



Real World Applications Cellular Automata List Question

## What are some real-world applications of cellular automata?

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### 8 Answers



**Jiří Kroc**, Biosignals - Heart Arrhythmias - Complex Systems (1996-present)

Answered September 11, 2017



**Cellular automata** are used to model natural phenomena in almost every discipline. Despite their simplicity, they are capable to solve many intractable scientific problems.

They are used in

1. **Physical systems**: One of their applications is **description of recrystallization** in certain types of metals and alloys. They describe **dendrites** during crystallization.
2. Description of **Percolation** within structures.
3. **Cracks propagation** within materials.
4. **Laser behaviour** is modeled.
5. **Avalanches**. Think about Per Bak sand pile models.
6. **Traffic flow** on highways and within cities.
7. Description of **Flood propagation** within the country.

10. **Medicine**, cellular automata model spread of diseases.
11. **Coding messages** by cellular automata, which produce very strong codes.
12. **Picture compression** gives very good results.

Descendants of cellular automata and lattice gasses are called **lattice Boltzmann models** describe flows in:

1. **Medicine**: flow of blood through vessels, their interactions with vessel calls, simulation and prediction of pressure within aneurysm, etc.
2. **Physical systems**: droplet behavior (ink printer, etc.)
3. **Wetting of surfaces**.
4. **Liquid versus deformable solid interactions**.
5. And many other apps.

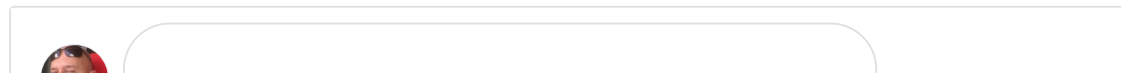
Cellular automata can be applied above another types of the computational worlds and not only above the lattices. For example, **they can work above networks**.

It is important to mention that **cellular automata are often part of multiscale models**, where they usually work at the mesoscale levels.

**They enables theoretical studies of self-organization and emergence**. They are extremely well suited for theoretical studies of complex systems *per se*.

**Cellular automata serve** as an easy to understand **test bed** of more advanced models and often solves the problem under consideration with sufficient preciseness. They are a **perfect theoretical tool**.

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Answered May 28, 2013

Simulations of various kinds of complex phenomena.

Basically, you can often construct discrete toy versions of systems that are described by intractable non-linear differential equations. These toy simulations are often at least CA-like or actually are canonical cellular automata.

A good example of this sort of work is the [Lattice Boltzmann](#)  method of simulating fluid flow. A fluid is represented as an array of colliding particles that obey conservation of momentum in which the "particles" are just states of a CA.

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**Rory Clemens**, <http://www.4x4evr.com>

Answered April 18, 2016



CA is used in geographical information sciences to model urban dynamics or basically any physical and complex pattern on land, sea, ice. When using models units can be used (similar to CA cells) to convey earthquake patterns, water flow using precipitation levels, ground-water flow to calculate erosion etc. It is my impression that the use of cellular automata models in these sciences is more theoretical than practical since known physical effects can be more precisely gauged using other GIS modeling systems.

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Answered May 22

So, you think you've drafted a tweet, an email, a short story, or even a novel. These are different forms of communication, but the process of bringing them to fruition has a

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Answered January 6, 2011



The structure of cellular automata is the transmission of one local node to another. Thus, any transmission problem, social or otherwise, can be modeled with a cellular structure with appropriate transmission dynamics. Basically, how many 'neighbors' should a cell have, should some cells be hubs, and should there be a randomized element to whether something is transmitted?

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**Anderson Moor**, Autodidact

Answered May 28, 2013



"Cave generation" - creating procedural maps of dungeons for games.

Cellular automata are also used in visual effects to create various patterns and growth animations.

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One real-world application of cellular automata is the production of pseudorandom numbers. This is used by Mathematica, for example.

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**Jorn Barger**, in search of robot wisdom

Answered June 12, 2012



The human brain is presumably a very specialized cellular automaton, and to understand it we'll have to explore the capabilities of all intervening styles of CA.

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**Anderson Green**, Developer of universal-transpiler for SWI-Prolog

Answered January 23, 2011



It depends on what the cellular automaton is used for. In a rectangular grid, it could have 4 neighbors or 8 neighbors. There are endless possibilities of how cellular automata can be arranged.

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