Time-computability of functions in (bounded) one-way cellular automata

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The classical grammar-based language theory classifies languages by their structural complexity. Another classification (computational complexity) is based on the amount of time, space, or other resources needed to recognize a language on some device, such as Turing machines or cellular automata. That is, the resources available are bounded by a function f. In order to obtain a infinite dense hierarchy one way (by using diagonalization) is to ensure that only a slight increase in the growth rate of f yields to a new complexity class. Therefore some "well-behaved" complexity functions are used, where the notion of well-behaviour is concretized in terms of constructibility of functions with respect to the investigated resources and devices.

We transfer the notion of time-constructibility to (bounded) one-way cellular automata (where we will call it time-computability, then). Surely, we cannot hope to obtain an infinite hierarchy of complexity classes for OCAs using such functions (diagonalization does not work). However we are interested in the spectrum of OCA-time-computable functions as is for understanding the capabilities of one-way cellular automata. In the talk we will give some examples of OCA-time-computable functions and show the existence of several gaps in the spectrum. Further we will charakterize OCA-time-computable functions by a special family of languages each of which is acceptable by an OCA in real-time.

References

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