1. Introduction

2. One-Dimensional CA

3. The Game of Life

4. Summary

Texture09: Cellular Automata
What is Cellular Automata

“Suppose one has an infinite regular system of lattice points in \( E^n \), each capable of existing in various states \( S_1, ..., S_k \). Each lattice point has a well defined system of \( m \) neighbours, and it is assumed that the state of each point at time \( t + 1 \) is uniquely determined by the states of all its neighbours at time \( t \). Assuming that at time \( t \) only a finite set of points are active, one wants to know how the activation will spread.” by Stanislaw Ulam
model. In CA, time, space, and state are discrete.

Space, time and state of the space site are the basic constituents of any

rule.

of the graph updates the states in parallel using the same state transition
which takes discrete states and updates its states at a discrete time; all nodes

A CA is a local regular graph, usually an orthogonal lattice, each node of
Fundamental Properties of CA

1. Parallelism: A system is said to be parallel when its constituents evolve simultaneously and independently. In that case, cells update are performed independently of each other.

2. Locality: The new state of a cell only depends on its actual state and on the neighborhood.

3. Homogeneity: The laws are universal, that is to say common to the whole space of CA.
Light cells are active ones. 

Easier, we numbered the cells from 0 to 4 horizontally and from 0 to 2 vertically. The space is here limited to a rectangle of 5 by 3. To make the explanation
In the game of life, any adjoining cell is considered as neighbour, including diagonals. The graphic shows the neighbourhood of cell 12. In this case, two cells are active out of the 8 neighbours.
Rules

1. If a live cell has less than two neighbours, then it dies (loneliness).
2. If a live cell has more than three neighbours, then it dies (overcrowding).
3. If an empty cell has more than three neighbours, then it comes to life.

(reproduction)

4. Otherwise, a cell stays as it is (stasis).
3. Ability to move information to and fro

Iterative operations:

2. Ability to count: to schedule events parallel in time and to coordinate

allow a basic type of memory:

1. Ability to form static objects: fixed objects being persistent in time