

Weighted Tiling Automata on Graphs: Evaluation Complexity

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Abstract

We consider weighted automata to represent functions from graphs to a commutative semiring such as Natural semiring or Tropical semiring. The automaton labels the nodes of a graph by its states, and check if the neighbourhood of every node belongs to a the set of permissible tiles, and assigns a weight accordingly. The weight of a labeling is the semiring-product of the weights assigned to the nodes, and the weight of the graph is the semiring-sum of the weights of labelings. We show that we can model interesting algorithmic questions using this formalism - like computing the clique number of a graph or computing the permanent of a matrix. We study the complexity of evaluation as a function problem, and the associated decision problems (threshold languages). The complexity varies between NP and PSPACE in the counting hierarchy for different semirings and problems. We give tight upper and lower bounds for each combination.