



Cellular Automata

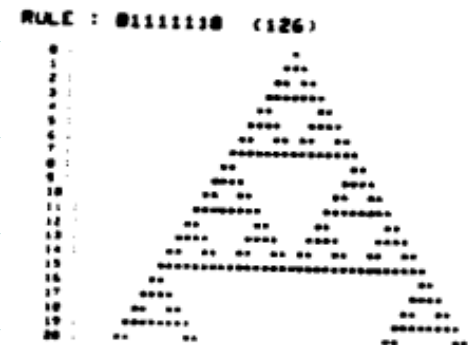


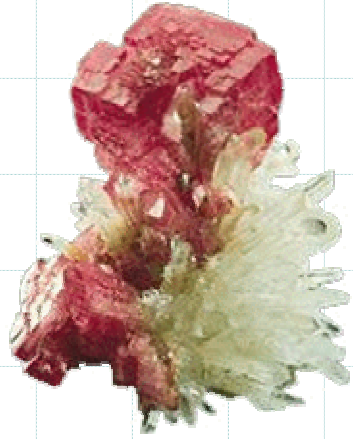
Cellular Automata

Cellular automata provide simple discrete deterministic mathematical models for physical, biological and computational systems. Despite their simple construction, cellular automata are shown to be capable of complicated behavior, and to generate complex patterns with universal features



Cellular automata were introduced by von Neumann and Ulam as simple models in which to study biological processes such as self-reproduction



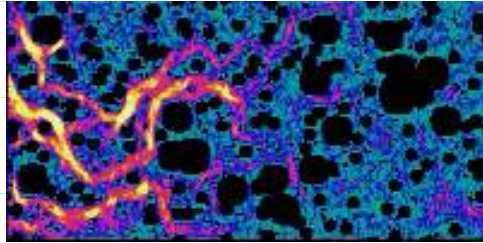


WATSim Animated Visualization of Simulated Traffic

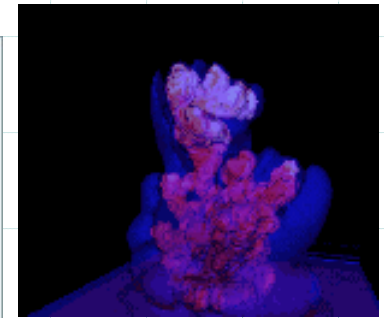
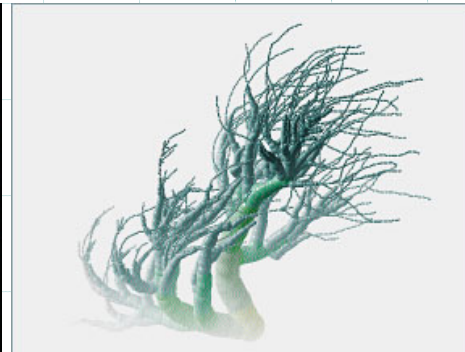
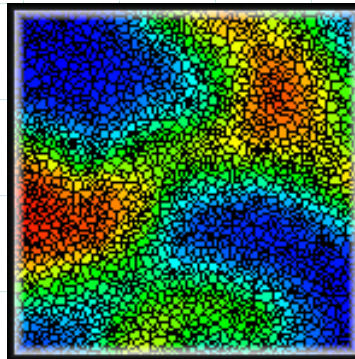
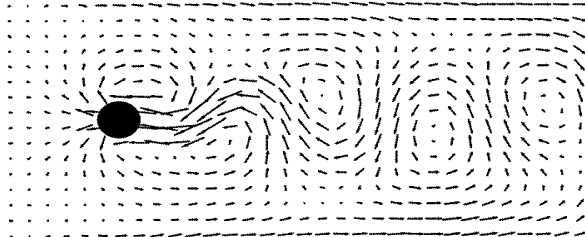


God's voice thunders in marvelous ways; he does great things beyond our understanding. Job 37:5

