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Synthesis with asymptotic resource bounds. (English) [Zbl 1493.68112]


Summary: We present a method for synthesizing recursive functions that satisfy both a functional specification and an asymptotic resource bound. Prior methods for synthesis with a resource metric require the user to specify a concrete expression exactly describing resource usage, whereas our method uses big-O notation to specify the asymptotic resource usage. Our method can synthesize programs with complex resource bounds, such as a sort function that has complexity $O(n \log(n))$.

Our synthesis procedure uses a type system that is able to assign an asymptotic complexity to terms, and can track recurrence relations of functions. These typing rules are justified by theorems used in analysis of algorithms, such as the Master Theorem and the Akra-Bazzi method. We implemented our method as an extension of prior type-based synthesis work. Our tool, SYNPLEXITY, was able to synthesize complex divide-and-conquer programs that cannot be synthesized by prior solvers.

For the entire collection see [Zbl 1489.68029].

MSC:

68N30 Mathematical aspects of software engineering (specification, verification, metrics, requirements, etc.)

68N18 Functional programming and lambda calculus

Software:

TiML

Full Text: DOI arXiv

References:


[12] Hu, Q.; D’Antoni, L.; Chockler, H.; Weissenbacher, G., Syntax-guided synthesis with quantitative syntactic objectives, Com-


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