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Topological Properties of D-dimensional Cellular Automata

A cellular automaton is a tool used to model complex systems, making discrete simulations of an intricate process. Cellular automata were first investigated from a purely mathematical point of view in 1969 with Hedlund's formative paper. This work was motivated by then-current problems in symbolic dynamics, possibly those of a cryptographic nature. When Wolfram turned his attention to cellular automata via computer simulation in the early 1980s, the subject gained momentum. Wolfram categorized one-dimensional cellular automata based on features of their asymptotic behavior which could be seen on a computer screen. Gilman's work in 1987 and 1988 was the first attempt to mathematically formalize these characterizations of Wolfram's; he utilized the notions of equicontinuity and expansiveness, as well as measure theoretic analogs of each. While measure is intrinsic to Gilman's partition, Kůrkahas a purely topological classification centered on equicontinuity, expansiveness, and sensitivity. We extend the one-dimensional topological classification of Kůrkafor cellular automata on the full shift space, to higher dimensional subshift spaces, providing examples to highlight the differences between one- and two-dimensional cellular automata, as some results do not extend directly from one dimension.