Cellular Automata Wars

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I.Introduction

View

My main inspiration for this project was my interest in cellular automata. I wanted to do something innovative, something that would appeal to anyone: CA enthusiasts, other programmers, as well as people without a computer science background.

As such, a browser-based multiplayer game was the ideal solution. Furthermore, it was a new technological challenge for me as I never used websockets-based frameworks until now and never did a multiplayer game before, so I took it as my chance to try it, learn something new, and have fun with it.

Game Flow:

- Step 1: Map Generation

A simple 2D square grid of size, let's say, 20x20, that is partitioned such as each player would get the same amount of territory.

- Step 2: Initial Configurations

Each player will activate cells as to create the most favorable initial configuration for himself. This process will finish after some time runs out.

- Step 3: Automata Evolution

We will now analyze a simplified case of automata evolution that can happen during the game:

We will start from the following initial configuration: (Figure 1.).

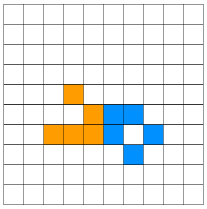

Figure 1: Initial Configuration

Here, player I has the orange cells and player II the blue ones.

The rule we'll be using is Conway's Game of Life (GOF) (in the future, the game could accommodate multiple rules, that can be applied to different cells, so as to make it more interesting and stop players from abusing the "best" patterns).

1. Any live cell with fewer than two live neighbors dies, as if caused by under population.
2. Any live cell with two or three live neighbors lives on to the next generation.
3. Any live cell with more than three live neighbors dies, as if by overpopulation.
4. Any dead cell with exactly three live neighbors becomes a live cell, as if by reproduction.

We can see in the picture that player I has a “Glider”, a pattern of GOF under the category: “spaceship” (for the way it “moves”). Player II has a “Boat”, a “still life”.

The initial configuration evolves as follows: (Figure 2.).

The last panel shows how a cell can overwrite an opponent cell.

At each iteration of the evolution, the transitions for a player are calculated as if the opponent’s cells are all dead. The only problem here would be the case when a cell wants to be activated with orange and blue at the same time. In this case the cell will remain dead.

Getting back to the evolution, the next state is: (Figure 3.).

To analyze how we arrived at this state we will use this: (Figure 4.).

Cell 1: died because of rule 1
Cell 2: was born because of rule 4; neighbors: {1,5,6}
Cell 3: died because of rule 1
Cell 4: lived because of rule 2
Cell 5: died because of rule 3
Cell 6: was reborn as a blue cell because of rule 4; neighbors: {3,4,12}
Cell 7: stayed dead
Cell 8: lived because of rule 2
Cell 9: lived because of rule 2
Cell 10: lived because of rule 2
Cell 11: was born because of rule 4; neighbors: {5,6,10}
Cell 12: died because of rule 1

The next state is: (Figure 5.).

After this state follows simultaneous death for both players’ cells.

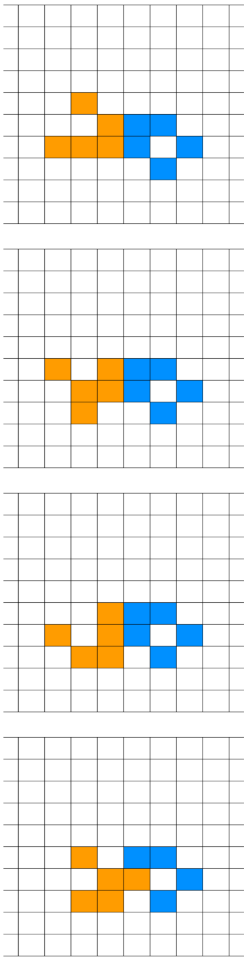

Figure 2: First Evolution Stages

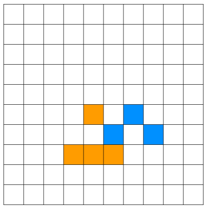

Figure 3: Fifth Generation

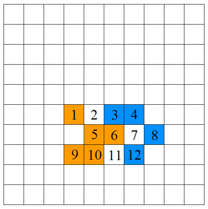

Figure 4: Evolution Analysis

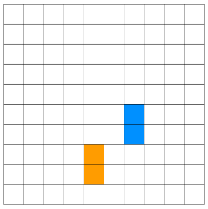

Figure 5: Last Generation