

Intersecting Dense Automata: Constructions, Complexity and Certificates

20.7.2026 - | IMDEA Software Institute

Sunday, July 19, 2026, 11:00am 302-Mountain View and Zoom3
(<https://zoom.us/j/3911012202>, password:@s3).

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Abstract:

Given k nondeterministic finite automata (NFA), finding an NFA that recognises the intersection of their languages is a basic problem in automata theory. We observe that the classical Cartesian product construction is non-optimal in the worst case, that is, if the automata have many transitions. For a fixed alphabet, the Cartesian product of two NFA may have $\Theta(m^2)$ transitions if these NFA have at most n states and m transitions each. In this talk, we describe alternative constructions with $O(mn)$ transitions; or $O(mn^{k-1})$ for the intersection of k NFA (for fixed $k \geq 2$ and alphabet Σ). This gives a faster algorithm for deciding NFA intersection emptiness, that is, deciding whether k given NFA accept a word in common.

We also show that this new algorithm is optimal, unless there exists a breakthrough combinatorial algorithm for detecting $(k + 1)$ -cliques in undirected graphs.

Lastly, we show how these new product constructions allow us to certify NFA intersection emptiness faster.

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