COMPLETE SIMULATION IN AUTOMATA NETWORKS

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Abstract: An automata network is a finite graph where each node holds a state from some finite alphabet and is equipped with an update function that changes its state according to the configuration of neighboring states. More concisely, it is given by a finite map $f : A^n \to A^n$. In this presentation, we will show how some automata networks can or cannot be simulated by some other automata networks with a prescribed update mode. When we consider non-Boolean alphabets and for any network size, we show that there are intrinsically non-sequential transformations (i.e. which cannot be obtained as a composition of sequential updates of some network). We also conjecture that any network of size at least 3 with a Boolean alphabet can be computed sequentially. Moreover, we show that there is no universal automaton network that can produce all non-bijective functions via compositions of sequential updates. Eventually, we show that there are universal automata networks for sequential updates if one is allowed to use a larger alphabet and then use either projection onto or restriction to the original alphabet.