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Peer Review

Review of: "Modeling and Simulating Agent-Based City Migration Using Conway's Game of Life"

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Modeling and Simulating Agent-Based City Migration Using Conway's Game of Life

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Summary

I like the idea of Conway's Game of Life being exploited to simulate city migrations. I'm confident that an appropriate GOL model could usefully be compared to data on population growth and expansion in cities.

Unfortunately, the current version of the article is substantially short of what is required to make it worthy of publication. In its current form, it has to be rejected. Nonetheless, I would encourage the authors to consider a more thorough and scientifically robust investigation along the lines of my suggestions below.

Detailed comments

1. The description of the procedure of the "pilot experiment" at the bottom of page 3 is clunky. All the authors are saying is that they execute the GOL rules on a two-dimensional grid of cells at t=0 and write the output to a fresh grid of cells labelled t=1.
2. A pilot experiment should not be presented in a paper. A comprehensive study should be provided instead.

a. The convergence criterion described at the top of page 4 is unworkable. If the authors look at the Conway's Game of Life wiki page, they will discover that systems yield objects described there as "still lifes", "oscillators", and "spaceships". The latter two object classes can change the number of live cells at each time step.

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b. I suggest the authors take a large grid, perhaps 100x100 as implemented later. Populate it based on the chosen probability, then execute the GOL simulation for a large number of steps (suggest 1000).

c. Use a convergence criterion that, for example, puts a horizontal line through the final 100 readings and then make a reasonable assessment of when this convergence was reached.

d. Repeat steps 3 and 4 many times (suggest 1000 repetitions). Obtain a mean and standard deviation for the number of timesteps required to reach convergence.

e. Repeat steps 3 to 5 for the next chosen probability.

f. Construct a plot of timesteps to convergence versus probability, showing the mean and standard deviation. The present Figure 1(a) must be incorrect in any case. For a probability of 1.0, every cell in the grid would be alive. If every cell is alive at t=0, the whole system will be instantaneously dead at t=1. The plot seems to show a value of t=2 timesteps to convergence when convergence was reached at t=1.

g. No lines should be put through the data points in Figures 1(b) and (c), just the data points with mean and standard deviation. This is because time is a discrete variable here. Figure 1(c) only has four data points at 0, 1, 2, and 3. This figure also shows it is nonsensical to present just one simulation result as it may, or may not, respect the overall average obtained with a multitude of identical simulations.

h. Similar comments can be made for the results presented in Figure 2. Figure 2 (right) is commented on by the authors at the bottom of page 5. The convergence in the presented example is to a completely dead grid after 1 timestep. If the authors were to repeat as suggested above a very large number of times, they would see that this is not always the outcome.

i. I cannot see how the authors can use the simple Conway's GOL for a city migration model. As I understand the initial city population setup, the inner region of the city contains the highest population. This, of course, is perfectly reasonable as an initial setup. But Figure 2 (right) shows that in one timestep, the GOL rules could reduce the inner-city population to close to 0 (as noted by the authors). That is hardly a successful model of population migration.

j. I have looked at references 10-12. Reference 12 adapts the GOL for different species according to how gregarious they are by using a single parameter and might be useful. I am not entirely convinced this model can be adapted, but one could try, for instance, changing the "gregariousness" parameter as a function of radius from the city center. Be mindful that populations tend to increase as well as spread out. I have no clue whether this would work, but I know that the present system does not.

k. Finally, the authors need city population data with which to compare.

Declarations

Potential competing interests: No potential competing interests to declare.