Cellular Automata

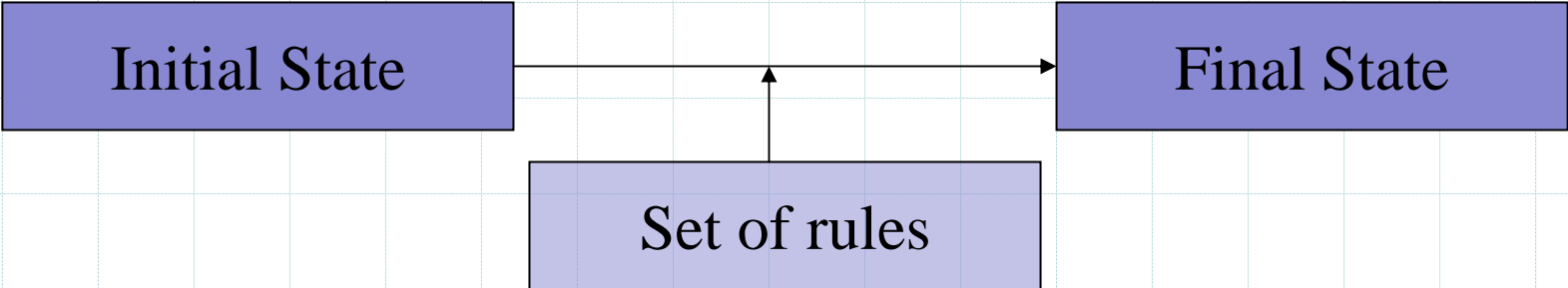


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How it works?



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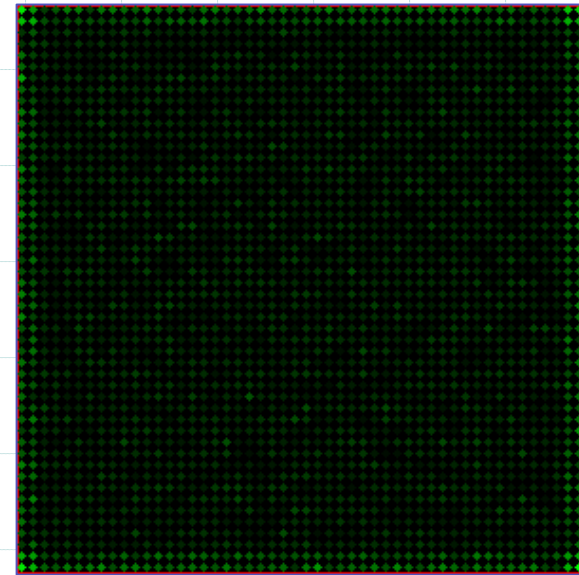
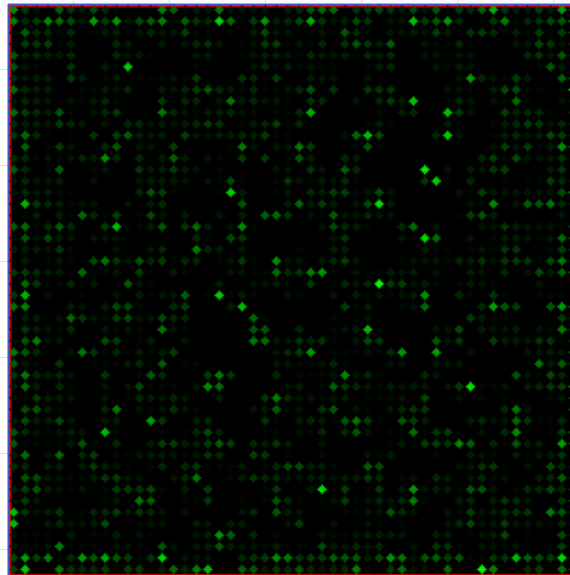
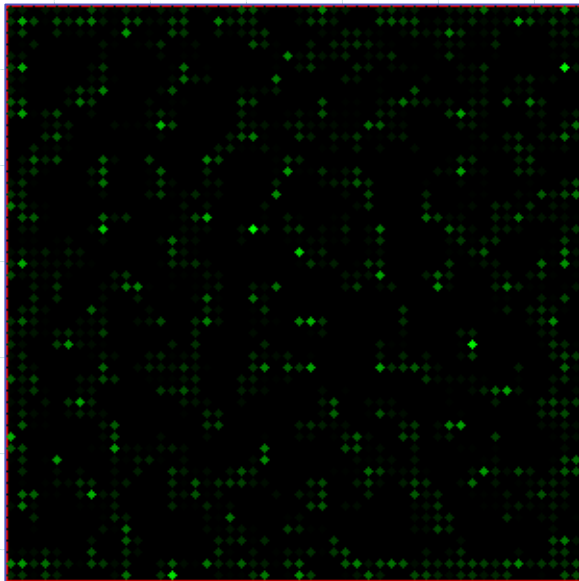
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What overall classification of cellular automaton behavior can be given?

