Artificial Intelligence in a Multi-Agent Model
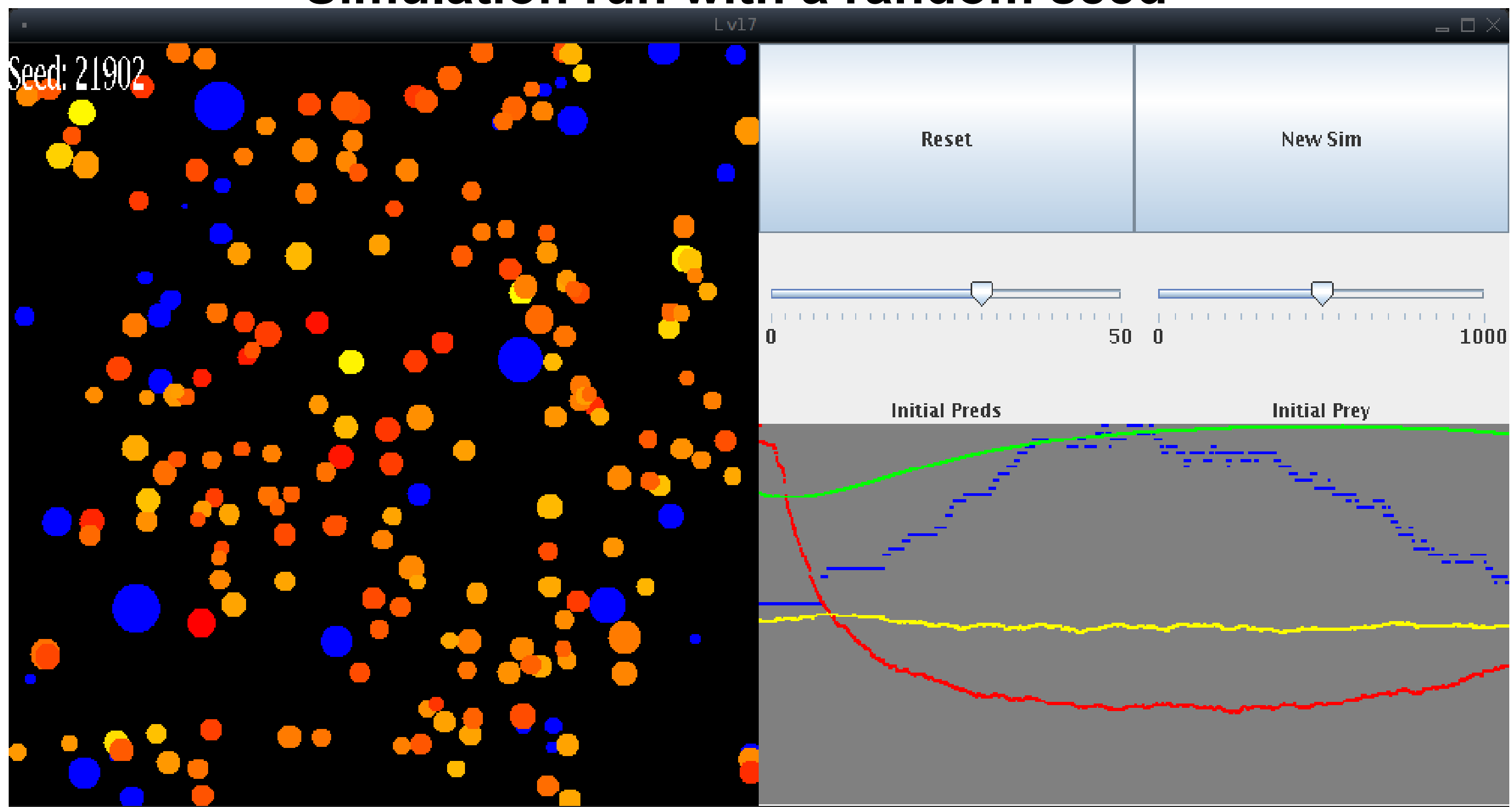
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Abstract

Agent-based modeling is an extremely diverse field of research, and much analysis and research into the effectiveness of agent-based modeling. Agent-based modeling is valued for its ability to model scenarios in a level of detail that would be prohibitively complicated in an equation based model. I investigated the possiblity of detailing agent behavior beyond simple rules, to the level of basic artificial intelligence for each agent.

Simulation run with a random seed

Green: food population
Blue: predator population
Red: prey population
Yellow: average prey intelligence

Goal

My obectives were:
• A deeper understanding of multi-agent modeling
• A demonstration of a simple predator-prey interaction
• A study of advanced decision-making mechanisms
• A comparison to equation-based modeling

Development

I created a non-grid based environment from the ground up in Java. The predators (blue) eat the prey (red) and each species can reproduce. Depending on intelligence level, each prey more or less actively searches the highest concentration of food (not displayed).

Problems

First, I had decided not to make my simulation grid-based, making agent interaction very computationally intensive to test for. Secondly, it was surprisingly difficult to create a stable scenario. Finally, the non-grid based setup made finding the closest predator to a given prey impossible given time constraints.

Results

I was successful in creating an agent-based model similar to an equation-based one. As you can see from the graph of the populations below, the population is relatively stable, though oscillating.