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2D Hexagonal Cellular Automata: The Complexity of Forms

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Abstract : We created two-dimensional hexagonal cellular automata to obtain complexity by using simple rules same as Conway's game of life. Considering the game of life rules, Wolfram's works about life-like structures and John von Neumann's self-replication, self-maintenance, self-reproduction problems, we developed 2-states and 3-states hexagonal growing algorithms that reach large populations through random initial states. Unlike the game of life, we used six neighbourhoods cellular automata instead of eight or four neighbourhoods. First simulations explained that whether we are able to obtain sort of oscillators, blinkers, and gliders. Inspired by Wolfram's 1D cellular automata complexity and life-like structures, we simulated 2D synchronous, discrete, deterministic cellular automata to reach life-like forms with 2-states cells. The life-like formations and the oscillators have been explained how they contribute to initiating self-maintenance together with self-reproduction and self-replication. After comparing simulation results, we decided to develop the algorithm for another step. Appending a new state to the same algorithm, which we used for reaching life-like structures, led us to experiment new branching and fractal forms. All these studies tried to demonstrate that complex life forms might come from uncomplicated rules.

Keywords : hexagonal cellular automata, self-replication, self-reproduction, self- maintenance
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