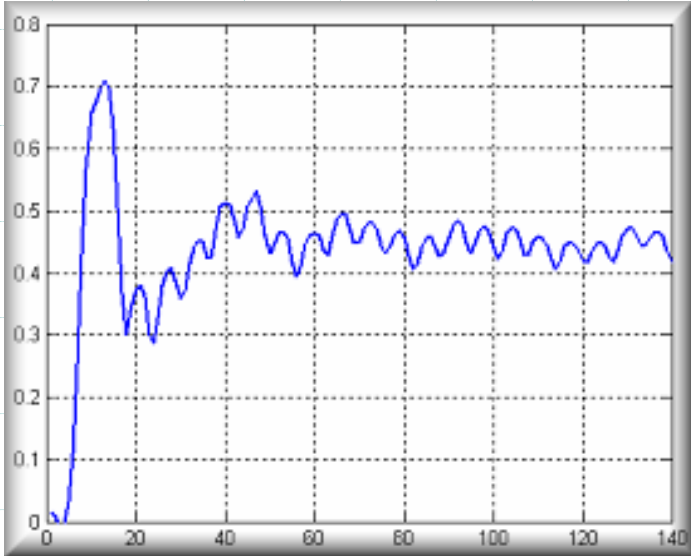
- Evolves to homogeneous state.
- Evolves to simple separated periodic structures.
- Yields chaotic aperiodic patterns.
- Yields complex pattern of localized structures.



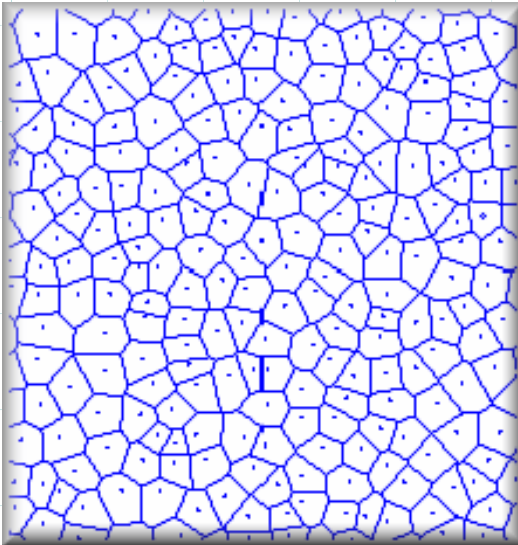


How to characterize cellular automaton behavior?

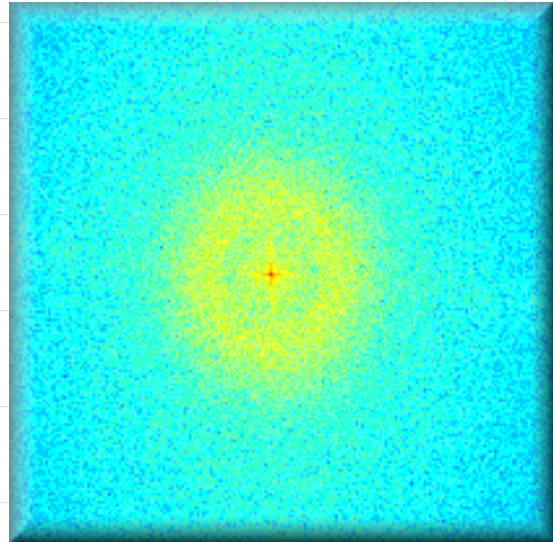
Radial Correlation



Voronoi Polyhedra



FFT



Walsh-Hadamard transforms

Entropies and Lyapunov exponents