Algebraic structure for recombining cellular automata

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Talk Abstract

We develop an algebraic structure arising from recombination of cellular automata. Cellular automata are discrete dynamical systems with local state $\mathbb{Z}_n$ and a particular cellular automaton is characterized by a finite sequence of elements in $\mathbb{Z}_n$. This sequence determines the time evolution rule and it is seen as the genotype of the cellular automata. We have defined in [1] a binary operation which determines the recombination of two finite sequences, each associated to a cellular automata. This operation is parametrized by real number, α, in the unit interval. Therefore, we obtain a one parameter family of algebraic structures defined on the space of cellular automata. This algebraic structure is non-commutative and non-associative. The main objective of our work is to study the algebraic structure generated by a finite initial population of cellular automata through recombination. Moreover, we study the Cayley graph for the structure, which can be seen as the phylogenetic tree for the initial population. We discuss the structure dependence of the parameter α, and the maximum diversity that can potentially be obtained, given a finite set of generators, and how fast it can be attained.

Keywords: cellular automata, recombination, algebraic structure, maximal diversity.

Acknowledgements

This research was supported by national funds through the Fundação para a Ciência e Tecnologia, FCT, under the project UIDB/04674/2020 (https://doi-.org/10.54499/UIDB/04674/2020).

References

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