Program Synthesis with Best-First Bottom-Up Search (Abstract Reprint)

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Abstract

Cost-guided bottom-up search (BUS) algorithms use a cost function to guide the search to solve program synthesis tasks. In this paper, we show that current state-of-the-art cost-guided BUS algorithms suffer from a common problem: they can lose useful information given by the model and fail to perform the search in a best-first order according to a cost function. We introduce a novel best-first bottom-up search algorithm, which we call Bee Search, that does not suffer information loss and is able to perform cost-guided bottom-up synthesis in a best-first manner. Importantly, Bee Search performs best-first search with respect to the generation of programs, i.e., it does not even create in memory programs that are more expensive than the solution program. It attains best-first ordering with respect to generation by performing a search in an abstract space of program costs. We also introduce a new cost function that better uses the information provided by an existing cost model. Empirical results on string manipulation and bit-vector tasks show that Bee Search can outperform existing cost-guided BUS approaches when employing more complex domain-specific languages (DSLs); Bee Search and previous approaches perform equally well with simpler DSLs. Furthermore, our new cost function with Bee Search outperforms previous cost functions on string manipulation tasks.

References

Ameen, S.; and Lelis, L. H. S. 2023. Program Synthesis with Best-First Bottom-Up Search. *Journal of Artificial Intelligence Research*, 77: 1275–1310.