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Multihead two-way probabilistic finite automata. (English. English summary)
ACM Symposium on Parallel Algorithms and Architectures (Velen, 1993).

The author extends the definitions of standard probabilistic multihead two-way finite automata and probabilistic Turing machines by allowing their transition probabilities to have values from the set of logspace constructible reals. A real number $r \in [0, 1]$ is said to be logspace constructible if there is a deterministic Turing machine that, for any positive integer $n$, given in binary representation as an input string, computes the $n$ most significant bits of $r$ using $O(\log n)$ bits on its worktape.

From the point of view of their computational power these probabilistic automata are situated in between the standard probabilistic automata, whose transition probabilities are from the set $\{0, \frac{1}{2}, 1\}$—or, equivalently, from the set of rational numbers from $[0, 1]$—and the probabilistic automata with transition probabilities from the set of real numbers from $[0, 1]$.

Then the author provides (i) a technique to simulate these automata by standard logspace probabilistic Turing machines, (ii) a representation of logspace probabilistic complexity classes as proper hierarchies based on corresponding multihead two-way probabilistic finite automata, (iii) a deterministic logspace reduction of logspace probabilistic complexity classes to the second levels of these hierarchies, and (iv) a simple formula for the maximum inherent bandwidth of the configuration transition matrices associated with the $k$-head probabilistic finite automata processing an input of length $n$. (The “inherent bandwidth” of the configuration transition matrices associated with an automaton $A$ processing an input of length $n$ is the smallest bandwidth we can get by changing the enumeration order of the configurations of $A$.) On the basis of (iv), an easier logspace complete problem for PL (the class of languages recognized by logspace unbounded-error probabilistic Turing machines) is found.

{For the entire collection see MR1424079 (97g:68002)}

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