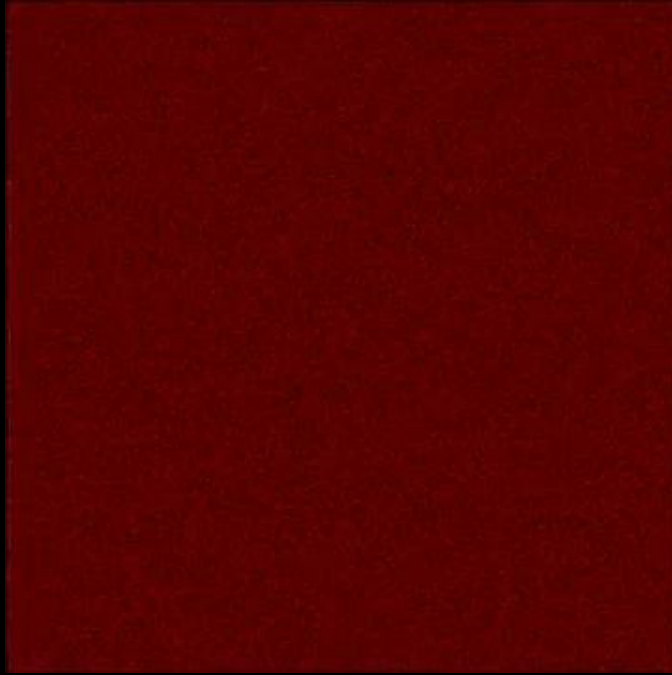


Figure 4. Animation of the time evolution of the forest fire model after 1000 iterations.

02

REFLECTION

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Overall, this was a great activity!

Agent-based modeling is far simpler than the previous activities because we start with a blank slate that can evolve due to various conditions and parameters that we set ourselves. I really enjoyed seeing how the model evolves after increasing iterations and how the forest fire was able to spread out across the grid.

Besides that, I believe that my results are accurate and stayed true to the topic, with additional cross references and analyses. I also cross-validated my results with my peers. However, if I was given more time, I would implement this task by increasing the number of agents and increasing the complexity of the model to see how things would play out in a contrast to a simpler model that I implemented.

SELF-GRADE

Technical Correctness: 35/35

I believe that my results are correct through math, research, and through validation with my peers and with my instructors.

Quality of Presentation: 35/35

I believe that the quality of my powerpoint is up to par with the course expectations. I constructed the figures as instructed, and exported my data accordingly.

Self-Reflection: 30/30

I believe that I have acknowledged and reflected upon the activity well enough. I also have complete citation on the next slide.

Initiative: 10/10

I went above and beyond with my data presentation, and included extra analyses for the activities.

REFERENCES

[1] *Agent Based Models — Scientific Computing with Python*. (n.d.).

https://caam37830.github.io/book/09_computing/agent_based_models.html

[2] Foong, N. W. (2021, December 12). Introduction to Mesa: Agent-based Modeling in Python. *Medium*.

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[3] Katan, J., & Perez, L. (2021). ABWiSE v1.0: toward an agent-based approach to simulating wildfire spread. *Natural*

Hazards and Earth System Sciences, 21(10), 3141–3160. <https://doi.org/10.5194/nhess-21-3141-2021>

[4] Zimbres, R. (2022, August 2). Agent-Based Modeling with Python and NetLogo - Rubens Zimbres - Medium. *Medium*.

<https://medium.com/@rubenszimbres/agent-based-modeling-with-python-and-netlogo-6f7bf4103f>