Tristan Knoth

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Education

UC San Diego	**San Diego, CA**
Ph.D., Computer Science (Expected January 2023)	*2017-Present*
Advisor: Nadia Polikarpova	
Grinnell College	**Grinnell, IA**
B.A., Computer Science and Mathematics	*2013-2017*

Research

- **Type-directed Program Synthesis:** My dissertation will present a Haskell framework for type-directed synthesis of functional code, allowing users to turn an arbitrary type checker into an efficient synthesizer. We show how to repurpose theoretical ideas from the gradual typing literature for synthesis, allowing users to design search techniques instead of custom synthesis calculi.
- **ReSyn:** A tool that automatically generates recursive functional programs given a logical specification, cost model, and resource bound. ReSyn generates a program alonside a proof that it satisfies the functional specification and consumes no more resources than allotted [1].
- **Static Resource Analysis:** Liquid Resource Types are a flexible and automatic approach to verifying a variety of nontrivial resource bounds on recursive functional programs [2].

Professional Experience

UC San Diego	**San Diego, CA**
Instructor	*2021-2022*

- Taught Discrete Mathemematics and Programming Languages at UCSD, planning and leading classes of over 150 undergraduate students.

Mathworks	**Boston, MA**
Compiler Research Intern	*Summer 2019*

- Implemented in C++ a prototype compiler backend for generating and automatically scheduling Halide code from compatible Simulink models.
- The system improves the performance of Simulink's generated code by taking into account parameters of the target hardware when scheduling the resulting Halide pipelines.

Fluxx Labs	**San Francisco, CA**
Software Engineering Intern	*2016-2017*

- Led development of a native Android client for Fluxx's Grantmaker platform, and released a beta version.

Grinnell College	**Grinnell, IA**
Student Researcher	*2015-2016*

- Designed a novel parallel algorithm for selecting multiple order statistics from large distributed data sets.
- Implemented the technique, which does not rely on approximation, with CUDA C++ and Open MPI.

Technical and Personal skills

- **Programming:** Haskell, C++, C, Python, Java, CUDA, MATLAB, Scheme, Ruby, JavaScript, R
- **Other:** Docker, git, mercurial, SMT Solvers, Simulink, Android development, Arduino

Publications

[1] Tristan Knoth, Di Wang, Nadia Polikarpova, and Jan Hoffmann. Resource-guided program synthesis. In *Programming Language Design and Implementation (PLDI)*, 2019.
[2] Tristan Knoth, Di Wang, Adam Reynolds, Jan Hoffmann, and Nadia Polikarpova. Liquid resource types. In *International Conference on Functional Programming (ICFP)*, 2020.