

Cellular automata – freeway traffic

Nagel–Schreckenberg model

Preparation:

Use the project code from the **Game Of Life** or **Sound Wave** lab as a basis. Customize the code to meet the requirements of the task.

The following tasks should be performed:

1. Implement a four-step iterative algorithm based on cellular automata (CA) according to the description available on: https://en.wikipedia.org/wiki/Nagel%E2%80%93Schreckenberg_model.

Score: 3p

2. Make CA with periodic boundaries ().

Score: 1p

3. Include the state history for the car lane according as indicated in Figure 1. In each iteration step, the historical state of the roadway should be moved down the grid.

Score: 1p

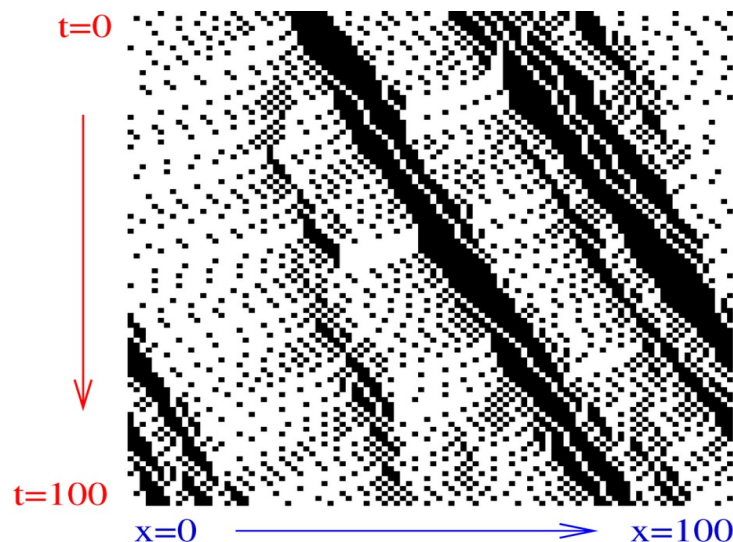


Figure 1: A road with jams of cars, in the Nagel–Schreckenberg model. Each line of pixels represents the road (of 100 cells) at one time. Black pixels are cells with cars in them, white pixels are empty cells. From the top to the bottom successive lines of pixels are the road at successive times, i.e., the top line is the road at $t = 1$, the line below it is the road at $t = 2$, etc. The road is circular (periodic boundary conditions), and cars exiting at the one edge and rejoining on the other edge.

4. Click on an empty cell, spawns a car. Nothing happens when clicked on an occupied cell.

Score: 1p

An additional task for extra points:

5. Adding the ability to allow cars to spontaneously appear and disappear from a lane. This is to allow the simulation of traffic flow with a certain intensity.

In a given iteration, a car can appear in a cell with index $x=0$ with some controlled probability. Similarly, it can disappear if it exceeds the periodic restriction also with a certain probability.