Celullar Automata

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Introduction

Cellular automata (CA) are *discrete, abstract computational systems* that have proved useful both as general models of complexity and as more specific representations of non-linear dynamics in a variety of scientific fields.

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Background

Cellular automata (CA) were conceptualized by Stanislaw Ulam and John Von Neumann in the 1940s at the Los Alamos National Laboratory. Von Neumann's extensive work on self-replicating automata was published posthumously in 1966. A CA consists of a one-dimensional array of cells that evolve over discrete time steps.

Cellular Automata Algorithm

Algorithm 1: Basic Cellular Automaton

Input: `gridWidth`: Width of the grid, `gridHeight`: Height of the grid, `states`: Set of possible states for the cells, `neighborhood`: Set of relative positions defining the neighborhood of each cell, `rules`: Set of state transition rules, `maxTimeSteps`: Maximum number of time steps

Output: The final state of the grid

1 Initialize $gridHeight \times gridWidth$, set the initial states on the grid and create `newGrid` as a copy of the grid.;

2 while $i < maxTimeSteps$ **do**

3   **for** x *in* $gridWidth$ **do**

4   **for** y *in* $gridHeight$ **do**

5   neighbors = getNeighbors(grid, `neighborhood`, x, y);

6   newGrid[x][y] = applyRules(grid[x][y], neighbors, rules);

7   Display the state of `newGrid`;

8   grid = newGrid;

9 i++;