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Towards Knowledge-guided Genetic Improvement[1]

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Abstract

- Grammar-guided Genetic Programming
- Tree-based Genetic Programming
- *combined* into Knowledge-guided Genetic Improvment

Introduction

Grammar-Guided Genetic Programming GGGP[2]

- Utilizes grammar to create syntactically correct individuals
- Oiginally crossover operator

Tree Genetic Programming (TGP)

- Utilizing tree structure, often Abstract Syntax Tree (AST)
- Enable operators, ex. homologous crossover[3]

- Previously Combined into Tree-adjunct Grammar Guided Genetic Programming (T3GP)

Knowledge-guided Genetic Improvement

- AST based representation form
- Grammar that ASTs adhere to
- Grammar enriched with *metadata*
- Operators can *access context*

Syntax Graph

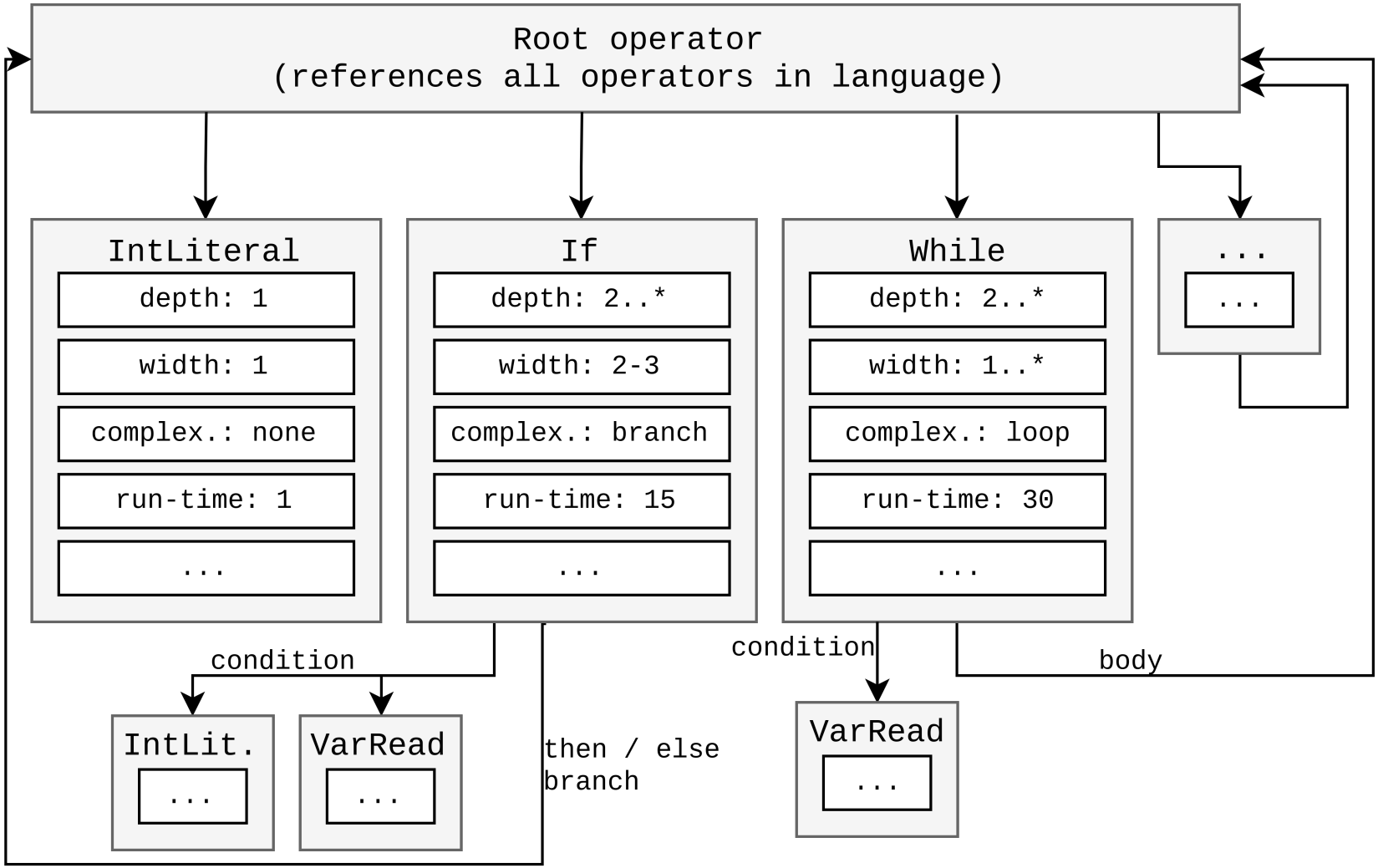


Figure: Syntax Graph for generating syntactically correct ASTs

Proposed Impact

Benefits

- Increased amount of *valid ASTs*.
- Not just syntactically correct but also semantically *executable*
- Metadata enables *complex operators* and *fitness function approximation*
- Syntax Graph can be pruned or redirected to *reduce execution errors*

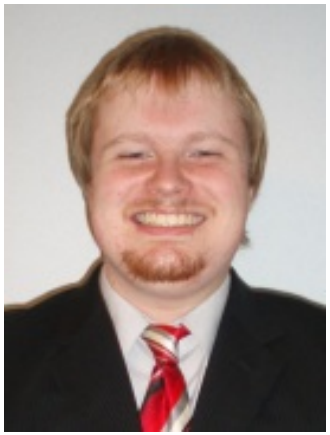
Drawbacks

- Mining metadata is *complex and expensive*.
- Complex operators cost *run-time performance*
- Mistakes in the syntax graph endanger *validity of experiments*

Conclusion and Outlook

- Metadata in syntax graph especially useful for Genetic Improvement
- Approach shows promise
  - Amount of compileable ASTs is at 100%
  - Amount of executeable ASTs is "very high"
- Upcoming empirical evaluation
  - to put a number to "very high"
  - Does the approach improves overall quality in individuals?
  - Does it increase success rates in experiments?

Questions?



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Bibliography I

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[2] D. Manrique, J. Rios, and A. Rodríguez-Patón, "Grammar-Guided Genetic Programming", in *Encyclopedia of Artificial Intelligence*, 2009.

[3] F. D. Francone, M. Conrads, W. Banzhaf, and P. Nordin, "Homologous crossover in genetic programming", in *Proceedings of the 1st Annual Conference on Genetic and Evolutionary Computation - Volume 2*, ser. GECCO'99, Orlando, Florida: Morgan Kaufmann Publishers Inc., Jul. 1999, pp. 1021–1026.