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Visualization of the computation process of a universal register machine. (English)

Summary: Universal register machine, a formal model of computation, can be emulated on the array of the Game of Life, a two-dimensional cellular automaton. We perform spectral analysis on the computation dynamical process of the universal register machine on the Game of Life. The array is divided into small sectors and the power spectrum is calculated from the evolution in each sector. The power spectrum can be classified into four categories by its shape; null, white noise, sharp peaks, and power law. By representing the shape of power spectrum by a mark, we can visualize the activity of the sector during the computation process. For example, the track of pulse moving between components of the universal register machine and the position of frequently modified registers can be identified. This method can expose the functional difference in each region of computing machine.

MSC:
68Q80 Cellular automata (computational aspects)
37B15 Dynamical aspects of cellular automata
68Q04 Classical models of computation (Turing machines, etc.)

Keywords: universal register machine; computation process; game of Life; functional imaging; spectral analysis

Full Text: arXiv Link

References:

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