InferType: A Compiler Toolkit for Implementing Efficient Constraint-Based Type Inference (Artifact)

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Abstract

Supporting automatic type inference is in demand in modern language development. It is a challenging task but without appropriate supporting toolkits. This paper presents InferType, a Java library that helps implement constraint-based type inference. A compiler writer uses InferType's classes and methods to describe type constraints and typing rules for type inference. InferType then performs constraint solving by translation to the Z3 SMT solver. InferType is equipped with our developed optimization technique. It reduces the search space for type variables by pre-computing the structures of those type variables for mitigating the performance bottleneck of constraint solving with deeply nested types. We use InferType to implement type inference for a subset of Python, and conduct experiments to evaluate how the developed optimization technique can affect the performance of type inference. Our results show that InferType's optimization can greatly mitigate the performance bottleneck for programs with deeply nested types, and can potentially improve the performance for large nested types.

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Evaluation Policy The artifact has been evaluated as described in the ECOOP 2024 Call for Artifacts and the ACM Artifact Review and Badging Policy.

1 Scope

This artifact provides the source code, the collected data set and the obtained result data covered in the paper. It allows the reproduction of the experiments presented in the paper.

2 Content

The artifact package includes:

- `infertype.tar`: a saved Docker image of this artifact
- `readme.md`: a description of detailed materials and instructions for using the artifact
- `artifact/`: the artifact itself containing all the materials

3 Getting the artifact

The artifact endorsed by the Artifact Evaluation Committee is available free of charge on the Dagstuhl Research Online Publication Server (DROPS). In addition, the artifact is also available at: `https://zenodo.org/records/10981733`.

4 Tested platforms

This artifact should work on Docker. The given Docker image is for platform `linux/arm64`. A Docker image for platform `linux/amd64` can be obtained in a version (v8) in the provided Zenodo link. The artifact was also tested on a desktop machine with the following dependencies:

- Ubuntu 19.10, 2.8 GHz Intel(R) Core(TM), i7-6700T CPU, 32GB RAM
- OpenJDK 14
- Python 3.9.6
- the SMT solver: Z3 4.12.2

5 License

6 MD5 sum of the artifact

b3eaf63b5c866ef2ae3af9ae20e309d7

7 Size of the artifact

485 MiB